Studii şi Cercetări	Mai 2018	Biologie	27/2	95-101	Universitatea"Vasile Alecsandri" din Bacău

INVOLVING THYROIDIAN HORMONES IN HUMAN PATHOLOGY

Maria Prisecaru, Ionuț Stoica, Denisa Hanganu, Gabriel Alin Iosob

Key words: *thyroid gland, hormone dosing, thyroid dysfunction*

INTRODUCTION

The thyroid gland is the largest gland of the endocrine system, being more developed in women with a rounded appearance in the anterior cervical region. It consists of 2 almost equal lobes, triangular pyramids that have both sides of the larynx and the trachea, united by an isthmus.

Unlike other glands, the thyroid needs iodine to synthesize the hormones T3 (triiodothyroxine) and T4 (thyroxine), and therefore iodine food intake plays a pivotal role in the production of thyroid hormones. In addition to iodine, T3 and T4 also contain a protein called thyroglobulin that is manufactured in thyroid follicular cells.

Thyroid disorders are manifested by qualitative or quantitative alterations in hormone secretion, thyroid size (goiter) or both. Insufficient hormone secretion causes hypothyroidism or mixedem in which lowering caloric intake is the main feature. Conversely, excessive hormone secretion causes hypermetabolism and other manifestations called hyperthyroidism or thyrotoxicosis.

MATERIAL AND METHODS

The study presented is based on data provided by Katimed Medical Center Piatra Neamt. The research was performed on a group of 150 patients aged between 9 and 85 years, both female and male in the urban environment.

All patients were evaluated for thyroid function as part of the routine evaluation prescribed by the family doctor or specialist. Hormonal dosages were performed from venous blood harvested á -jun.

For the dosing of TSH (thyroid stimulating hormone, thyrotropin), FT4 (free thyroxine) and ATPO (anti-TPO) are auto-antibodies that attack thyroperoxidase (TPO) - an essential enzyme in the synthesis of thyroid hormones, the enzyme-linked fluorescent assay (ELFA) was used as an automatic ELISA method with final reading in the fluorescence method, with the MiniVIDAS analyzer, Biomerieux France manufacturer (Figure 1).

Mini VIDAS is an automated immunology system for ELPA (enzyme linked fluorescent assay). Convenient and easy to use, it delivers accurate test results. It processes the sample with the sample and various test batches for all types of analysis: serology, immunochemistry, antigen detection. All stages of the immunoenzymatic reaction are performed automatically in minimum space: pipetting, incubation, washing, reading and the results are automatically sent to the integrated printer.

Fig.1. MiniVidas automatic analyzer

RESULTS AND DISCUSSIONS

Of the 150 patients enrolled in the study, only 80 patients experienced changes in thyroid hormone, between 17-88 years of age, of whom 9 were men and 71 women (Figure 2).

The most numerous group is those aged 60-70 years, followed by those aged over 70, the 50-60 age group, those aged 40-50 and then those between 30-40 years. The fewest cases occurring in those aged 20-30 and those aged 12-20.

There is a predominance of female sex for all age groups.

Of the 80 patients, 46 suffer from hypothyroidism, 17 hyperthyroidism, 9 cases of autoimmune thyroiditis, and 11 patients with thyroid hormone resistance (Figure 3).

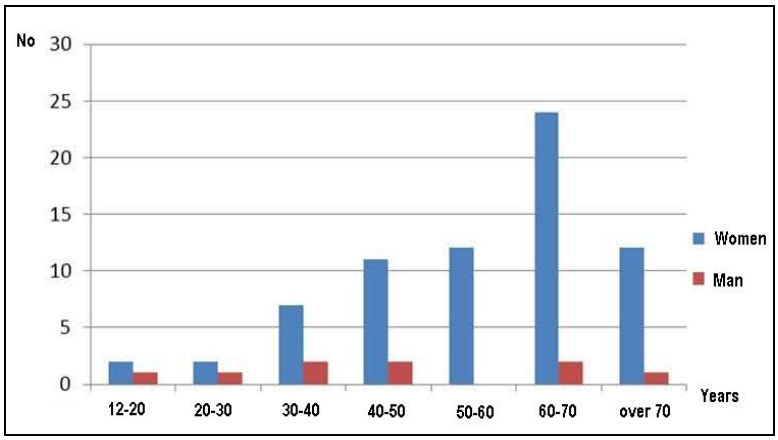

Fig. 2. The result of the hormonal investigation of the patients included in the study

