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Excessive Weight Gain: the Problems and Solutions

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According to the data of the World Health Organization a prevalence of obesity has increased since 1975. Almost 2 billion adults are overweight, among them over 650 million are obese. It is also known that overweight and obesity kill more people than underweight. Currently, it is estimated that about 3 billion adults will be overweight and over 1 billion will be obese by 2025. Moreover, among 13 biggest health problems facing people in their country an obesity takes the fifth place.

The purpose of the study was to analyze the new data of the scientific publications of recent years explaining new concepts of physiological mechanism of hunger and satiety balance, the causes of excessive weight or obesity, and suggestions for mindful eating, avoiding overeating and food temptation.

Results and discussion. The obesity epidemic is now one of the most important public health problems in the world. However, overweight and obesity are preventable. Being overweight increases the risk of death. The results of recent researches suggest that weight gain itself, even if a person stays within the "normal" weight range, also increases the risk of disease and premature death. There are studies that showed that a weight gain even less than 5 kg and within a healthy body mass index range, is associated with an increased risk of disease. Results of other research findings showed that biological indicators of health risk are strongly related to body weight from the lowest body mass index to the highest body mass index, with higher body mass associated with greater health risk. Obesity becomes global health problem. Obese people are at high risk of developing a number of comorbidities, including disorders of gastrointestinal tract, type 2 diabetes mellitus, joint and muscle diseases, respiratory problems and psychological problems, which can significantly affect the quality of their daily life and increase the risk of mortality. The conditions associated with obesity are diverse, but even modest weight loss can reduce the risk of development of cardiovascular disease, diabetes mellitus, obstructive sleep apnea, and arterial hypertension, among many other comorbidities. Even relatively small weight loss can improve patient condition and can act as a trigger for further change, with sustained weight loss achieved through a series of gradual weight loss steps.

Conclusion. The increase in obesity prevalence has an essential influence on the global morbidity of many diseases, moreover obesity and overweight affect quality and quantity of health thus being the causes of disability and significantly affect quality of life. Prevention of weight gain has been the focus of much discussion and debate, with many theories about the causes and solutions of the problem. However, prevention programs, which take in account the causes and risks factors, are more effective than weight-loss programs.

Keywords: overweight, obesity, risk factors, feeding center, mindful eating.

Worldwide Statistics of overweight and obesity. According to the data of WHO a prevalence of obesity has increased since 1975. Almost 2 billion adults are overweight, among them over 650 million are obese. It is also known that overweight and obesity kill more people than underweight. Currently, it is estimated that about 3 billion adults will be overweight and over 1 billion will be obese by 2025 [1]. Moreover, among 13 biggest health problems facing people in their country an obesity takes the fifth place [2]. The obesity epidemic is now one of the most important public health problems in the world. However, overweight and obesity are preventable.

The purpose of the study was to analyze the new data of the scientific publications of recent years explaining new concepts of physiological mechanism of hunger and satiety balance, the causes of excessive weight or obesity, and suggestions for mindful eating, avoiding overeating and food temptation.

The triggers affecting body weight. Many causes and contributing factors of overweight and obesity are already known. It is usually a result of a combination of factors. There are several influences in the base of overweight and obesity such as genetic, behavioral, metabolic and hormonal, however, obesity occurs when calories intake is more than burned through normal daily activities and exercise, then an organism stores excess calories as fat [3].

Unhealthy diets are too high in calories. Lack of fruits and vegetables, full of fast food, high-calorie drinks, including alcohol, and oversized portions lead to weight gain. In hypodynamic life style an organism takes in more calories every day than it burns through exercise and routine daily activities. Unfortunately, during last years the world was in pandemic condition thus most of people were stuck at homes working online at computer, tablet and phone, online shopping and drive-through banks, food delivery, which refers to a sedentary activity. The longer the hours spent in front of a screen are, the higher risk of weight gain is [4].

Genetic factors. Health experts believed that some people were especially prone to being overweight or obese because they inherited genes that made their bodies particularly efficient at storing fat to ensure survival [5]. Currently, researchers have found 445 different genes that have been linked to some aspect of obesity. For example, certain people are born with a genetic mutation that results in congenital leptin deficiency, which causes severe obesity as early as infancy. People with this condition have a normal weight at birth, but because they don't produce sufficient leptin (a hormone predominantly made by adipose cells and enterocytes in the small intestine that helps to regulate metabolism by inhibiting hunger), they are always hungry and gain weight quickly. In addition, other genes cause weight gain by slowing metabolic rate, reducing ability to burn calories from fat or promoting a tendency to develop and to accumulate excess fat cells [6]. Nevertheless, mindful eating, physical activity and other improvements may help in managing the body weight.

