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Bariatric patient from the point of view of a nutritionist

Pacjent bariatryczny z punktu widzenia dietetyka

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Abstract

Nowadays obesity is one of the biggest worldwide problem. The predominant factor that may result in obesity is an excesive amount of energy and low physical activity. At the present time there are two overwhelming methods to fight obesity- conservative treatment and bariatric surgery. The second one is regarded as the most effective way to reduce body weight of the people suffering from the morbid obesity. Surgical treatment can only be efficient when it is followed by introducing dietary indications, both before and after the surgery. The bariat-

ric patients have to be monitored by medical staff including the dietician to help them change eating habits. The dietician's support is also crucial to avoid nutrient deficiency and digestive system ailments.

Key words: obesity, bariatric surgery, diet, supplementation

Admission

Obesity is now a major health problem in many countries. It is considered a civilizational disease that directly threatens health as well as life [1]. Until recently, it was believed that it affects only highly developed countries. Nowadays, there is an increase in the number of overweight and obese people also in societies with medium or low state budgets [2]. Due to its prevalence and global reach, it was declared an epidemic by the WHO in 1997 [3]. According to World Health Organization estimates, 1.6 billion people suffer from overweight and 400 million because of obesity. The most important thing is that more and more doctors and people related to health service management is aware of how wide this problem is, causing many additional medical conditions in people with obese. This, in turn, translates into higher treatment costs for these patients and often their premature deaths [4].

Definition

By definition, obesity is a chronic disease characterized by an increase in the amount of fatty tissue in the body. In men it is assumed that the increase is above 25%, and in women - above 30% of body weight [5]. The consequence is impairment of the basic functions of the organism and increase of the risk of morbidity and mortality [1]. We can also talk about obesity when weight gain is 20% above the due body weight, which we calculate according to the Broc's formula: increase reduced by 100. For young women, this value should be reduced by 10% and young men by 5% [6]. Accumulation of excess body fat occurs at a time when the supply of energy is greater than its disbursement. In short, inadequate diet and low physical activity, associated with sedentary lifestyle are some of the main causes of the obesity epidemic [2]. Systematizing obesity, we can divide it into primary obesity - simple obesity, which is the effect of a positive energy balance and secondary obesity. The second is one of the symptoms of metabolic disorders, e.g. hypothyroidism adrenal hyperthyroidism [6]. The primitive type, which is the result of bad eating habits cultivated over the years, may also be associated with personality and mood disorders [3].

The simplest way to assess the degree of obesity is to determine the body Mass Index (BMI), which we calculate according to the formula: body weight [kg]/(height [m])^2 [7]. When BMI is within 25-29 kg/m2 We are faced with excess weight. We can already talk about obesity of the first degree when the BMI is 30-34.9 kg/m^2. We can begin to think about bariatric surgery if the patient has BMI of 35-39.9 kg/m2 (so called obesity II), while they must additionally accompany him with concomitant diseases. On the other hand, BMI ≥ 40 kg/m^2 is already pathological obesity, which is an indication for bariatric surgery. Due to the growing problem of obesity in the world we can meet with expressions superobesity, when BMI is within 50-70 kg/m2 and BMI > 70, where we are faced with megaobesity [3].

Epidemiology

As reported by the World Health Organization, the problem of obesity is getting bigger and becomes one of the major societal problems. Comparing the year 1980 and 2008, it was found that the number of obese people doubled. In 1980, obesity was diagnosed in 5% of men and 8% of women. In 2008, however, this problem affected 10% of men and 14% of women, which is 205 million men and 297 million women worldwide [2]. The year 2000 was a special year in terms of obesity. According to WHO studies, for the first time in the world there were as many people living with weight loss as people with excess weight [8]. The majority of overweight or obese people (62% of the population) are present in the Americas [2]. Unfortunately, Europe, too, is not showing itself at its best, where the problem of overweight and obesity is getting worse and worse. It is assumed that the prevalence varies between 10 and 30% depending on the country. In Poland we can talk about 18%. Pathological obesity, on the other hand, constitutes 1.4% of the whole population [7].