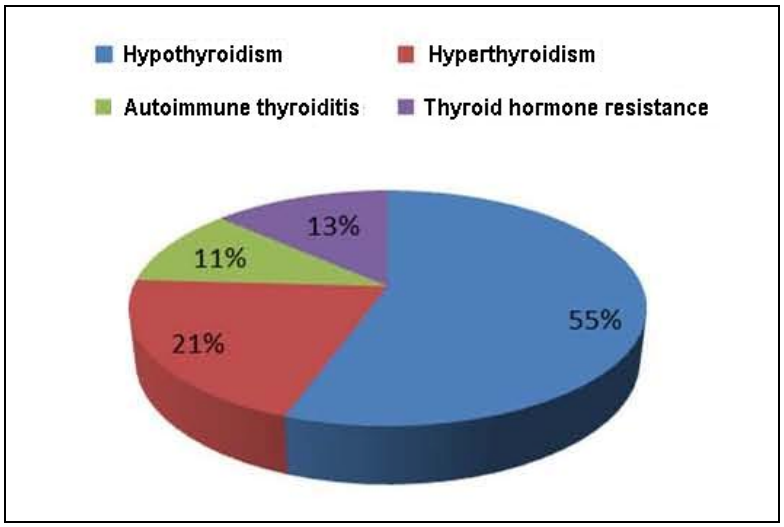

Fig. 3. Graphical representation of thyroid dysfunctions in the investigated group of patients

Clinical forms of hypothyroidism

TSH determination is useful for the diagnosis of hypothyroidism but also for the differentiation of primary hypothyroidism (situations in which the elevated values are present) from the secondary, central (pituitary or hypothalamic) when normal or even low levels of this hormone can occur.

There is also the possibility of differentiation of a syndrome of euthyroid disease from those with primary hypothyroidism, so TSH is very low in patients with euthyroid disease and is significantly reduced in those with real thyroid disease. To determine with certainty the type of thyroid dysfunction, the hormonal profile is supplemented with FT4.

The combination of an elevated TSH and low FT4 assumes the existence of primary hypothyroidism. In the case of a TSH normally correlated with low FT4, at least two possible situations may occur: either secondary hypothyroidism (because of the cetral cause) or an euthyroid disease (non-thyroid disease, affection not based on thyroid disease).

Another possible variant of hypothyroidism is the association of elevated TSH and normal FT4, either in the case of primary subclinical hypothyroidism (early stage) or possibly in the case of a netiroidal disorder.

Thus, 47 cases of hypothyroidism 15 are elevated TSH and FT4 decreased (32%), 23 cases are with elevated TSH and normal FT4 (49%), and the remaining 9 cases with normal TSH and FT4 decreased (19%).

In the first situation we discuss primary hypothyroidism, the second one corresponds to a subclinical primary hypothyroidism or to a etiologic disease, the third to a secondary hypothyroidism or an euthyroid disease (Figure 4).

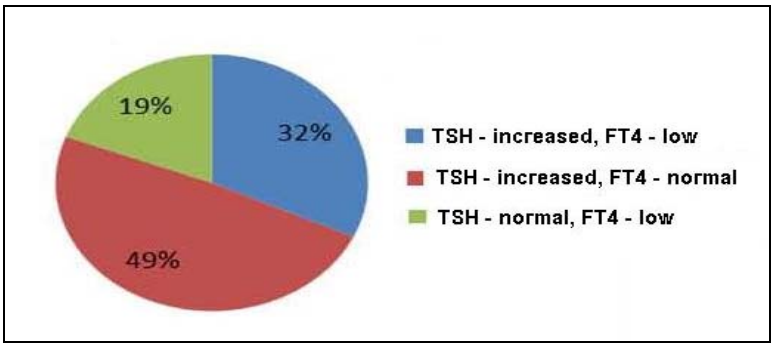

Fig. 4. Clinical forms of hypothyroidism represented percent

Clinical forms of hyperthyroidism

TSH is equally important for the management of thyroid hyperfunction. A low level of TSH occurs in hyperthyroidism.

Primary hyperthyroidism is characterized by a low TSH and an elevated FT4.

In the case of a low TSH associated with a normal FT4, we may be in one of two cases: either a primary subclinical hyperthyroidism (latent) or a non-thyroid disease.

According to the graph (Figure 5), 14 cases of hyperthyroidism (82%) had low TSH and increased FT4, and the remaining 3 cases (18%) had low TSH and normal FT4. In the first group, cases with primary hyperthyroidism are combined, and in the second one with primary subclinical hyperthyroidism or other netiroidal diseases.