Age. Metabolism (depends on age) is the combination of all the chemical processes that allow an organism to maintain life including processes such as breathing, blood circulation, digestion, and excretion of waste products.

The minimum amount of energy needed to carry out these basic processes while an organism is fasting and at the state of rest is known as the basal metabolism or basal metabolic rate (BMR), which takes into account height, weight, age, and sex. Total metabolism is a combination of BMR, plus energy used for any kind of activitiy (physical, mental or emotional) and energy used for digestion [7].

On the one hand, an obesity can occur at any age, on the other hand, it depends on metabolic rate, hormonal changes that are related to aging. Moreover, the muscular mass tends to decrease with age leading to a decrease in metabolism that reduces calorie needs and makes it harder to keep normal body weight [7]. Despite the reverse relationship of metabolic rate and body weight, recently researchers found out, that metabolism reaches its peak much earlier in life and slows down much later than we previously thought, where adult characteristics of metabolic rate are maintained from age 20 to 60 years [7].

Gut microbiome. Gut microbiota plays an important role in many specific functions in human organism such as regulation of metabolic rate, maintenance of gut mucosal barrier integrity, modulation of immunity, it protects against pathogens and also has significant influence on both physical and mental health of an individual [8]. Gut microbiota includes different bacteria species, however, composition depends on many factors such as birth date, peculiarities of delivery, breast feeding and weaning period and antibiotic use. In case of normal physiological state of body, the microbiota remains relatively stable but there are some differences between the level of body mass index, exercises, lifestyle, cultural and dietary habits. However, a healthy intestinal microflora must be balanced to optimally perform all functions and prevent disease development [8].

Gut microbiota is composed of species of microorganisms (more than 100 trillion microbial cells, up to 1,150 different species). The following represent 90% of gut microbiota such as Firmicutes, Bacteroidetes, Actinobacteria, Proteobacteria, Fusobacteria, and Verrucomicrobia, with the two phyla Firmicutes and Bacteroidetes [8]. Gut microbial diversity generally decreases with age, which is likely due to changes in physiology, diet, medication, and lifestyles. Decreased diversity, considered as an indicator of an unhealthy microbiome, has been linked to different chronic conditions such as obesity and diabetes of type 2 [9]. Gut bacterias are also affected by quality of food and may cause weight gain or difficulty to lose weight while certain microbes may help to maintain the weight by stimulating the production of hormones that keep the body feeling full, such as leptin. Other gut bacteria may promote weight gain by increasing the fermentation of carbohydrates, encouraging the body to absorb more of their calories and other microbes may prompt the body to store greater amounts of fat. The food determines unique gut bacterial profile. Moreover, a diet containing lots of fiber-filled plant foods appears to protect against obesity-causing bacteria. In contrast, the diet that is full with sugar, fat, and animal products has been linked to microbes that promote weight gain [10].

Smoking. Smokers generally gain weight when they quit smoking. Mechanisms of body weight reduction in cigarette smokers are as following: nicotine increases energy expenditure by direct effects on peripheral tissues, mediated by catecholamines, and by effects on central nervous system neuroendocrine circuits. Nicotine also suppresses appetite, and smoking can serve as a behavioral alternative to eating [11]. However, to quit smoking is a greater benefit to health than keep smoking. Mindful eating can help in preventing weight gain after quitting smoking.

Lack of sleep. Numerous scientific data suggested that sleep deprivation has metabolic effects that lead to weight gain. However, mechanisms are still unclear, but if metabolic changes resulting from sleep restriction led to an increase in body weight, insulin resistance and increased blood pressure, then interventions designed to increase the amount and improve the quality of sleep could serve as treatments and as primary preventative measures for these metabolic disorders [12]. Lack of sleep can cause hormonal changes that increase appetite resulting in food craving especially high in carbohydrates, which can lead to weight gain. The results of conducted research (Drs. Erin Hanlon, Eve Van Cauter, University of Chicago) have shown that effects of sleep deprivation are similar to activation of the endocannabinoid system, stimulating a desire for tasty foods [13].

