Tkachenko H.[1], Kurhaluk N.[1], Osmólska U.[1,2], Kasiyan O.[3], Yurchenko S.[3]

Lipid profile and lipid peroxidation biomarker in the blood of patients with subclinical hypothyroidism

[1]Institute of Biology and Earth Sciences, Pomeranian University in Słupsk, Słupsk, Poland

[2]Non-public Health Care Center U & O Zdrowie – Home-based long-term care, Lębork, Poland

[3]Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

Subclinical hypothyroidism (SH) is defined as an elevated serum thyroid-stimulating hormone (TSH) level associated with serum thyroid hormone concentrations within the reference range (Razvi et al., 2008). Patients with the subclinical stage of hypothyroidism have an increased risk of developing atherosclerosis and increased levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and apolipoprotein (apo) B (Wiseman et al., 1993; Mya and Aronow, 2002; Gao et al., 2015). Hypercholesterolemia is a common feature in hypothyroidism since thyroid hormones upregulate LDL-receptor expression (Huesca-Gómez et al., 2002). Thyroid hormones may stimulate hydroxymethylglutaryl-coenzyme A (HMG CoA), the key enzyme of cholesterol biosynthesis, and induce increased synthesis of cholesterol. Additionally, the LDL-C receptor gene contains a thyroid hormone-responsive element (TRE) that could allow triiodothyronine (T3) to modulate the gene expression of the LDL-C receptor increasing LDL-C receptor synthesis (Santi et al., 2012). Oxidative stress biomarkers seem to be associated with secondary hypercholesterolemia to hypothyroidism, whereas hypothyroidism per se does not cause oxidative stress in SH patients. On the other hand, high-plasma lipids can be considered as an oxidation substrate for oxidative stress (Santi et al., 2012). Thyroid dysfunction influences lipid metabolism and consequently on oxidant/antioxidant status in these patients. Considering that there are different results regarding the values of blood oxidative stress markers in patients with hypothyroidism, our study aimed to analyze the lipid peroxidation in male and female populations with subclinical hypothyroidism from the central Pomeranian region (northern Poland). The present study aimed to evaluate the lipid profiles and lipid peroxidation biomarkers in patients with subclinical hypothyroidism (n = 31) and health controls (n = 30).

A total of 31 patients with hypothyroidism between 25 and 65 years old were studied. The participants in the study were recruited from healthy volunteers and patients. None of the patients was included when presenting history or underlying symptoms of diabetes, cardiovascular disease, as well as if receiving hormonal treatment. In all cases, the patients and controls were non-smokers and non-pregnant. The participants of the study were

recruited among patients of non-public Health Care Center U & O Zdrowie – Home-based long-term care (Lębork, Poland). A detailed medical history was taken, and a physical examination was performed on all participants. The protocol was approved by the Human Ethics Committee of the Medical University in Gdańsk (KB 32/2018, Gdańsk, Poland). The patients were separated into two groups. The euthyroid group (18 female and 12 male) presented normal free T4 (FT4) and TSH values in the serum. The experimental group presenting FT4 and TSH values indicative for subclinical hypothyroidism (19 female and 12 male).

Thyroid profile was assessed by estimation of serums TSH, T3, and fT4 that were measured by electrochemiluminescence immunometric assay on Cobas 6000 Roche/Hitachi (e601 module). Serum total cholesterol (TC) and triglycerides (TG) concentrations were measured using standard enzymatic methods by use of kit reagents on the fully automated analyzer Cobas 6000 Roche/Hitachi (module c501). High-density lipoprotein cholesterol (HDL-C) was measured in the supernatant plasma after the precipitation of apolipoprotein B-containing lipoproteins. Low-density lipoprotein cholesterol (LDL-C) was estimated with the Friedewald equation. The level of lipid peroxidation was determined by quantifying the concentration of 2-thiobarbituric acid reacting substances (TBARS) with the Kamyshnikov (2004) method for determining the malonic dialdehyde (MDA) concentration.

Our results showed that subjects with SH had significantly higher levels of TC, LDL-C, TG, and TC to HDL-C ratio. Thus, a more atherogenic lipid profile when compared with healthy individuals was observed. In the present study, we have demonstrated that hypothyroid patients had non-significantly higher levels of TBARS (by 4.95% and by 3.59% for females and males with sub-clinical hypothyroidism compared to the healthy individuals. SH patients had significantly higher TSH, TC, LDL-C, and TC to HDL ratio with FT4 normal range than the control group. We also observed a positive correlation between TC and TBARS ($r = 0.625$, $p = 0.001$), TLDL and TBARS ($r = 0.712$, $p = 0.000$). A positive correlation between TSH and total cholesterol, triglyceride levels, and LDL fraction as well as thyroid hormones (T3 and FT4) was noted. TSH was also associated with deleterious changes in serum lipids, particularly HDL-C, LDL-C, and the ratio of LDL-C to HDL-C.

The present research has shown that thyroid hormones change lipid profiles. We have found associations between serum TSH levels and serum lipids levels, showing thyroid dysfunction influence on lipid metabolism and consequently on oxidant and antioxidant status in these patients. How-

ever, further studies are necessary to evaluate a larger series of patients, with a longer duration of subclinical hypothyroidism.

This study was carried out during the Scholarship Program supported by The Polish National Commission for UNESCO in the Department of Zoology and Animal Physiology, Institute of Biology and Earth Sciences, Pomeranian University in Słupsk (Poland). We thank The Polish National Commission for UNESCO for supporting our study.