Etiology

There are several factors that favour obesity. However, no matter which one is dominant in a current case, excess body fat is taken from the excessive supply of energy in relation to its spending by the body. Among the causes of overweight and obesity we can mention environmental, genetic, pharmacological, psychological and biological factors. Studies show that environmental factors most influence the development of obesity, and genetic factors may play a role in up to 40% of cases [8]. Environmental factors conducive to the development of overweight and obesity are small physical activity related to sedentary lifestyles and easy access to high-processed, fat- and sugar-rich food [5].

Consequences

Obesity is a disease that has a number of adverse health consequences, which very often lead to death [2]. Obese people more often suffer from type 2 diabetes mellitus, insulin resistance, serum lipid level disorders, gall bladder disease, obstructive sleep apnoea syndrome, ischemic heart disease, arthritic and spinal degenerative diseases, non-alcoholic fatty liver, hyperuricemia and urate bottom and increases the risk of perioperative complications [8]. Obesity contributes to more frequent occurrence of cancer, hormonal and reproductive disorders, as well as psychosociological disorders and significantly increases the costs of treatment [2].

Treatment methods

Two treatments for obesity are currently predominate – conservative and surgical treatment. According to experts of the Polish Society of Dietetics, which in 2015 developed the standards for the treatment of dietary obesity straight, all those who have been diagnosed with overweight (BMI 25-30 kg/m2 without additional loads) can be treated safely with conservative and behavioural therapy. However, each adult patient diagnosed with obesity I, II with additional risk factors or obesity III, should have a treatment plan developed by a therapeutic team [9]. According to current studies, the best option for advanced obesity seems to be bariatric surgery. Applying only dietary recommendations in such patients gives a small and short-term effect [10]. Patients with pathological obesity undergoing bariatric surgery reduce body weight more than patients undergoing conservative treatment. Moreover, the majority of patients experience remission of type 2 diabetes mellitus and metabolic syndrome [11]. Other studies carried out in Swedish patients show that surgical intervention in obese patients has a beneficial effect on the cardiovascular system, decreases sleep apnea, joint pain and significantly improves quality of life [12]. A contraindication to bariatric surgery is: lack of prior conservative treatment, lack of adequate medical care, inability to participate in long-term post-operative care, unstable psychiatric disorders, severe depression, Personality disorder, alcohol abuse, rug addiction, life-threatening diseases inability to care for themselves, lack of family and environment support [13].

Types of bariatric treatments

Bariatric operations may be restrictive, where the amount of food is reduced and excluded, which cause a bypass of the process of absorption of the duct sections of the feed [3]. Restrictive surgeries include laparscopic adjustable gastric banding *(LAGB)*, laparoscopic

sleeve gastrectomy *(LSG)* and vertical banded gastroplasty *(VGB).* The advantage of this type of treatment is short course, relatively simple technique, low burden for the patient and lower risk of food shortages. The disadvantage is less weight loss. The second type of operation is bilio-pancreatic diversion *(BPD)* and bilio-pancreatic diversion with duodeanl switch *(BPD-DS).* These treatments are currently less frequently performed, pose a higher risk of perioperative complications. Weight loss After this type of surgery is more effective, because we limit the absorption of foods, but it is therefore necessary to take supplementation. The third type of treatment combining both mechanisms is usually the Roux-en-Y gastric bypass *(RYGB).* This technique helps to achieve greater weight reduction compared to restrictive treatments, with a lower risk of nutrient shortages than exclusion operations. Bariatric treatment may be used in obese patients with a BMI ≥ 40 kg/m^2 or ≥ 35 kg/m^2, with additional concomitant conditions such as hypertension, coronary heart disease, respiratory failure, type 2 diabetes, where conservative treatment during the last six months has not been effective [14]. It is very important that the patient is assessed and cared by a multidisciplinary team that will supervise the proper course of preparation and the whole perioperative period [7]. The bariatrist surgeon, anaesthesiologist, internist, trainer, psychologist and dietician should be a part of the team [1,15, 16].