Stress. Stress is one of many external factors that affect mood and well-being and may contribute to obesity. People often seek more high-calorie food in stressful situations. The main hormone providing adaptation to *chronic stress* is cortisol. It also increases appetite, increasing the consumption of foods enriched in fat and sugar. Therefore, when under chronic stress, it may be difficult to maintain healthy eating habits [14]. An excess of cortisol also can lead body to produce less testosterone that results in reduction of muscle mass, as well as slows down how many calories body burns [14].

Pregnancy. Weight gain is common during pregnancy. Some women find it difficult to lose weight after delivery. The statistics shows that more than 50% of pregnant women are overweight or obese. Visceral obesity associated with glucose intolerance and insulin resistance, may lead to gestational diabetes in obese women [15]. Obese women are more prone to adverse pregnancy outcomes, including gestational diabetes, hypertensive disorders, and cardiovascular diseases [16]. Postpartum, obese women have an increased risk of thromboembolism, depression, and difficulty with breast feeding [17].

"Obesogenic" food. Health experts refer to the combination of too much high-calorie food and too little exercise as an "obesogenic" environment, an environment that encourages body to develop obesity. Moreover, life style habits and chronic stress are making a negative impact affecting hormones that control feelings of hunger and satiety [18]. In addition, we are surrounded by processed and fast food with grown portion sizes, especially eating with a smartphone or in front of TV.

Endocrine disorders. The mechanisms for the development of obesity vary according to the endocrine condition. Obesity is associated with several endocrine diseases, including hypothyroidism, polycystic ovarian syndrome, Cushing's syndrome, and hypothalamic disorders [19].

Medication. Some medications also can lead to weight gain. These medications include the following: anticonvulsants (convulsions and bipolar disorder), antihistamines (allergies), antihypertensives (high blood pressure), antipsychotics (bipolar disorder and schizophrenia), chemotherapy (cancer), corticosteroids (inflammatory diseases such as asthma, rheumatoid arthritis, and lupus), contraceptives (birth control), diabetes drugs, monoamine oxidase inhibitors (depression), mood stabilizer (bipolar disorder), selective serotonin reuptake inhibitors (depression), tricyclic antidepressants (depression) [20].

Normal body weight. Keeping weight in the normal range is an important part of healthy being. Any decline of body mass index (BMI) can result in development of health problems. Being underweight also increases chance of developing health problems. For instance, in case of low BMI, it is more likely to develop medical problems such as osteoporosis and anemia, and it may be harder to recover from an illness or infection. At the same time, obesity along with overweight affect over a third of the world's population today, however they are largely preventable.

Obesity increases risk of many chronic diseases, including cardiovascular disease, diabetes, many cancers (e.g., esophageal, colon, postmenopausal breast), dyslipidemia, osteoarthritis, infertility, diseases of respiratory system (e.g., sleep apnea, asthma), liver diseases (e.g., nonalcoholic fatty liver disease, nonalcoholic steatohepatitis), gallstones, infection, psychological conditions (e.g., depression), physical disability/hypodynamic, absenteeism/loss of productivity, as well as premature death [21].

Normalizing weight or maintaining a healthy weight can help decrease these risks. A healthy weight, or normal weight, means that BMI is within a range that is not associated with an increased risk for weight-related diseases and health issues, therefore, BMI was developed as a risk indicator of disease [22]. BMI is defined as a person's weight in kilograms divided by the square of the person's height in metres (kg/m^2). For adults over 20 years old, BMI falls into one of the following categories: below 18.5 – underweight; 18.5–24.9 – normal weight; 25.0–29.9 – pre-obesity; 30.0–34.9 – obesity class I; 35.0–39.9 – obesity class II; above 40 – obesity class III.

Except knowing BMI, it's helpful to consider a fat accumulation. If it is around middle part of the body – a problem is known as abdominal obesity, which is one of five components of metabolic syndrome increasing health risks [23]. That's because fat in the abdomen is more metabolically active than fat stored elsewhere, so it secretes more fatty acids, hormones, and inflammatory compounds into bloodstream. Scientists define abdominal obesity as a waist circumference measuring > 102 cm for men or > 88 cm for women (35 inches or more – for women or 40 inches or more – for men) [24].

