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# Obesity, exercise, and health

**Oana-Cristina Cînpeanu [1], Maria Sălcudean-Czinege [2], Monica Tarcea [2]**
*[1] "Dr. Gheorghe Marinescu" County Hospital, Târnăveni, Romania*
*[2] Department of Community Nutrition and Food Safety, University of Medicine, Pharmacy, Science and Technology, Târgu Mureș, Romania*

**Abstract**

Obesity has become an epidemic reality, which must be controlled by all means, given the dramatic consequences on public health, by increasing and developing metabolic risks (type 2 diabetes, gout, dyslipidemia, hypertension), the risk of cardiovascular disease, cancer or psycho-emotional disorders (anxiety, depression, loss of self-esteem). Most research and interventions have initially focused on the adult population, but at present, child obesity has devastating effects on children's and adult's health, drastically increasing the risk of developing associated chronic diseases.

In order to optimize the services in wellness centers, modern technologies for screening the levels of health, nutrition, fitness and lifestyle characteristics are required to develop personalized programs. We recommend the usage of educational and physical applications and also internet programs, to be practical tools focused on the physical part of wellness. Wellness incorporates factors such as proper fitness exercises, personalized diet, stress management, psychological balance, disease prevention, no smoking or alcohol abuse, personal safety, regular physical examination, and health education.

Prevention programs should start early in life and be personalized at some point, in order to have good results. It is certain that overweight can be managed with proper and regular exercise along with a healthy lifestyle and diet, managed by an interdisciplinary team.

**Key words:** obesity, exercise, diet, wellness

## Introduction

Obesity is a serious health problem of the 21st century and is an important cause of morbidity and mortality in adults as well as adolescents and children (Engin, 2017).

Worldwide obesity has nearly tripled since 1975. In 2016, more than 1.9 billion adults aged 18 years or older were overweight, and of these over 650 million were obese. 39% of adults aged 18 years and over were overweight in 2016, and 13% were obese. Most of the world's population lives in countries where overweight and obesity kills more people than underweight. Over 41 million children under the age of 5 were overweight or obese in 2016, and more than 340 million children and adolescents aged 5-19 years were overweight or obese in 2016.

Since 1997, WHO has recognized obesity as a global epidemic (1). Portugal has officially recognized obesity as a chronic disease since 2004, but remains the only country in Europe to do so (***, 2017). In 2013, the American Medical Association officially recognized obesity as a complex chronic disease (Pollack, 2013) as a result of developments over three decades (Kyle et al., 2016), and recognition by the Canadian Medical Association followed in 2015.

Obesity is a complex, multifactorial and heterogeneous disease due to the complex interaction of genetic and environmental factors (Neslihan, 2014); it is a largely preventable disease (Pollack, 2013), which affects over one-third of the world's population today (Hruby & Hu, 2015).

In the US, one in five men and women and one in four children suffers from obesity, and in the European Union, obesity progressed from 10 to 40 percent of the population between 1980 and 2003. In Europe, more than half of the population aged between 35 and 65 is obese (2). The World Health Organization (WHO) estimates that about 50% of the population of Western countries will suffer from overweight by 2040. Developing countries also record an alarming increase in the population affected by obesity.

## Obesity epidemics

Childhood obesity tends to become an increasingly alarming problem. The prevalence of childhood obesity has increased remarkably over the past 3 decades (Neslihan, 2014). In Europe, the growing incidence of childhood obesity is of particular concern. Child obesity is recognized

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*Address for correspondence:* : University of Medicine, Pharmacy, Sciences and Technology of Târgu Mureș, 38 Gheorghe Marinescu Str., 540139, Romania
*E-mail:* monica.tarcea@umftgm.ro
*Corresponding author:* Monica Tarcea, monica.tarcea@umftgm.ro
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as a predictive factor of obesity in adults, especially in the case of very obese children from obese parents. There is increasing evidence that obesity has negative social, economic and health consequences. Therefore, child obesity is currently recognized as an important public health problem and this has been reinforced by the growing prevalence of adult obesity in both developed and developing countries (3) (Weng et al., 2006).

