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Analysis and correction of diets of overweight and obese women

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Abstract

The proposed study is important and relevant in view of the increasing level of obesity in the world. Preventive interventions are important to reduce long-term health care costs and improve overall population health as health care systems struggle with the financial burden of obesity-related diseases.

Hypodynamia and obesity act as predictors of the development of atherosclerosis and metabolic syndrome. It is worth noting that the level of vitamin D in blood serum affects the development of the risk factors listed above. Research results demonstrate an inverse

relationship between the level of 25-hydroxyvitamin D in blood serum and the development of obesity, metabolic syndrome, and insulin resistance.

As part of a prospective randomized controlled trial, 106 women aged 19 to 68 years (mean age 43.66 ± 5.02 years) who had a BMI of 25 kg/m² or higher were examined. Measures (weight, body mass index, 25(OH)D) were assessed at the start of the study and every four weeks to monitor development and dietary compliance for 6 months. After six months of individual dietary adjustments, body weight and BMI were significantly reduced. Participants reduced their weight on average by 7.13 ± 0.78 kg and 2.53 ± 0.19 kg/m² ($p < 0.001$). Individualized dietary adjustments resulted in significant weight loss, highlighting the value of individualized dietary interventions for effective weight management. A link between excess body weight and vitamin D deficiency has been established.

Key words: obesity; diet; BMI; prevention; hygienic assessment; vitamin D

Actuality. Obesity is a global medical and social problem for the entire society, as it negatively affects life expectancy and leads to early disability [1]. Over the past 50 years, the prevalence of obesity has increased dramatically, affecting more than 650 million adults worldwide, becoming a major global health problem of pandemic proportions [2]. According to the Global Nutrition Report, in 2016, 61.4% of men and 55.5% of women in Ukraine were obese [3]. Being closely related to type 2 diabetes, osteoarthritis, obstructive sleep apnea, depression and some types of cancer, obesity is a global medico-social problem for the entire society, as it negatively affects life expectancy and leads to early disability [1, 3].

According to experts, the main cause of excess body weight is a sedentary lifestyle and overeating, as a result of which significantly more calories are consumed than burned [1, 4]. Hypodynamia and obesity act as predictors of the development of atherosclerosis and metabolic syndrome [2, 5]. It is worth noting that the level of vitamin D in blood serum affects the development of the risk factors listed above [6]. Research results demonstrate an inverse relationship between the level of 25-hydroxyvitamin D in blood serum and the development of obesity, metabolic syndrome, and insulin resistance [7].

Despite the well-established relationship between diet and obesity, little is known about the actual eating habits of overweight and obese women. Therefore, the search for new mechanisms of obesity development, factors contributing to its development, methods of treatment and prevention, improvement of the quality of life of obese patients is a strategic task of modern medicine [7, 8].

Goal: Determination of the actual nutrition of overweight and obese women. To assess the effectiveness of the correction of individual diets for the purpose of reducing body weight.

Materials and methods. As part of a prospective randomized controlled trial, 106 women who had a BMI of 25 kg/m² or higher were examined. Participants, representing a cohort of overweight and obese women aged 19 to 68 years (mean age 43.66±5.02 years), were drawn from a variety of occupations. Evaluation of indicators (weight, body mass index, 25(OH)D) took place at the beginning of the study and every four weeks for 6 months.

Pregnant or lactating women, patients with diseases of the endocrine system, autoimmune pathology, chronic diseases of the kidneys, liver and gastrointestinal tract, patients who have undergone bariatric surgery in the past, as well as people who have had severe dietary restrictions in the past, were excluded from the study.

Nutritional assessment of nutritional status was performed using validated food frequency questionnaires and 24-hour dietary recall to assess subjects' actual nutrition. To investigate potential correlations with changes in body weight, information on intake of vitamin D and other relevant nutrients was collected. The evaluation of food rations, in terms of their provision of basic nutrients, was carried out in accordance with the Order of the Ministry of Health of Ukraine dated September 3, 2017 No. 1073 "On the approval of the norms of physiological needs of the population of Ukraine in basic nutrients and energy" [9].

Each study participant received an individualized meal plan based on their individual nutritional needs, food intolerances, and energy needs. A moderate caloric deficit was the goal of dietary correction, which also ensured adequate intake of vitamin D and other vitamins, micro- and macronutrients.

Levels of 25-hydroxyvitamin D (25(OH)D) in blood serum were determined using a chemiluminescent immunoassay "Midray-CL900i".