Preparation of the patient for bariatric surgery

The role of a dietitian is extremely important both in the preparation of the patient for bariatric surgery, as well as aid in the issue of nutrition after surgery. It is recommended that a patient who is qualified for a surgical procedure should lose 5-10% of the current body weight. This allows the patient to become more easily accustomed to changing the type of life that he will have to maintain after surgery. Body weight reduction of 5-10% allows to reduce the amount of fat inside the abdominal cavity and allows to degrease the liver, which facilitates the surgeon's work. The procedure is shorter and the risk of complications is reduced and the hospitalization period is shorter [15]. It is the dietician who should conduct a detailed nutritional interview with the patient, which will make it possible to determine the mistakes made so far and to convince him/her that a change in eating habits at this stage will help to achieve success in treatment. A nutritionist's task is to introduce the principles of nutrition, teach the selection of appropriate products and technologies of food preparation [1]. Because the patient has an exact goal, which must be achieved when preparing for the treatment, that is, body weight reduction within 5-10% of the current body weight, the best solution is to use a low energy diet (richer, with a reduction in fat and carbohydrate products with a high

glycemic index). This type of diet allows you to lose weight gently, without the risk of complications, and the loss of weight is 0.5-1.0 kg per week, or an average of 2-4 kg per month. The protein supply should be physiological, i.e. 0.8-1.0 g/k of body weight (NMC) and should constitute 20-25% of the energy value. If the diet contains too little protein, the body starts to use the intra-organic protein, which slows down the resting metabolism. The delivered protein should have a high energy value, i.e. it should come from lean milk, meat, poultry, fish, cottage cheese, eggs, lean meats. Fat supply, however, should not exceed 10-20% of the supplied energy. A very important element is an adequate supply of omega-3 acids, because they have a positive effect on insulin levels. The sick person should provide sea fish, nuts, pulses and flax seeds in their daily diet. The supply of these acids should be at the level of about 3% of energy. The patient should also pay attention to reduce the supply of cholesterol. Its amount should be maximum 300 mg, and in the case of hyperlipidemia and/or diabetes 200 mg per day. Carbohydrates should account for 45-50% of energy supply and it is not recommended that there should be less than 100g per day, so there will be no intersystematic protein consumption. It is best to supply them in the form of low-absorbable carbohydrates, i.e. wholemeal bread, coarse groat, brown rice, bran. It is important to limit the simple sugars in the diet: sugar, honey, jams, all kinds of sweets, confectionery bread, sweetened beverages, including those that have fructose, etc. Too much sugar has a negative effect on our body because it increases the level of triglycerides, increases the amount of body fat, additionally, due to the high glycemic index, it increases the concentration of insulin in the blood, which in turn facilitates the accumulation of fat. It is important to remember that a diet should contain an adequate amount of dietary fiber. The most optimal level of dietary fiber is about 25-30 grams per day. Products that are a rich source of dietary fiber require longer rumination, which means that we eat a meal longer, and this positively affects the feeling of satiety. In addition, it accelerates the intestinal passage and the effect on the absorption of nutrients from the food supplied. The soluble fraction of fiber binds to the intestine with water, it reduces glucose concentration after a meal. Thanks to this, the patient has a lower level of insulin in the blood, so the appetite does not increase quickly. Other beneficial effects include lowering the level of cholesterol and triglycerides. Patient preparing for the procedure should eat as much as possible vegetables in raw and cooked form, such as: tomatoes, cucumbers, lettuce, spinach, radish, sauerkraut, chive, asparagus, chicory, beetroot, broccoli, cauliflower, cabbage, pepper, kohlrabi, sorrel, onion. They will also provide a range of water-soluble vitamins and minerals.