Resistance to thyroid hormones is characterized by elevated levels of both TSH and FT4 but can also occur if TSH is normal and FT4 increased.

Resistance to thyroid hormones

There were 11 cases with thyroid hormone resistance (Figure 6), of which 10 (91%) with normal TSH. Thyroid hormone variations are recorded in autoimmune in autoimmune thyroiditis.

The most important cases in which increases in anti-TPO are Hashimoto's disease and Basedow-Graves disease. In Hashimoto and Basedow disease there are very high levels of this antibody. In the case of Hashimoto thyroiditis, the TSH and FT4 hormone levels are variable, most often within normal limits.

Diagnosis of autoimmune thyroiditis is done with anti-thyroid autoantibodies.

Thyroid autoantibodies are microsomal autoantibodies, also called thyroid antiperoxidase or antithyroglobulin antibodies. The latter are fewer used in the diagnosis of autoimmune. Only one case showed both increased TSH and FT4 (9%).

The most important diseases in which increases in thyroid antiperoxidase are recorded are Hashimoto's thyroiditis and Basedow Graves disease. Very high titers of these antibodies are pathocnomonic for these conditions.

Increased values also occur in other thyroiditis (subacute thyroiditis, lymphocyte), but also in thyroid carcinoma and thyroid lymphoma, but also in other autoimmune conditions (rheumatoid arthritis, systemic lupus erythematosus, acute articular rheumatism, myasthenia graves) and up to 7% in the normal population.

It should be noted that in Hashimoto's thyroid hormone, the TSH and FT4 values may be variable. Patients with autoimmune thromboses may have hypo, hyperfunction, or they may be euthyroid (Figure 7).

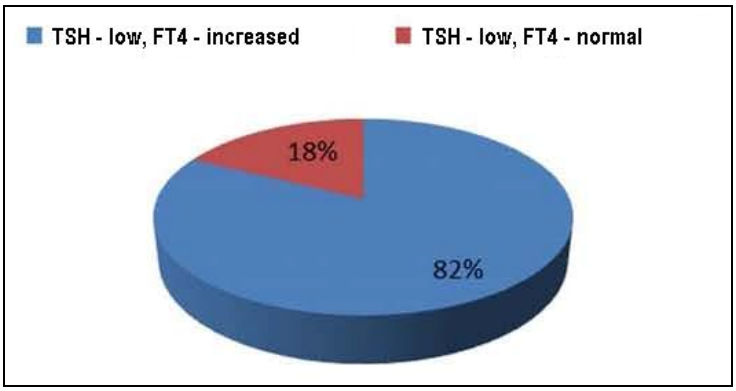

Fig. 5. Clinical forms of hyperthyroidism identified in the study group

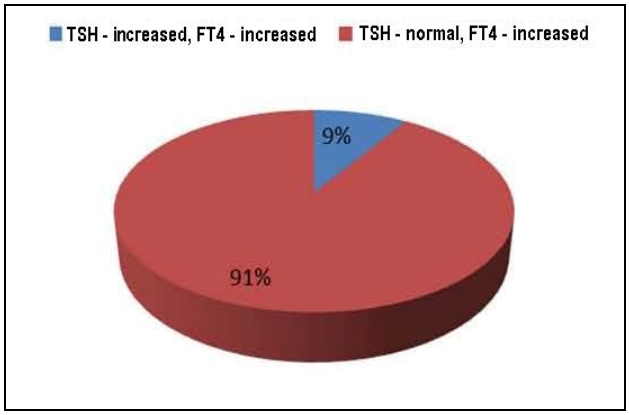

Fig. 6. Resistance to thyroid hormones identified in the study group

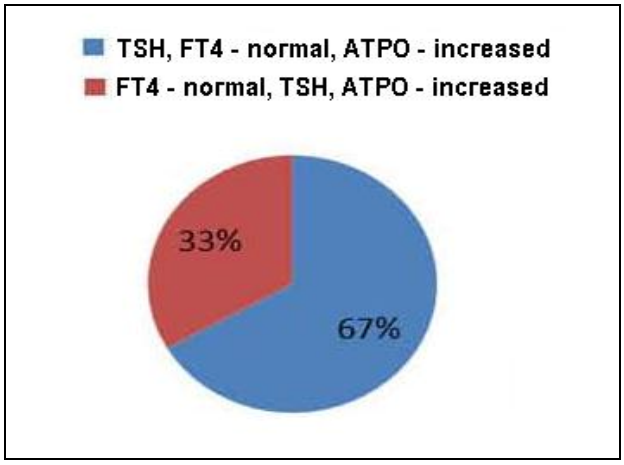

Fig. 7. Variations of thyroid hormones in autoimmune thyroiditis

Of the 9 cases with high levels of peroxidase antibodies, 6 cases have normal TSH and FT4 (67%), and 3 cases have elevated TSH and normal FT4 (33%) (hypothyroidism) after as can be seen from the graph (Figure 7).