The research was carried out with the provision of safety measures for life and health, with respect for human rights and moral and ethical norms, which corresponds to the principles of the Helsinki Declaration of Human Rights, the order of the Ministry of Health of Ukraine No. 693 dated 10.01.2015, and the Council of Europe Convention on Human Rights and biomedicine (ETS-164) dated 04.04.1997

Research results

According to the analysis of the food diet, it was established that the participants consumed more calories than their physiological norm, on average - 2687.22±413.59 kcal/day. Most of the participants reported that they lead a sedentary lifestyle and have erratic

eating habits. Fruits, vegetables and sources of vitamin D were deficient, while the diet was oversaturated with processed foods, including high amounts of refined sugars and saturated fats (Table 1).

Table 1

Assessment of the diet of overweight and obese women

Total calories (kcal)	2687,22±413,59
Saturated fat (g)	41,66±12,27
Refined sugar (g)	51,98±14,36
Fruits (portions/day)	2±1
Vegetables (servings/day)	3±1
Vitamin D (IU/day)	236,59±97,41

When assessing the level of 25(OH)D in blood serum, it was established that 79% of women who were part of the study group had vitamin D deficiency (25(OH)D<20 ng/ml), 16% insufficiency (25(OH)D from 20 to 30 ng/ml) and only 5% of women had adequate vitamin D levels (25(OH)D>30 ng/ml).

On average, the monthly increase in serum 25(OH)D level was 0.66 ng/ml. The greatest increase was observed after the second and after the fourth month and amounted to 0.81 ng/ml (Fig. 1).

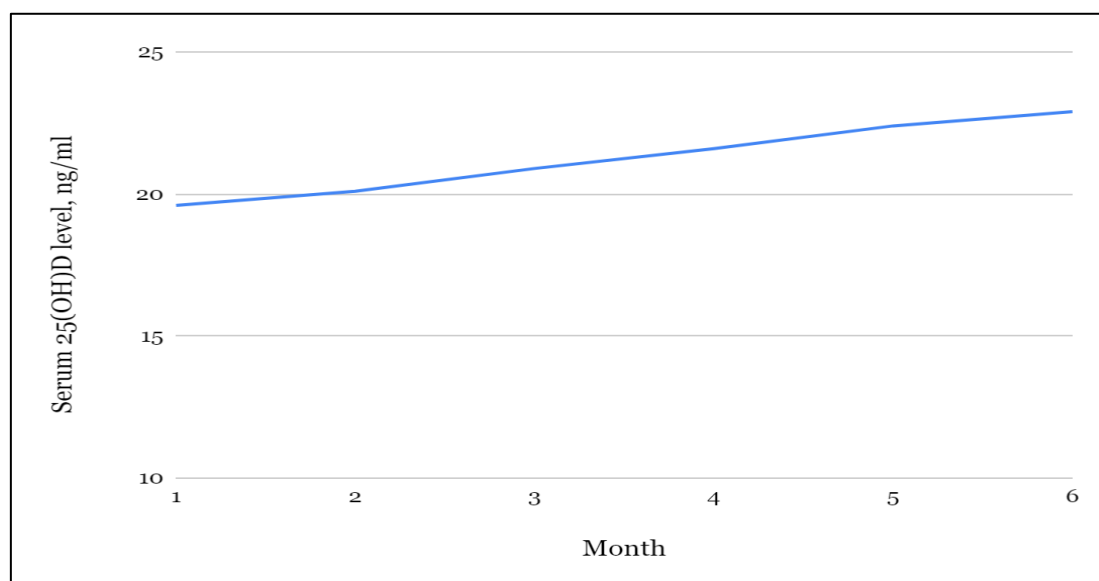


Fig. 1 Dynamics of the average indicators of the level of 25(OH)D in the blood serum

The correction of the diet provided for four meals with the following distribution of calories: breakfast – 30%; snack - 15%; lunch – 35%; dinner - 20%. When forming the diet, basic metabolism, physical activity and individual nutrient needs were taken into account. The calculation formula of Harris Benedict was used to determine the basic metabolism:

$$655 + (9,6 * \text{weight}) + (1,8 * \text{height in cm}) - (4,7 * \text{age}) \text{ (for women).}$$

The total caloric content of the rations each month decreased by an average of 7-10% in relation to the recommended coefficient of physical activity. The content of proteins relative to the energy value of the daily diet was 13%, fats - 30%, carbohydrates - 10% of the total caloric content (Fig. 2).

According to initial dietary assessments, the diets of overweight and obese women were high in calories and poor in nutrients. Individualized dietary adjustments resulted in significant weight loss, highlighting the value of individualized dietary interventions for effective weight management.

A significant majority of patients were vitamin D deficient and their baseline vitamin D intake was below recommended limits. Improvements in vitamin D intake were observed during dietary adjustment, suggesting potential implications for overall health and weight management.