Obesity is a serious public health problem because, in addition to the decrease in quality of life (Taylor et al., 2013) and life expectancy (Grover et al., 2015), there is an increased risk of chronic diseases (Nyberg, 2018), such as type 2 diabetes, cardiovascular disease, hypertension, coronary artery disease, asthma and certain cancers (Poirier et al., 2006; Guh et al., 2009; Lauby-Secretan et al., 2016). In some cases, even psychological problems arise (4). For society as a whole, obesity involves direct and indirect costs that impose a burden on the health system and social resources. The burden of illnesses is measured by years of disability - adjusted disability (Disability Adjusted Life Years-DALY), which is the sum of the years of life lost through premature deaths and years of disability due to the presence of disease or accidents adjusted for the severity of the illness). Overweight and obesity are responsible for about 10% of the total burden of DALY disease in Western and Central Europe. Between 1990 and 2010, the contribution of overweight to DALY increased by 39% in Europe and Central Asia.

In Romania, in 2012, the DALY burden of illness per 100,000 inhabitants for all causes was 20-40% higher than in western European countries, about 10% higher than in Poland and about 15% lower than in Bulgaria. The major causes of illnesses for which DALY per 100,000 inhabitants are higher in Romania than in Western European countries are those on which excess weight has a proven negative impact, namely: ischemic heart disease, the most common cause of DALY in most countries, is 2-3 times more frequent in Romania than in western European countries, 10% more frequent than in Poland and about 15% less frequent than in Bulgaria; accidental stroke, the second cause in terms of frequency in Eastern European countries, is 3-4 times more frequent in Romania than in Western European countries, about 30% more frequent than in Poland and about 60% less frequent than in Bulgaria; hypertensive disease is in Romania 18 times more frequent than in the Netherlands, 15 times more common than in the UK, 5 times more frequent than in Poland, 4 times more frequent than in Germany and about 75% more frequent than in Bulgaria (5).

The Basal Metabolic Index (BMI) is commonly used to define overweight and obesity in adults. Individuals with a BMI of 25-30 are labeled as overweight and those with a BMI over 30 are called obese in most Western societies, while in children, obesity occurs at a BMI ≥95th percentile (***, 2006; Burdette et al., 2008).

Many people find it increasingly difficult to maintain a "normal" weight in a largely obesogenic environment (6). This environment ranges from low breastfeeding rates, difficulties in geographic or financial access to the ingredients of a healthy diet, lack of cooking skills, the abundance and marketing of energy-rich foods and food additives, urban planning choices and pressures of a lifestyle that often reduces the opportunity for physical activity (both at work and at leisure) (Mustajoki, 2015; Jaworowska et al., 2013; Birch & Anzman-Frasca, 2011).

Obesity is responsible for direct medical costs (eg. physician fees, clinical tests) and non-medical costs (eg. patient transport to treatment centers). The direct cost per capita of a person with normal weight is lower than that of an overweight/obese person. Costs for overweight and obese individuals were 9.9% and 42.7% higher, respectively, compared to normal weight adults. The whole Europe spends between 1.9% and 4.7% of the total annual health care costs and 2.8% of the annual cost of hospitals for treating overweight or obese patients (Cuschieri & Mamo, 2016).

## Obesity life cycle

*Pre-conception* - The surprising path of obesity begins in the period before conception itself. The nutritional status of women and men before conception has profound implications for the growth, development and long-term health of their children. Epidemiological data and findings from developmental biology suggested that intervention to improve the nutritional status of men and women before pregnancy improves long-term outcomes for mothers and children (Barker et al., 2018; Fleming et al., 2018).

The physical and mental health of the future child is determined by the health of both parents (Chiarlitti & Kolen, 2017; Karimzadeh et al., 2017; Boardman et al., 2012). The health of women around the conception period is now a topic of high interest, reflected in several reports from international agencies (Davies, 2015; Johnson et al., 2012; Hanson et al., 2015; ***, 2013). A woman who is healthy at the time of conception is more likely to have a successful pregnancy and a healthy baby. Observational studies show strong links between pre-pregnancy health and maternal and child health outcomes, with consequences that may extend between generations, but awareness of these links is not widespread. Poor nutrition and obesity are spread among women of reproductive age, and differences between high income countries and low income countries have become less distinct (Stephenson et al., 2018). Preconception health research requires mental health academics to work with medical, nutritional, and surgical academics to shape both the mental and physical health of our future offspring (Wilson et al., 2018).