The patient should also be aware that he should limit the supply of kitchen salt to 5 grams per day and spices, as they can unnecessarily stimulate appetite [5,6]. Obese patients often lead a very irregular lifestyle, and breaks between meals can be for hours. Therefore, in addition to all the above recommendations, it is extremely important to regulate the timing of individual meals. The patient should learn to eat breakfast up to one hour after getting out of bed. The next ones should be about every 3-4 hours, preferably 5 of them during the day - 3 main ones and 2 healthy light snacks for the second breakfast and afternoon snack. The sick should acquire the ability to consciously choose food products, i.e. learn to read labels. It is important for a nutritionist to indicate what patients should pay attention to, both in terms of harmful substances and those that positively affect our health. In addition, the patient should eliminate sweet drinks from his diet and learn to drink non-carbonated mineral water up to 2 litres per day. He should not eat between meals, especially salty or sweet snacks and, if this is the case, dispense with fast food products. These recommendations will allow for controlled weight reduction. It is advisable for the patient to introduce as much physical activity as possible, which will also help to reduce body weight [16]. It is very important that the patient develops a habit of calm, fully conscious eating and thorough rumination, even up to 30 times, which will be necessary after the surgery. This stimulates the satiety centre in the brain and makes it feel saturated more quickly [1]. It is good for the patient before the surgery if he learned not to drink to the meal, only an hour after or before the meal. Thanks to this, the feeling of satiety is achieved faster [15The most important task of a dietitian is to guide the patient to understand that a change in eating habits and lifestyle affects not only the period before the procedure, but also after it. In this way, the reduced body weight can be maintained [1]. It is important to convince the patient that only a rational balanced diet will help him/her to prepare for the bariatric procedure. It is important to be aware that the wrong choice will be to use a diet, which is often promoted by women's magazines. They are mostly unbalanced and can therefore cause nutrient deficiencies. This is particularly true for fruit diets (pineapple, apple, grapefruit) and vegetable diets (e.g. cabbage). They do not provide an adequate amount of protein, calcium, iron and mainly B vitamins. Such diets, although they will help to reduce body weight in a short time, however, can lead to a shortage of various nutrients, which in turn adversely affects the functioning of the organism [17]. The purpose of a rational energy-poor diet is to change eating habits, which are also to be a normal part of life after the procedure [16].

Nutritional recommendations after bariatric surgery

Assistance in preparing for bariatric treatment is the first stage of a dietician's work with a patient. It is equally important to conduct dietary management of the patient after surgery, at an early stage as well as later. The aim of the postoperative diet is to further develop normal eating habits, allowing for weight reduction, preventing stomach stretching, refattening and counteracting adverse symptoms such as pain, vomiting and obstruction. The first 6-8 weeks after the procedure, when the postoperative wounds heal and the body adapts to new anatomical conditions, seem to be the most important and at the same time the most restrictive. Regardless of the procedure the patient is undergoing, the change of the current diet involves modification of the consistency, type and size of meals and, above all, reducing the amount of energy supplied. The most important thing is that meals are eaten in full concentration, chewed carefully to prevent air swallowing, bouncing and vomiting. Meals should be initially in the amount of even 8-10/day, ultimately 4-5. Their volume varies between 30 ml (immediately after RYGB, BPD, BPD-DS) to 100-150 ml (after LSG, LAGB). According to the guidelines of the doctors from the University of Nevada School of Medicine, at the beginning we introduce a liquid and liquid reinforced diet. On 1-2 days after the treatment it is recommended to consume neutral liquids, without sugar and caffeine. It is necessary to sip them slowly in the amount absorbed by the body, reaching 1500 ml per day. It's important not to drink them through a straw. This will avoid unnecessary air supply. The next days up to a week after the procedure is the continuation of fluid supply in the amount of 1500-1900 ml (depending on the patient's tolerance). You can start taking skimmed milk, soya milk, skimmed natural yoghurt, skimmed clear broth, diluted rice gruel. It is very important to remember about the temperature of meals. They should preferably be warm or lukewarm, so as not to irritate the gastric mucosa. It may happen that the patient will tolerate protein products badly, which is why US scientists allow powdered protein supplements (soya bean isolates or whey proteins) up to a maximum of 20 grams of protein per day. It is very important to include vitamin-mineral supplementation at this stage. The number of meals consumed is 4-6 at ¼ cup volume. The third stage is the pap diet, which can last up to 4 weeks (LSG) or up to 6 weeks (RYGB, BPD). Nutritional fluids are replaced into soft, mixed, ground, chopped and smooth products. This stage should be based on protein products that are designed to deliver at least 60 grams of protein per day. The best products will be boiled and ground eggs, fish, lean meat, poultry, low-fat cottage cheese. You can start to introduce well cooked (mixed or

