



**A RETROSPECTIVE STUDY OF THE SERUM
BIOCHEMICAL PARAMETERS IN A LABORATORY
FROM TIMIȘOARA, ROMANIA**

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SUMMARY

A retrospective analysis of 348 patients evaluated in respect to their biochemical parameters was conducted. The biochemical parameters investigated are serum total protein, alanine aminotransferase (ALAT), aspartat aminotransferase (ASAT), triglycerides, total cholesterol, LDL-cholesterol, glucose and creatinine.

Keywords: biochemical parameters; alanine aminotransferase (ALAT); aspartat aminotransferase (ASAT); LDL-cholesterol.

INTRODUCTION

Laboratory blood assays are designed to give information about the evaluation and management of patients. In interpreting laboratory test results of an individual, the clinician usually compares the observed values with reference values. Laboratory based

investigations are influenced by factors such as age, sex, nutrition and climate.

Serum total protein represent the overall amount of proteins in blood serum and have a normal values of 6-8 g /dL blood serum in adults. Blood proteins may have elevated levels in some genetic and parasitic diseases or hypertension [1].

Marker enzymes of certain cells enter the blood only when the cells to which they are restricted are damaged or destroyed. The presence in the blood of elevated quantities of this enzymes indicates the probable site of tissue damage [2].

In biochemistry, the transaminase enzymes catalyze chemical reaction between an amino-acid and a keto-acid, in which an amino group is transferred from a donor molecule to a receive molecule.

Alanine aminotransferase (ALAT), also called alanine transaminase (ALT) is a member of transaminase family, present in the cytoplasm of the liver, kidney, pancreas and skeletal muscle cells. ALAT is involved in the transfer of amino group, from glutamic acid to pyruvic acid to result alanine and alpha ketoglutaric acid (Figure 1) [3]. Pathologic alterations in transaminase activity can be produced in cardiac disease, skin disease, muscular and liver disease. Serum ALAT determination is commonly used as a marker of hepatic cytolysis [4]. In physiological conditions the serum amount of ALAT are low, but increase especially in the cases of viral hepatitis and heart attacks.

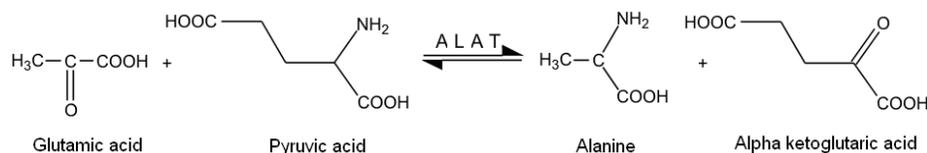


Figure 1. The reaction catalyzed by alanine aminotransferase

Aspartate aminotransferase (ASAT), also called aspartate transaminase (AST) catalyze the transfer of an amino group, form aspartate to alpha ketoglutarate to produce oxalacetic acid and glutamante [3]. ASAT is commonly found in many tissues, at the level of cytoplasm and mitochondria of cells. The heart muscle is found to have the most activity of this enzyme, followed by brain, liver, gastric mucosa, skeletal muscle and kidneys [5].

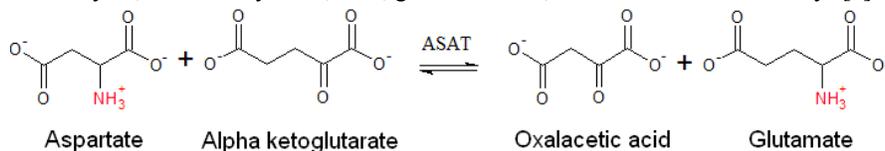


Figure 2. The reaction catalyzed by aspartate aminotransferase

When the tissues are damage, ASAT is released into blood and results in high blood ASAT activity. Increased circulating levels of ASAT is generally used for the diagnosis of heart muscle injury, liver damages and skeletal muscle diseases as well as for

monitoring the treatment. Some studies indicate that the serum levels of ASAT can provide informations about the presence and the degree of liver disease, follow the response to treatment and about the prognostic [4]. A moderate increase of ASAT level in blood may indicate a loading of liver steatosis or recent alcohol abuse. Also can have higher values of ASAT obese people and people with diabetes.

The normal values for ALAT and ASAT are 7–40 U /L [6, 7]. The ASAT and ALAT levels increases in case of destruction of liver cells, the later presenting higher values.