Combination of a low TSH with FT4 increased along with elevated levels of ATPO may be the premises of a diagnosis of hyperthyroidism with thyrotoxicosis.

Other biochemical changes that may occur include increased glycemia with possible glycosuria, elevated liver tests (ALT, alkaline phosphatase) but also urea and creatine.

The association of all these modified parameters did not occur in any of the patients presented.

Variations in biochemical parameters in thyroid disorders

In cases of hypothyroidism there are increases in biochemical parameters such as LDH (lactate dehydrogenase), CK (creatinine kinase), cholesterol, triglycerides, AST (aspartate aminotransferase) but also a decrease in glucose, iron, alkaline phosphatase and serum sodium.

The presence of a normochemical and normocytoma anemia is also characteristic and the occurrence of a proteinuria in the examination of the urine summary.

Thyroid hormones with hyperglycemic action may cause hypofunction a decrease or normalization of blood glucose levels.

Thyroid dysfunction is accompanied by alteration of lipid metabolism, hypothyroidism causing the growth of all lipid fractions but especially of cholesterol.

This is explained by the involvement of thyroid hormones in lipoprotein metabolism by receptor synthesis for LDL in control by negative feedback of endogenous cholesterol synthesis, but also by the excretion of cholesterol through the bile in solubilized form and transformed into bile acids.

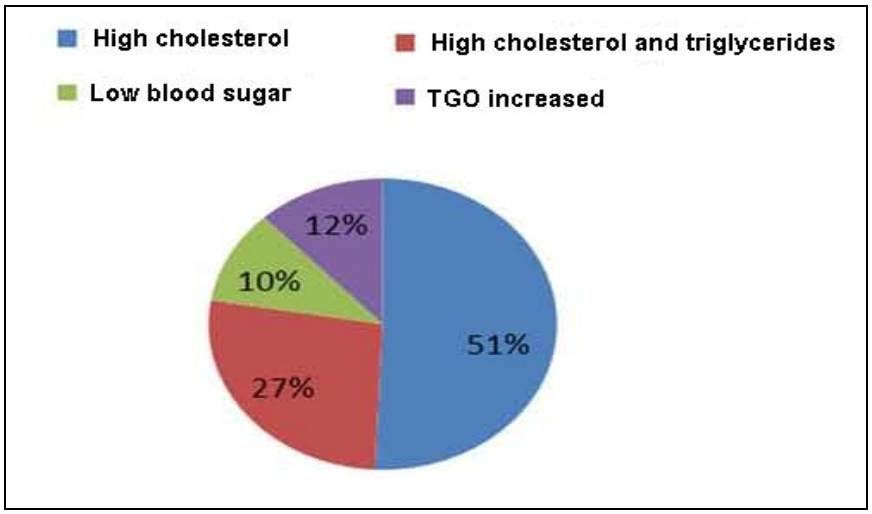

Fig. 8. Percentage representation of patients with hypothyroidism in whom they were registered modified biochemical parameters