whole, but after thorough chewing) easily digestible vegetables such as carrots, pumpkins, squash, celery, patissons, parsley. You can also eat creams of vegetable soups with mixed meat. Remember to eat 4-6 small (60-100g- ½ cups) meals at regular intervals and deliver 2 litres of liquids between them daily. It is important that you drink at least 30 minutes before and 30-60 minutes after a meal. 4-6 weeks after the operation, soft, peeled or canned fruit with no added sugar can be added to the diet. If the patient tolerates well, one solid product can be added, not forgetting the exact chewing. It is also the moment of transition to a easily digestible diet containing lean meat, vegetables and fruits. Avoid high protein products. The patient should eat 5 meals a day, with the volume of a cup (200g) in full concentration, chewing each bite thoroughly. At this stage, if there are no contraindications, you can introduce more physical activity to achieve better results in weight reduction. The last stage is a balanced reduction diet, which includes lean meat from poultry or fish, vegetables, whole grains products and fruits. Beware of too much dietary fiber in the form of raw vegetables and fruits, which can be badly tolerated. In this case, they can be heat treated (cooked) or rubbed off. Meals should be 5 cups in volume, liquids 1500-1900 ml, consumed 30 minutes before or 30-60 minutes after a meal. It is still necessary to chew the food thoroughly. We cannot predict how patients will tolerate products from different groups, especially in the first months after surgery. Therefore, it is important for the patient to be under the care of a dietitian who will help to adjust the choice of food products, prepare them properly and advise how to act in the event of poor absorption of specific products. The amount of energy supplied by the patient in the first months is 700-900 kcal per day and should be adjusted to the age, height and weight of the body. It is usually in the range of 1000-1200 kcal/day. The number of meals per day is 5. The protein should be at a physiological level (0.8-1.0 g/kg of body weight) and the fat should be no more than 30% of the energy supplied. Carbohydrates should be supplied in a quantity of not less than 100 g per day to prevent the loss of body protein for energy purposes. Remember not to eat fatty meat and sausages, fatty cottage cheese and yellow cheese, offal, pates, and replace them with vegetable oils and fish. Carbohydrates should come from products such as dark bread, oatmeal and groats. Dietary fiber should come from the above products and, in addition, from young vegetables and low-calorie fruits. We avoid high-calorie products, i.e. mainly sweets and fast food. We try to eliminate alcohol, because it provides unnecessary "empty" calories. The method of thermal processing is also important. It is recommended to steam, boil in water, bake in foil or sleeve, stew without frying [18].