The optimal values of triglycerides (TG) are < 150 mg /dL [8]. The increase of TG to high level (150-400 mg /dL) and very high level (> 500 mg /dL) contribute together with high blood pressure, obesity and elevated LDL-cholesterol level at the increasing cardiovascular diseases and stroke risk. Increased TG values can represent a factor of severity in some patients (e.g. those who had an episode of acute pancreatitis) or may be a transient metabolic disorder in other diseases (eg diabetes mellitus decompensated). The consequences of elevated (TG) values are controversial [9]. Several studies [10, 11, 12, 13] conducted in healthy persons, mostly men, showed that elevated TG levels were associated with increased risk for coronary heart disease.

Many international prospective studies [14, 15, 16] indicate that the prime contributing factor and actual precipitant of the heart disease is high serum cholesterol level. In routine practice, low-density lipoprotein cholesterol (LDL) concentration is estimated indirectly from the measured levels of TG, high-density lipoprotein cholesterol (HDL), and total cholesterol (TC) using the Friedewald equation [17]:

$$LDL = TC - HDL - \frac{TG}{5}$$

Elevation of serum LDL constitutes a major risk factor for the development of atherosclerosis and coronary heart disease [18].

Table I. The values of total cholesterol and LDL-cholesterol [3]

Value	Total cholesterol (mg/dL)	LDL-cholesterol (mg/dL)
Normal value	< 200	< 100
Above the optimal value	-	100 -129
Increased, at limit	200 - 239	130 -159
Increased	-	160 -189
Very high	≥ 240	≥ 190

The normal values for blood sugars are within 70-110 mg /dL [20] ranging at any time of day. Hyperglycemia has multiple causes, such as for example, at type 1 diabetes is possible that insulin injected dose may not be sufficient, while in type 2 diabetes the body

can have enough insulin but can not use it properly. Stress caused by another illness may be another cause of hyperglycemia. Very high blood glucose (> 240 mg /dL) can cause diabetic coma, but exist persons more adapted to elevated glucose level.

The normal values for creatinine are in the range of 0.5 to 1.2 mg /dL serum in adults. The upper limits for normal serum concentration in men are 1.2 mg /dL while values for women are ~85% men's values [21]. Serum creatinine is highly correlated with urine excretion in 24 h in subjects with normal renal function [22] and varies inversely with the glomerular filtration rate [21].

Chronic renal insufficiency, demonstrates an increase in serum creatinine over a period of months to years [23]. Determination of serum creatinine concentration is recommended in all patients with hypertension as a indicator of target organ injure, an elevated serum creatinine level representing a delayed sign of renal damage in essential hypertension [24] and indicate a high risk of acute pancreatitis [25]. In non-end-stage renal disease, changes in renal drug clearance are generally proportional to those in creatinine clearance, which may be measured directly or estimated from the serum creatinine.

Low serum creatinine levels were associated with a higher risk of type 2 diabetes mellitus [26], chronic renal failure, a decrease in muscle mass, hyperthyroidism and pregnancy. In addition, glomerular hyperfiltration, which is associated with lower serum creatinine levels, may be associated with increased metabolic risk [27] and future diabetes [28].

The aim of this study was to investigate the biochemical parameters of 348 laboratory patients in 2009.

METHODOLOGY

The study subjects were 348 patients of Laboratory SC DERMATOMED SRL, from Timșoara in 2009, with age between 8-89 years. The data were collected from the laboratory database, introduced in Excel and then were transferred to Stata statistical software, version 5.0. Graphical representation of results was done with Excel. Frequencies were calculated based on theoretical considerations of each biological indicator examined.

This study comprised 348 patients both female (n = 259), males (n = 88), from Timșoara urban area (n = 269) and near rural areas (n = 78). Information about age and body condition for each patient was recorded.

The blood samples have been collected at rest via median antebranchial vein into vacutainer tubes containing the anticoagulant EDTA. The biochemical parameters (serum total protein, levels of ASAT, ALAT, triglycerides, total cholesterol, LDL-cholesterol, glucose and creatinine) were analyzed in automated equipment (which is checked daily by

internal quality protocol and monthly by an external protocol as the Romanian law requires) approximately 2 hours after blood drawing. All the investigated biochemical parameters were compared with the standard values presented in literature and then they were the subject of a statistical analysis.

RESULTS AND DISCUSSIONS

The measurement and description of population by age groups presents interest to the health system because morbidity and mortality picture varies from one age group to another. Thus the batch was divided into five age groups.