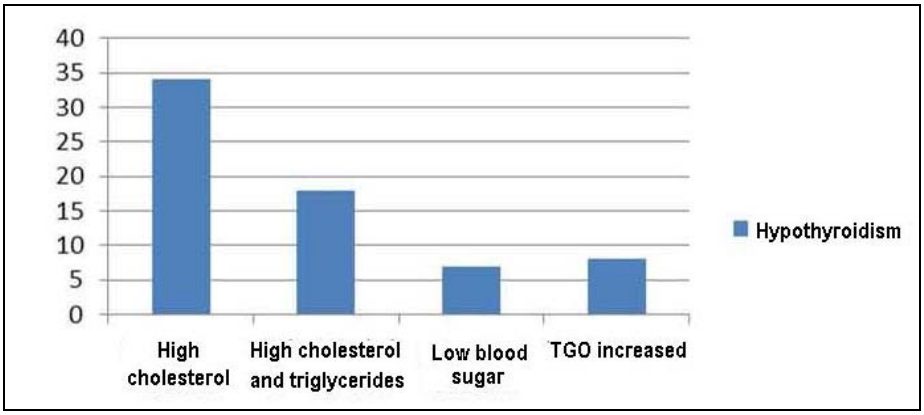

Fig. 9. Variations of some biochemical parameters in hypothyroidism

Of the 47 cases of hypothyroidism presented (Figures 8, 9), the highest proportion of cases had high cholesterol (34 patients representing 51%), a significant group being those with high cholesterol and triglycerides (18 patients - 27%) and also cases with high blood glucose (10%) and increased AST (12%).

Hyperglycemia is not characteristic of hypothyroidism, and can be explained in the context of other conditions. Increased cholesterol, triglyceride and AST values may be associated with hypothyroidism.

Thyroid hyperfunction is characterized by an increase in blood glucose, serum calcium, cholesterol lowering triglycerides. The association of hyperthyroidism with thyrotoxicosis may be accompanied by alterations in other liver tests (ALT, alkaline phosphatase but also urea and creatine).

Thyroid hormones by their hyperglycemic action make this hyperfunction more accentuated by the occurrence of hyperglycemia that can also be accompanied by glycosuria.

Thyroid hormones activate fat-dependent hormone lipase, which causes degradation of storage triglycerides with secondary growth of free fatty acids. They can be transported in hepatocytes for re-esterification and transformation into endogenous triglycerides, which can be sent into circulation as components of VLDL. Thyroid hormones also stimulate the catabolism of cholesterol.

Of the 17 cases of hyperthyroidism, there are 8 cases of hyperglycemia (28%), 6 cases with increased triglycerides (21%), 0 cases with hypercalcaemia (Figures 10, 11).

High cholesterol levels do not occur in hyperthyroidism, as they may have a different etiology. Also, elevated levels of ALT are not characteristic except in the case of hyperthyroidism associated with thyrotoxicosis, which is unlikely to occur in the patients studied, therefore the increased values of this transaminase are associated with other conditions.

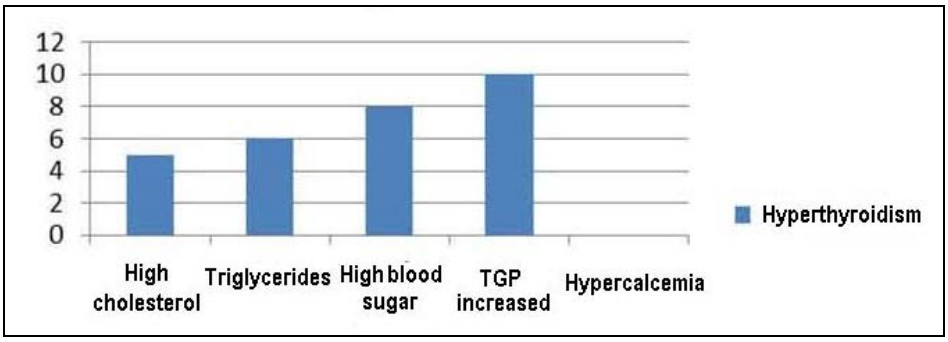

Fig. 10. Variations of some biochemical parameters in hyperthyroidism

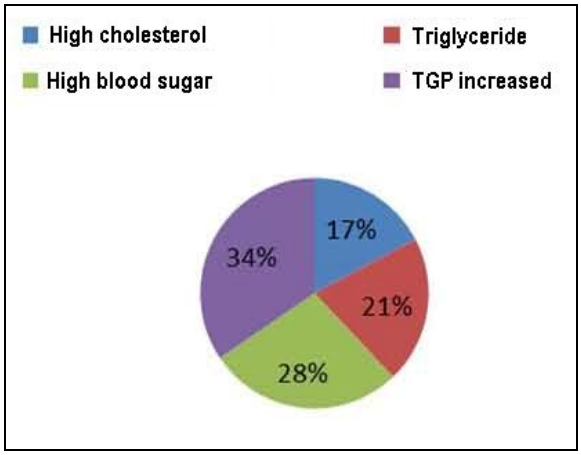

Fig. 11. Percentage representation of patients with hyperthyroidism in whom they were registered modified biochemical parameters

CONCLUSIONS

There is a predominance of thyroid disease in the women, and the age group most representative of the frequency of these dysfunctions is between 60 and 70 years.