The Bariatric Nutrition Pyramid

To make it easier for patients to follow dietary recommendations even at late stages after the Moize et al. procedure, they created a bariatric feeding pyramid for patients after RYGB. At the very bottom of the pyramid there is a daily vitamin-mineral supplementation, an adequate amount of fluids and daily physical activity. Another stage of the pyramid is high-protein and low-fat products. Moize et al. recommends 4-6 protein-rich meals, where 60 g of lean meat (poultry, lean beef or pork), 60 g of oily sea fish, 80 g of lean fish, 140 g of milk, 115 g of yoghurt, 50 g of eggs, 80 g of boiled beans or lentils per serving. It is recommended that fatty fish are eaten 3 times a week. The next pyramid level is low energy products with high fibre content (fruit and vegetables) and vegetable oils. It is recommended to eat 2-3 fruits and 2-3 portions of vegetables (all types of vegetables in the amount of 85 g). The fruit is divided into two groups due to the fact that they contain different energy values. The first group consists of fruits with low carbohydrate content (1 portion is 149 g melon, watermelon, strawberries, grapefruit, apples or oranges). The second group is fruit with high carbohydrate content - 1 portion is 70 g of grapes, apricots, bananas, cherries, nectarines, lychees. Vegetable oils provide a significant amount of energy. They should be consumed in the amount of 2-3 teaspoons per day. The next level of the pyramid is flour products. It is recommended to consume two portions of these products per day, where 1 portion is 90 g of boiled rice or pasta, 30 g of whole grain bread or cereal flakes, 80 g of boiled legumes or 85 boiled potatoes. The last level includes high energy products containing saturated fats, cholesterol and sweets. The patient should definitely avoid this group of products [19,20].

Dumping syndrome

In the context of the principles of nutrition after bariatric surgery, it is necessary to mention *dumping syndrome.* This name is used to describe a group of Vasomotor and gastrointestinal ailments that occur after rapid exposure of the small intestine to nutrients and during rapid gastric emptying [21]. *Dumping syndrome* is caused by the very rapid emptying of the stomach from the non-hydrolyzed food content that entered the small intestine and caused the binding of large amounts of water from the bloodstream to balance the osmotic pressure. Stomach, intestine and circulatory system disorders occur in people who consume too many portions and in those who have a lot of simple carbohydrates in their diet - sweet drinks, sweets, excessive amount of fruit, etc. [22]. The first symptoms may appear as early as 30-60 minutes after the meal, which was a hyperosmolaline meal. This is called early dump-

ing syndrome. Then we can observe abdominal pain, diarrhoea, vomiting, empty reflection, palpitations, tachycardia, low blood pressure. After about 1-3 hours after a meal, late dumping syndrome may occur, which is associated with hypoglycaemia and manifests itself as weakness, sweating, disorientation, hunger, convulsions. Much more often such symptoms appear after RYGB than after LSG. That is why it is so important to remember not only about the choice of products, but especially about the rigour of irrigation 30 minutes before a meal and 30-60 minutes after a meal. Thanks to this, we will avoid unpleasant ailments [23].

Supplementation

People who underwent bariatric treatment should remember about daily vitamin-mineral supplementation. This is necessary because reducing stomach capacity and/or limiting nutrient absorption may lead to complaints related to deficiency of macro and microelements. In addition, dumping syndrome can also contribute to dietary deficits. The greatest deficiencies are after mixed or excluded operations [16]. The most common deficiencies are protein, iron, vitamin B1, B12, folic acid, calcium, vitamin D [24]. In addition, there are deficits of vitamins A, E, K, B6 and zinc, selenium, copper and magnesium [25]. Protein malnutrition is characterized by hypoproteinaemia, anaemia, swelling and excessive hair loss. It has a multifactor substrate, but is primarily associated with the bypass of the small intestine, which is responsible for protein absorption and reduced supply of protein with food. Most often it appears after BPD, less frequently RYGB. Patients often do not tolerate meat and dairy products well, which should provide adequate amount of protein, therefore, such patients are recommended to supplement it in the form of e.g. protein powder added to dishes. If malnutrition is high, protein deficiency can also be compensated for by total parenteral nutrition. Low iron levels are perhaps the most common initial nutrient deficiency, affecting between 12 and 47% of patients after bariatric surgery, particularly after RYGB. This is due to the fact that iron is absorbed in the duodenum and the jejunum, i.e. in parts that are bypassed. Some studies show that iron supplementation is necessary because vitamin-mineral supplementation is not enough to prevent deficiencies. If iron deficiency is extremely resistant to oral treatment, an intravenous supply of iron or even a blood transfusion may be necessary, especially in women during menstruation and pregnant women. There are many studies on iron deficiency, one shows that it is good to supplement vitamin C in addition. This has a better effect on the increase in iron levels than when only the iron preparation itself is administered. Iron deficiency after bariatric procedures may be caused by the fact that the patient may have had low iron