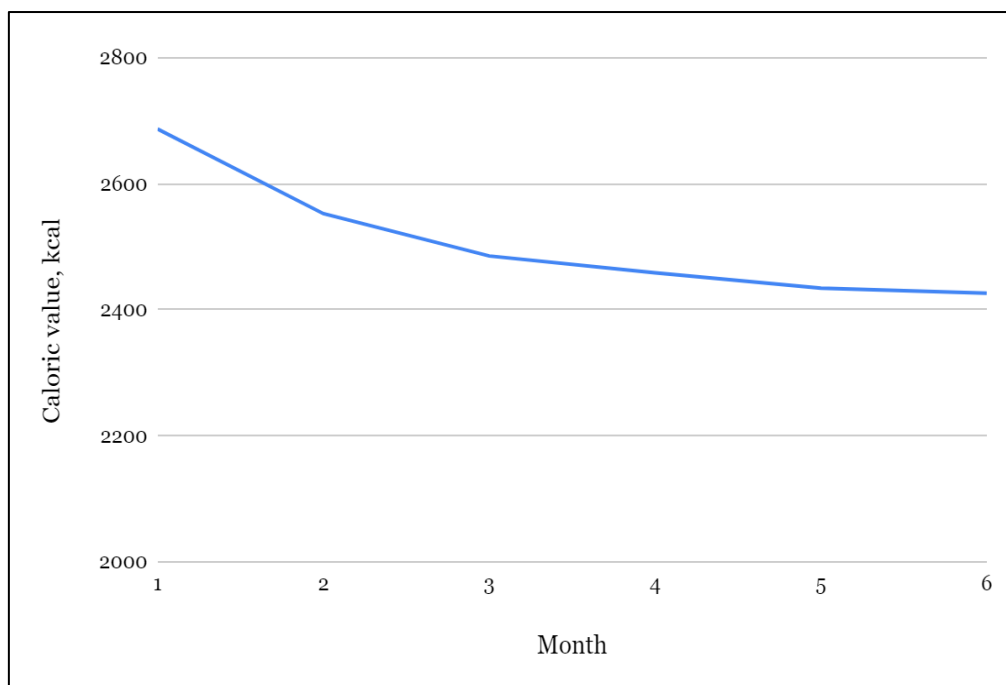


Fig. 2 Dynamics of changes in the average caloric content of food

After six months of individual dietary adjustments, body weight and BMI were significantly reduced. Participants reduced their weight on average by 7.13 ± 0.78 kg and 2.53 ± 0.19 kg/m² ($p < 0.001$). The average level of 25-hydroxyvitamin D doubled (Table 2).

Table 2

Changes in body weight and changes in BMI after individual dietary correction

Indicator	Initial level	After						General change	p
		1 month	2 month	3 month	4 month	5 month	6 month		
Body weight (kg)	85,22 ±7.61	84.34±7.41	83.36±7.77	82.55±7.21	81.55±6.85	80.62±7.45	78.09 ± 6.83	-7.13±0.78	<0.001
BMI (kg/m ²)	30.85 ±3.53	30.28±3.43	29.38±2.78	29.29±2.45	28.57±3.07	28.34±4.03	28.32 ±3.34	-2.53±0.19	<0.001
25(OH)D (ng/ml)	15.31 ±5.16	18.02±4.89	21.05±5.52	24.33±5.57	27.19±4.26	30.37±5.06	30.66 ±7.98	+15.35±2.82	<0.001

Conclusions:

The results of the study emphasize the importance of assessing the actual nutrition of overweight and obese women, as well as the role that individual dietary adjustment plays in weight loss.

The relationship between excess body weight and vitamin D deficiency has been established, which is confirmed by previous studies (Shanyhin A.V. et al., 2023) and proves that excess body weight reduces the bioavailability of 25(OH)D in blood serum and contributes to its deposition in adipose tissue [8, 10]. It should be noted separately that obesity develops non-alcoholic steatosis of the liver, due to which the function of hepatocytes suffers, in which the rate of synthesis of 25(OH)D decreases [11, 12].

The associations found between dietary habits, vitamin D status, and weight loss outcomes offer important new information for the study of obesity. For overweight and obese women, incorporating vitamin D testing and individualized dietary interventions into clinical practice may increase the effectiveness of weight management and improve health outcomes.

The results of the study encourage additional research into the function of vitamin D in weight control, as well as the potential benefits of formulating individual diets in different

population groups. Future studies should focus on long-term sustainability and investigate the best combinations of dietary changes to promote weight loss and improve overall health.

This work contributes to evidence-based approaches to addressing the global obesity crisis and promoting better lifestyles among vulnerable populations by understanding the actual diets of overweight and obese women and evaluating the effectiveness of certain dietary treatments.

The results of this study provide valuable information about the eating habits of overweight and obese women, offering evidence-based recommendations for weight management. The development of personalized dietary adjustments has the potential to improve long-term adherence to dietary interventions, promoting sustained weight loss and improved overall health.

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