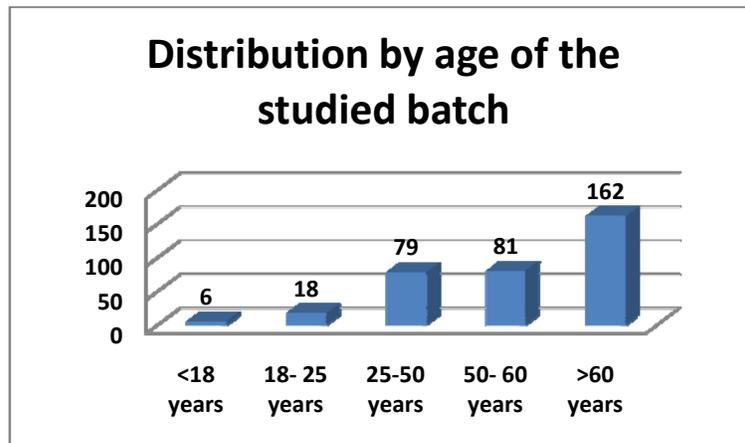


Figure 3. Distribution by age of the studied batch

In children and adolescents less than 18 years were more frequently prenatal conditions, respiratory, digestive, infectious and parasitic diseases. In young adults (18-25 years) were more common sexual transmitted diseases and in women specific pathologies of pregnancy. Generally this age group is free from diseases.

In adults between 25 and 50 years are more common chronic diseases in early stages and occupational diseases; while in adults between 50 and 60 years are common chronic disease. In the elderly, over 60 years are often meet mixed pathology: chronic diseases associated. The figure 3 shows that laboratory was dealing more with older people (162 from 348) at which prevail chronic diseases and associated chronic diseases.

Serum total proteins in the studied group were 97% in the range of normal values (see Fig. 4). The 3% patients who had values above the upper limit of normal had total

protein values up to 9 g /dL, presenting diagnosis of hypertension.

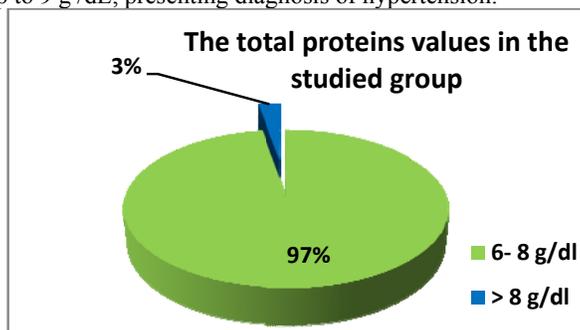


Figure 4. The total proteins values in the studied group

The ALT values in the studied group were between 2 and 207 with an average of 24.44 ± 20.69 . From the figure 5 it can be observed that majority of results were within normal limits, only 23 individuals had elevated values, from which only 2 had an increased liver cytolysis with ALT over 100 U /L, which represent viral hepatitis. The remaining 21 individuals with elevated values presented liver stasis.

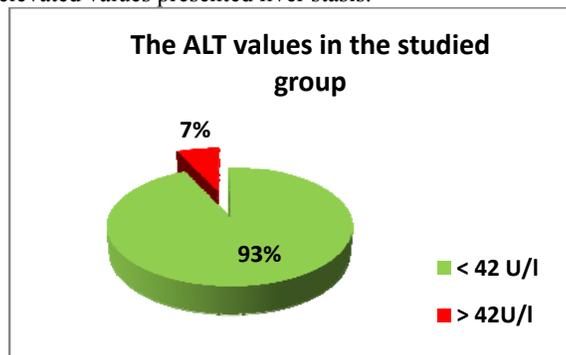


Figure 5. The ALT values in the studied group

The AST values in the studied group were between 2 and 214 with an average of 23.58 ± 19.38 . From the figure 6 it can be observed that the majority of results were within normal limits, only 30 individuals had increased AST levels, from which only 3 had an increased liver cytolysis with AST over 100 U /L, which can indicate the viral hepatitis which is also the presumptive diagnostic.

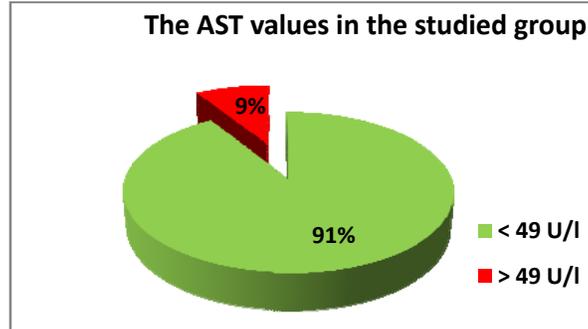


Figure 6. The AST values in the studied group

The concentration of creatinine in serum is the most widely used and commonly accepted measure of renal function [29] and muscle injury [30] in clinical medicine.

Almost all the registered values for the serum creatinine content (311 subjects) were in the limits of the reference values and only 27 had values above 1.2 mg/dL. From these 7 had presumptive diagnosis of type II diabetes and another 12 were presented to the laboratory with diagnosis of hypertension with or without ischemic heart disease and dyslipidemia.