Balanced hunger and saturation. Feeding behavior is regulated by a variety of psychological and physiological factors. The hunger-satiety feeling involves preabsorptive and postabsorptive humoral and neuronal mechanisms. Hunger signals are initiated by psychological, social and environmental factors, nutrients, metabolical processes and gastric contractions. Meal activates inhibitory signals to produce satiety [25]. The "feeding center" or "hunger center" of the brain is located in the lateral area of the hypothalamus while the ventral medial portion of the hypothalamus is the "satiety center" which is excited by stomach distention while eating. Food provides powerful visual, smell and taste signals which can swap satiety and stimulate eating, that can result in overeating sweet and salty foods and consuming less bitter or sour foods. The taste and smell of food can profoundly alter behavior, so that palatable food is sought after while unpleasant food induces aversion. A variety of taste receptors, including the classic sweet, salty, sour, bitter tastes, is expressed by taste cells in the tongue and oral cavity, which convey the information to the brainstem and then to lateral hypothalamus area [26].

Many chemicals of hypothalamus, such as melanin-concentrating hormone, neuropeptide Y, proopiomelanocortin, orexin and ghrelin, have been involved in feeding regulation. In peripheral tissues, two critical factors are involved in feeding regulation, leptin and ghrelin, which are secreted mainly from adipose and stomach tissue, respectively [27].

Hunger is defined as a strong desire or need for food while satiety is the condition of being full or gratified. The drive for food is a powerful stimulus that arises from a need generated by metabolic processing, at the same time, the maintenance of energy homeostasis requires a balance between energy intake and energy expenditure, and energy intake (feeding) must be adequate to meet the energy needs (physical activity, basal metabolism, and adaptive thermogenesis) of the organism. Positive energy balance leads to an accumulation of fat and weight gain while defending strongly against negative energy balances that threaten to cause weight loss. The regulation of food intake is a balance between hunger, an excitatory process that arises from energy needs, and satiety, an inhibitory process that initially arises from postingestive physiological processing. The sensitivity of both the excitatory and inhibitory processes can be modulated by signals that reflect the body's energy stores via a biological feedback control system that promotes stability of body fat mass [28].

Due to the fact that postabsorptive saturation requires time, therefore, a short-term signal preventing over-eating which is activated by sensory-specific satiety, chemical senses of taste and smell and mechanical factors is related to the gastric distension.

After absorption of nutrients, the long-term satiety is activated by the chemoreceptors controlling nutrients concentration [25].

The mechanism of satiety combines the physiological events controlling appetite with the behavioral and psychological reactions that are integral to the eating process. Hunger initiates eating process and results in the termination of the eating event. The sensation of hunger is a result of the emptiness of the stomach, secretion of the hormone – ghrelin, and by blood glucose level (hypoglycaemia). In contrast, the physiological state at the end of a meal when further eating is inhibited by "fullness" of the stomach is called satiety. Satiety results in meal processing by digestive juices with following absorption of nutrients monomers until hunger initiates the next period of eating. Therefore, the post-ingestive satiety is provided by stretch/distension signals from stomach and intestines informing brain about meal quantity. Medium-term satiety is controlled by intestinal hormones including glucagon-like peptide-1, cholecystokinin and peptide YY which have inhibitory effects on food intake. The post-absorptive (as nutrients are absorbed) phase is when long-term satiety is controlled by insulin, glucose and amino acid concentrations in the blood and oxidation of nutrients in the liver [29].

To sum up, during weight lose, a low leptin level initiates the sensation of hunger by signaling to brain, and when we haven't eaten for a few hours, a high level of ghrelin informs the brain that it is time to eat again or if we lose weight the ghrelin prompts to eat more and slows metabolism. The accumulation of body fat in obesity is fundamentally a result of positive energy balance, where energy consumed as food and drink exceeds that expended through metabolism, thermogenesis and physical activity.

Food temptation. On the one hand, people are surrounded by and exposed to "bad" food temptations, such as chocolate, sweets, and other obesogenic (tending to make individuals fat) food items, which are rewarding in the short term but potentially harming in the long term, on the other hand, food temptations may also remind about restriction objectives, which may facilitate self-control, therefore, food temptations involve a self-control conflict [30].

Doctor of psychology, chartered psychologist, nutritional therapist, Christy Fergusson has devised a food temptation ratio on three key factors: 45% of aroma, 35% of sight and 20% of positive association. In the view of Dr. Fergusson there are certain factors that play a universal role in attracting to specific foods and sometimes it is in DNA – for instance, women are more attracted to sweet foods (60%) than men (40%), the chocolate is almost impossible to resist, moreover, it is proven to be the most tempting of all foods because of released chemicals such as endorphins, dopamine and serotonin bringing good feelings.