levels even before the procedure, and this has not been detected and treated [24,25]. Deficiencies in patients undergoing bariatric surgery may also concern vitamin D and calcium. Low levels may already occur in preoperative patients due to sedentary lifestyle and less exposure to sunlight. [25]. Shortages of these components may lead to various disorders - osteoporosis, increased parathormone concentration, increased blood pressure, central nervous system disorders [16, 26, 27]. These components are absorbed in the duodenum and the jejunum, therefore, due to the very dangerous complications associated with deficiencies, it is necessary to supplement these components especially after exclusion procedures. This also applies to other fat-soluble vitamins, i.e. A, E and K. Vitamin C or ascorbic acid deficiency was observed in 36% of adult patients aged 20-55 years before the bariatric procedure. These deficiencies correlate with higher BMI, younger age and diet poor in fruit and vegetables and lack of supplementation. Postoperative deficiencies mainly concern people with RYGB. Preliminary studies show that vitamin C supplementation together with vitamin E reduce inflammation markers and may improve insulin sensitivity. It seems that the standard supplementation of vitamin C in multivitamin preparations is sufficient and allows to compensate for deficiencies. B group vitamins (B1, B2, B3, B6, B12), folic acid, biotin are essential for proper functioning of the nervous and haematological system. Studies show deficiencies in these ingredients, especially after exclusion treatments. Therefore, a supplementation with a strong emphasis on vitamin B12 is necessary, where supplementation with a multivitamin preparation is not sufficient to compensate for the deficiency and intramuscular injections of this component are recommended. It is worth noting the shortages of micronutrients such as zinc, selenium and copper. They can cause disorders such as unexplained anaemia, dysfunctions of the nervous system, heart problems, unusual skin problems, or excessive hair loss. Multivitamin preparations contain these microelements in their composition, so it seems that this type of supplementation should be sufficient [24]. To sum up the deficiency problem, the principles of supplementation prepared by American scientists are as follows: vitamin-mineral preparation (1-2 tablets per day), calcium citrate - 1200-1500 mg/day, vitamin D in the amount of 1000-2000 IU./Day, iron (65-80 mg/day) with vitamin C, folic acid (400 mcg/day, women planning pregnancy after RYGB 1 mcg/day), vitamin B12 500 mcg/day in tablets or 1000 mcg/month in injection. In case of BPD-DS patients, vitamin A supplement of 5000-10000 IU/day and vitamin K of 300 mcg/day should be added. The best form of supplementation - liquid or chewing gum, preparations in the form of tablets initially require crumbling. Vitamin-mineral supple-

mentation is a routine indication, especially after *gastric bypass* procedures. In situations of shortages before the procedure, each case should be considered individually [16,19].

Summary

Taking into account all aspects of a bariatric patient, the role of a qualified dietician is extremely important. Thanks to such care, the patient will be properly prepared for the procedure through broadly understood nutritional education and lifestyle changes, which will also be necessary in the postoperative period. Thanks to this, the patient has a chance to maintain a reduced body weight, avoid unpleasant ailments of the digestive system and nutritional deficiencies. Only comprehensive care of a bariatric patient increases the chances of permanent weight loss and success in the fight against obesity.

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