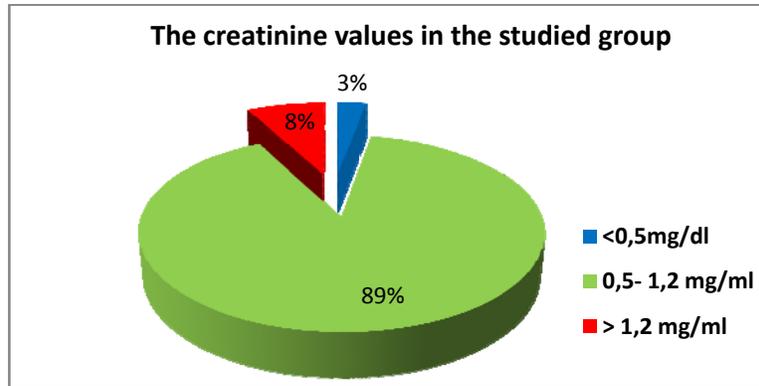


Figure 6. The creatinine values in the studied group

In the studied group in most of the cases the values of glucose were normal and at 23 persons blood sugar was slightly below normal, the minimum was 61.5 mg/dL, most likely from lack of food. At 21 subjects were found high levels of glucose, 15 had values to 170 mg/dL, 5 people were very high, over 220/dL, a person presenting even 316 mg/dL. Six people with elevated levels had glucose between 110 and 130 mg/dL, being necessary glucose tolerance test to see if they have type II diabetes.

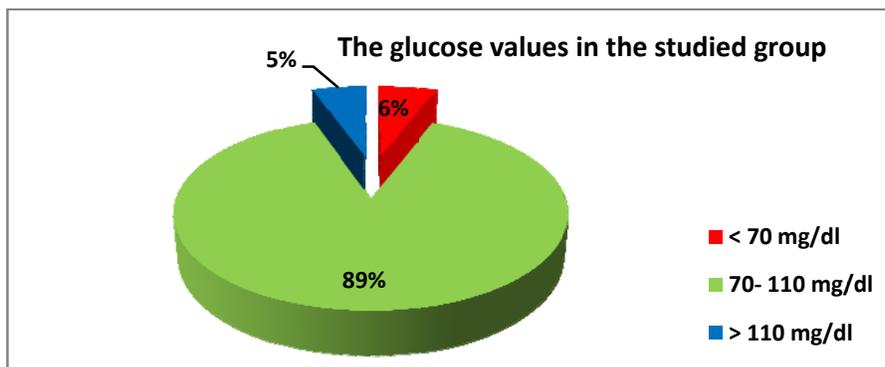


Figure 7. The glucose values in the studied group

From the 279 subjects at which TG were investigated 218 subjects had values within normal limits and 71 of them present elevated values, with only one person who have the TG value above 500 mg /dL.

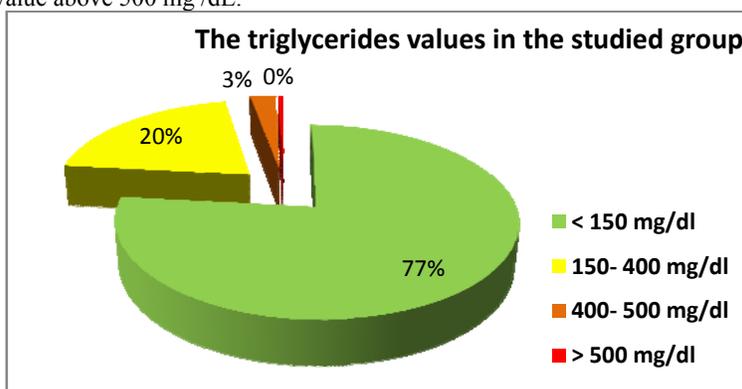


Figure 8. The triglycerides values in the studied group

From the 309 subjects investigated for cholesterol, 192 people showed normal levels, 73 had high values and 44 very high values. Risk of cardiovascular diseases and atherosclerosis is increased at 117 persons. Of these 96% were presented to investigations with presumptive diagnosis of hypertension, ischemic heart disease or dyslipidemia.