In the clinical forms of hypothyroidism there is a higher incidence of primary hypothyroidism even in the subclinical stage (81%) than in cases of secondary hypothyroidism (19%).

Clinical forms of hyperthyroidism predominate cases of primary hyperthyroidism (82%) versus 18% representing cases of primary subclinical hyperthyroidism or other netiroidal diseases.

In the case of autoimmune thyroiditis, there is a higher proportion of cases with euthyroidism (67%) than those with hypothyroidism (33%).

Of the total thyroid dysfunction, the highest percentage (55%) is held by hypothyroidism, followed by hyperthyroidism (21%), the third place being occupied by those with thyroid hormone resistance (13%) and the last place by those with autoimmune thyroiditis (11%).

In the cases of hypothyroidism presented, the most numerous group is the one with high cholesterol (51%), a significant group being the one with both triglycerides and increased cholesterol (27%), fewer cases being reported with increased AST (12%).

In hypertrophic thyroid hypertrophy the highest frequency is in cases with hyperglycemia (28%), a lower percentage being in those with high triglycerides (21%), with 0 cases of hypercalcaemia.

ABSTRACT

The study presented is based on data provided by Katimed Medical Center Piatra Neamt. The research was performed on a group of 150 patients aged between 9 and 85 years, both female and male in the urban environment. All patients were evaluated for thyroid function as part of the routine evaluation prescribed by the family doctor or specialist. Hormonal dosages were performed from venous blood harvested á - jun. For the dosing of TSH, FT4 and ATPO, the enzyme-linked fluorescent assay (ELFA) was used as an automatic ELISA method with final reading in the fluorescence method, with the MiniVIDAS analyzer, Biomerieux France manufacturer. Of the total thyroid dysfunction, the highest percentage (55%) is held by hypothyroidism,

followed by hyperthyroidism (21%), the third place being occupied by those with thyroid hormone resistance (13%) and the last place by those with autoimmune thyroiditis (11%).

REFERENCES

1. AYALA A., WARTOFSKY L., 1997 - Minimally symptomatic (subclinical) hypothyroidism. The Endocrinologist;
2. BRUCKER- DAVIS F., 1995 - Genetic and clinical features of 42 Kindreds with resistance to thyroid hormone. Ann Intern Med.;
3. CUCULESCU M., 1996 - Endocrinologie clinică, Ediția a II a, Editura Medicală, Bucureşti (Clinical Endocrinology, 2nd Edition, Medical Publishing House, Bucharest);
4. DINU VERONICA, EUGEN TRUDIA, ELENA POPA- CRISTEA, AURORA POPESCU, 1998 - Biochimie medicala - mic tratat, Editura Medicala, Bucuresti (Medical Biochemistry - Small Treated, Medical Publishing House, Bucharest);
5. DUMITRACHE C., 1999 - Endocrinologie, mica enciclopedie, Editura Națională, Bucureşti (Endocrinology, small encyclopedia, National Publishing House, Bucharest);
6. HADEN ST., 1996 - Subclinical hyperthyroidism. The Endocrinologist;
7. LUCA COLEV VERONICA, 2000 - Fiziopatologie Generala, Volumul I, Editura Gp. T. Popa, Iaşi (General Physiopathology, Volume I, Gp. T. Popa, Iasi);
8. NĂSTOIU IOAN, 2007 - Bolile şi analizele medicale pe întelesul tuturor, Editura Niculescu, (Medical Diseases and Analyzes for All, Niculescu Publishing House);
9. VÂRCIU MIHAI, ALINA STOICESCU, 2009 - Endocriniligie clinica, Volumul I, Editura Lux Libris, Brasov (Clinical Endocriniligy, Volume I, Lux Libris Publishing House, Brasov);
10. WEETMAN AP, MCGREGOR A.M.,1994 - Autoimmune thyroid disease: Further developments in our understading. Endocr Rev.

AUTHORS` ADDRESS

PRISECARU MARIA STOICA IONUȚ, HANGANU DENISA –„Vasile Alecsandri" University of Bacau, Faculty of Science, Department of Biology, Marasesti Street, No 157, Bacau, Romania, e-mail: prisecaru_maria@yahoo.com; ionut_stoica23@yahoo.com;

IOSOB GABRIEL ALIN - Doctoral School - „Vasile Alecsandri" University of Bacau, Marasesti Street, No 157, Bacau, Romania, e-mail: iosob.gabriel@gmail.com