The most popular pieces of advice how to avoid food temptation are the following:

1. Keep balance in common triggers of food temptation (blood sugar imbalance, stress, boredom, emotional factors, and hypoglycemia).
2. Eating more proteins may reduce appetite and keep satisfied for longer. The results of some researches have shown that increase in protein intake reduces cravings by up to 60% and cut the desire to snack at night by 50% [31].
3. Avoid sugary drinks.
4. As results of studies showed that craving for junk food last about 10 minutes therefore, any distractions can help to ignore the craving until it passes. For instance, quick body-weight workout, go for a walk, run, or take a shower [32].
5. Thirst is often confused with hunger or food cravings therefore drinking a large glass of water and wait a few minutes can cause craving fades away. Additionally, drinking water before meals may reduce cravings and appetite, as well as help with weight loss [33].
6. Planning meals for the day or week reduces spontaneity of factors causing cravings.
7. Hunger is a big reason for cravings, hence avoiding extreme hunger by having a healthy snack is a solution.
8. Stress induces cravings and changes eating behaviors, especially for women. The studies have shown that stressed women eat significantly more calories and experience more cravings than non-stressed women [34].
9. Sleep deprivation may change normal fluctuations in hormones controlling appetite, leading to cravings.
10. Hunger and a lack of essential nutrients can both cause certain cravings. Balanced diet helps in preventing hunger and cravings, while also providing body with nutrients.
11. Mindful eating is about recognition the difference between cravings and actual hunger [35].

Strict restrictions just increase food craving but trying a little of everything in moderation will bring a relaxed attitude with eating. Over time, with these ways of practice the new food behavioral response will appear.

Conclusion. The increase in obesity prevalence has an essential influence on the global morbidity of many diseases. Overweight and obesity are the causes of disability and significantly affect quality of life. Prevention of weight gain has been the focus of much discussion and debate, with many theories about the causes and solutions of the problem. However, prevention programs, which take in account the causes and risks factors, are more effective than weight-loss programs.

Perspectives of further research. Prospect for further research is to study the effect of mindful eating concept in overweight and obese people.

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НАДМІРНА ВАГА: ПРОБЛЕМИ ТА РІШЕННЯ

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Резюме. *Мета.* Провести аналіз нових даних наукової літератури щодо про фізіологічного механізму балансу голоду та насичення, причини надмірної ваги чи ожиріння та пропозиції щодо усвідомленого харчування та уникнення переїдання.

Результати. Дані досліджень останніх років свідчать про те, що саме збільшення ваги, навіть якщо людина залишається в межах «нормального» діапазону ваги, підвищує ризик захворювань і передчасної смерті. Існують результати досліджень, які стверджують, що збільшення маси тіла менше ніж на 5 кг, причому навіть у межах здорового діапазону індексу маси тіла, пов'язане зі збільшенням ризику розвитку хвороб. Інші результати досліджень показують, що біологічні показники ризику для здоров'я мають сильний зв'язок із масою тіла від найнижчого індексу маси тіла до найвищого індексу маси тіла, причому більша маса тіла пов'язана з більшим ризиком для здоров'я. Ожиріння стає глобальною проблемою охорони здоров'я, яка зростає. Люди з ожирінням мають високий ризик розвитку ряду супутніх захворювань, включаючи шлунково-кишкові розлади, діабет 2 типу, захворювання суглобів і м'язів, респіраторні проблеми та психологічні проблеми, які можуть суттєво вплинути на їхнє повсякденне життя, а також підвищити ризик смертності. Стани, пов'язані з ожирінням, різноманітні, однак навіть помірне зниження ваги може дозволити зменшити ризик серцево-судинних захворювань, діабету, обструктивного апное сну та гіпертонії серед багатьох інших супутніх захворювань. Відносно невелике зниження ваги може покращити результати лікування пацієнтів і може виступати тригером для подальших змін, при цьому стійка втрата ваги досягається за допомогою ряду кроків поступового зниження ваги.

Висновки. Надмірна вага та ожиріння істотно впливають на якість та кількість здоров'я людини. Профілактика збільшення ваги є предметом багатьох дискусій і дебатів, з багатьма теоріями про причини та вирішення проблеми. Проте профілактичні програми, які враховують причини та фактори ризику, ефективніші за програми зниження ваги.

Ключові слова: надмірна вага, ожиріння, фактори ризику, центр голоду та насичення, усвідомлене харчування

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