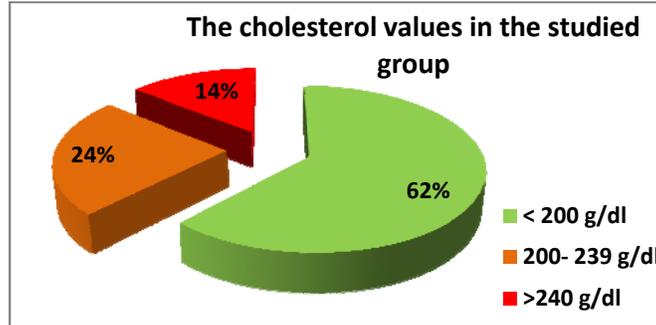


Figure 9. The cholesterol values in the studied group

Analyzing the values of cholesterol and triglycerides we note that 117 of the subjects have hypercholesterolemia and 66 have dyslipidemia, meaning elevated values for triglycerides and cholesterol.

From the 77 subjects who were investigated for LDL-cholesterol value, 39 were below 100 g /dL, 16 had values above the optimum with very low risk of cardiovascular disease, 17 had elevated borderline values, 4 showed values with increased risk of cardiovascular disease and atherosclerosis and 1 person has very high value of LDL-cholesterol, 196 g /dL, presenting very high risk of cardiovascular disease.

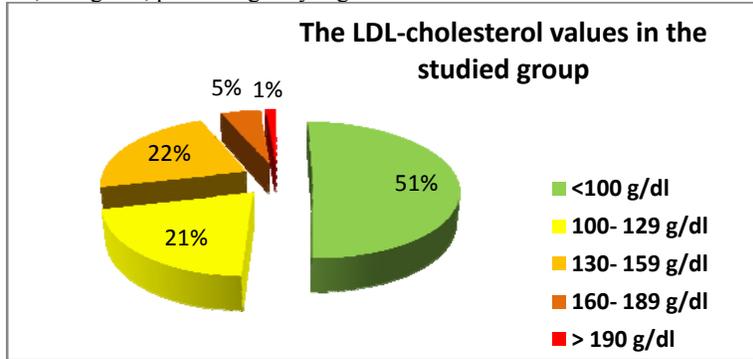


Figure 10. The LDL-cholesterol values in the studied group

As observed from figure 11, we can say that the age group over 60 years presents, the most elevated LDL-cholesterol values as it is normal. Is interesting to notice that the highest value of LDL-cholesterol is found in the age group 25-50 years, this person presented at laboratory with the presumptive diagnosis of dyslipidemia.

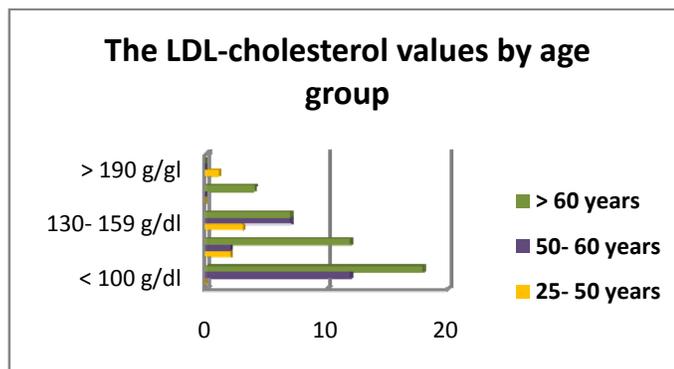


Figure 11. The LDL-cholesterol values by age group

It was confirmed the diagnosis of type II diabetes mellitus in 4 from the 8 people sent at laboratory with this diagnosis, but probably the remaining 4 people would have also increased glucose values if would not be controlled by medication or insulin. Following these investigations have been discovered 17 new people with hyperglycemia.

It was confirmed the diagnosis of chronic hepatitis in 3 from the 5 persons sent at laboratory with this diagnosis, the rest could have controlled hepatic cytolysis. Another 21 people have elevated transaminases presenting a possible steatosis or chronic alcoholism.

The diagnosis of dyslipidemia was confirmed in 18 patients of those suspected of dyslipidemia, but probably some of those who were suspects were being treated with statins or have been keeping a diet and TG and cholesterol were in normal values. Thus at 48 people was confirmed also dyslipidemia, having in 79.11 % of cases also increased LDL-cholesterol value. From the 48 persons who were found elevated triglyceride and cholesterol values, 95.83 % had presumptive diagnosis of hypertension or ischemic heart disease.

CONCLUSION

In conclusion, our researches showed that were diagnosed 17 new cases of hyperglycemia, possibly type II diabetes. From the 5 persons with chronic viral hepatitis who have medical tests done at 3 was confirmed the existence of hepatic cytolysis and at 21 of the subjects were found elevated transaminases values which may be explained by liver steatosis or chronic alcoholism. The diagnosis of hypertension or ischemic heart disease could not be confirmed or refuted only by biological samples, here necessary the physical and functional examination of the subject.

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