

SUMMARY

Introduction. Breastfeeding accompanies a woman from the beginning of time and, according to anthropological research, naturally ends between the age of 2 and 6. The World Health Organization recommends exclusive breastfeeding up to 6 months of age and continuing with complementary feeding until the child is 2 years old or longer. Despite the increasing promotion of breastfeeding, women do not comply with the WHO guidelines and quickly give up exclusive breastfeeding, while long-breastfeeding mothers still struggle with misunderstanding of the society.

Breast milk has a rich nutritional composition that changes depending on maternal, geographical and perinatal factors, lactation phases, but above all, on the needs of the child. Women's milk is increasingly considered a medicine due to its wide range of properties, including anti-inflammatory, anti-infectious, immunomodulatory and antioxidant.

The main aim of the study was to analyze the composition and antioxidant status of milk of women living in the Kuyavian-Pomeranian Voivodeship, after taking into account maternal factors.

Material and methods. Breastfeeding women living in the Kuyavian-Pomeranian Voivodeship (n=107) participated in the study. Breast milk donors were divided into the following groups: long-breastfeeding women (n=47), women in the third phase of lactation (n=60), vegans (17), control group (women not following diets, healthy women (n=27)), women suffering from hypothyroidism (n=29), women struggling with allergies (n=27), women living in the city center (n=54) and women living on the outskirts and in the countryside (n=53).

The material for the study was breast milk from the daily collective collection (30 ml) and from the night collection carried out between 2:00 and 3:00 am (10 ml). The material provided by nursing women within 24 hours of milk collection was portioned and frozen (-20°C, then -80°C).

The MIRIS HMA analyzer was used to analyze the basic composition of human milk, and the concentrations of hormones (leptin, adiponectin, melatonin, cortisol, TSH), PON1 and TAS were determined using commercial ELISA tests. Spectrometric methods were used to determine the antioxidant activity of human milk using the DPPH• radical, the ability of human milk to reduce Fe (III) ions and the content of total polyphenols. BioMaxima colorimetric tests were used to determine the concentration of iron, magnesium, phosphorus and calcium in breast milk.

Results. The milk of long-breastfeeding women differed in basic composition, containing more fat ($p = 0.012$; $p = 0.018$), dry matter ($p = 0.034$; $p = 0.003$), energy value ($p = 0.005$; $p = 0.008$) in day and night samples, as well as total ($p < 0.001$) and nutrient ($p = 0.001$) proteins in overnight samples compared to mature milk. There were no differences in the concentrations of hormones and the antioxidant status of milk between the groups.

In the next stage of the study, after taking into account the examined lactation phases, lower content of carbohydrates ($p = 0.012$), dry matter ($p = 0.018$), total protein ($p = 0.004$) and nutritional protein ($p = 0.011$) in human food in the night portion was observed. compared to the daily dose. Breast milk from the night batch reduces more of the DPPH• radical (by 25.51%, $p < 0.001$), contains a higher concentration of polyphenols (by 11.73%, $p = 0.043$) and PON1 (by 142.86%, $p < 0.001$) compared to daily samples. Lower concentrations of melatonin were also noted (by 57.42%, $p < 0.001$) in daytime samples compared to nighttime samples.

Vegan milk was characterized by an increased concentration of cortisol (by 61.10%, $p = 0.022$) and a lower antioxidant status compared to the control group. Lower TAS (by 32.85%; $p < 0.001$), FRAP in night samples (by 27.50%; $p = 0.049$), PON1 concentration (by 29.03%; $p = 0.021$) and polyphenols (by 11.18%; $p = 0.039$) were found in the milk of vegans compared to the milk of women not using diets. When analyzing the concentration of vitamins, micro- and macroelements, lower concentrations of iron ($p = 0.037$) and vitamin B6 ($p = 0.024$) were found in the milk of vegan women.

Taking into account the phases of lactation, the milk obtained from women suffering from hypothyroidism showed a higher concentration of total protein ($p = 0.026$) and nutritional protein ($p = 0.044$) compared to the milk of healthy women. The milk TAS of women with hypothyroidism was lower (by 19.77%, $p = 0.005$) compared to the milk of healthy mothers.

The milk of women suffering from allergies was characterized by an increased content of fat ($p = 0.047$), dry matter ($p = 0.002$), energy value ($p = 0.002$) in the night portion, and energy value ($p = 0.028$) in the daily portion compared to with the control group.

The last stage of the experiment included the analysis of the influence of the environmental factor (place of residence) on the variability of the composition and antioxidant status of human milk. No effect of the above-mentioned factor on the antioxidant status of breast milk was observed in any of the study groups. In the milk of women living on the outskirts of the city and in the village, the concentration of cortisol and melatonin in the night

sample was lower compared to the milk of women living in the city center (by 32.52%, $p=0.002$; by 9.29%, $p=0.032$, respectively).

Conclusions. The milk of women from the Kuyavian-Pomeranian Voivodship showed variability in the composition and antioxidant status depending on maternal factors. Due to the presented results and recommendations regarding a vegan diet used by lactating women, it is worth paying special attention to the impact of veganism on the composition and antioxidant status of human milk. The presented analyzes suggest that nursing mothers following a vegan diet should pay attention to supplementation and the quality of consumed products. Another important issue is the antioxidant status of breast milk, which, as the results show, varies depending on maternal factors. It was confirmed that the antioxidant status of milk of long-breastfeeding women is still at a good level, which is crucial in ensuring the oxidative-antioxidant balance in the body of a child consuming human milk.

Currently, there is still a lack of extended research on the impact of a vegan diet or diseases occurring in a nursing mother on the composition of breast milk, as well as on the analysis of milk of long-breastfeeding women. This work is part of the popularization of knowledge on proper nutrition in infancy among pregnant women, women who are breastfeeding, future parents and guardians of the youngest children and representatives of the medical community interested in the field of paediatrics.