*Intrauterine life* - Studies have shown that the period of intrauterine life influences deeply health and long-term behavior (Marquez et al., 2013; Lewis et al., 2015; Godfrey et al., 2017; Li et al., 2016). The quality of fetal life in the mother's womb programs the susceptibility to cardiovascular, cerebrovascular disease, diabetes, obesity, etc. (Parlee & MacDougald, 2014; Gaillard, 2015; Villanueva-Ortega et al., 2017).

Lifetime health programming takes place during intrauterine life, the conditions in the mother's womb being at least as important as genetic programming in determining the mental and physical performance of the child and the adult. Modern research has shown that the organization of neuronal circuits, including those that control the behavior and food intakes of the future child, is established and regulated during the intrauterine period, and this process

is highly dependent on the mother's nutrition (Georgieff et al., 2015; Prado & Dewey, 2014).

Proper nutrition is needed from the very beginning, the formation of the neural plate and neural tube being affected by nutrients such as folic acid, copper and vitamin A. Approximately 22 days after conception, the neural plate begins to fold inward, forming the neural tube, which eventually becomes the brain and spinal cord (Couperus & Nelson, 2006). Seven weeks after conception, cell division begins inside the neural tube, creating nerve cells (neurons) and glial cells (cells that support neurons). These neurodevelopment processes start during gestation and continue during childhood (Prado & Dewey, 2014). From the 4th month of gestation, the fetus begins to taste, by swallowing the amniotic fluid which contains much of the substance that the mother ingests with food (Mennella et al., 2001; Sullivan et al., 2014). Thus, the fetus will consume natural or artificial sweeteners, excess salt, other organoleptic substances such as glutamates, guanylates, inosinates, artificial flavors, with a predilection for these food additives.

Food flavors, sweeteners and artificial flavors, found everywhere in modern food, create dependence during intrauterine life, depending on what the pregnant woman consumes, exacerbating the genetic predisposition of the fetus for the sweet, salty, umami, meat, fat, sour and bitter (Bachmanov et al., 2014). Between the age of 4 months and 8 months, an intrauterine process of differentiation of adipocytes begins, i.e. a genetically predetermined number of adipocytes (Berry et al., 2013).

A diet too high in fat of pregnant women influences the organization of brain territories, which will coordinate satiety in the child and then in the adult. The neurohormonal circuits that will direct food search, satiety-hunger, the ability to voluntarily stop eating, begin to regulate during intrauterine life (Sullivan et al., 2014). This is why it is estimated that the current epidemic of obesity is largely related to the diet of pregnant women.

Since food has begun to be contaminated, especially with pesticides, many of these pesticides behave like estrogen-like endocrine disruptors (Darbre, 2017; Gore et al., 2018). These endocrine disruptors cause the supplementation of adipocytes, so instead of being born with a number of genetically predetermined adipocytes, the fetus will be born with a much higher number (Bateman et al., 2017; Petrakis et al., 2017; Bommarito et al., 2017; Campioli et al., 2014; Lucchese et al., 2017; Kim & Lee, 2017).

*Neonatal period* - Steps to obesity continue after birth, during breastfeeding and then throughout life. The newborn baby's development pattern in the first 3 months of life has its impact on adult health. Children with a rapid increase in this have a high risk of obesity and development of diabetes (Weng et al., 2006; Couperus & Nelson, 2006). Breast milk and its quality are strongly influenced by the diet of the breastfeeding woman. Human milk has species specificity. No other substitute reaches the qualities of mother's milk (***, 2005; Horta et al., 2007), a sterile food, biologically active by enzymes, antibodies, vitamins, providing a balanced proportion of proteins, lipids and carbohydrates, ensuring good digestive tolerance. Maternal milk reduces morbidity through infectious diseases, respiratory diseases (Fredriksson et al., 2007). It also prevents diabetes, obesity and its complications such as hypertension or dyslipidemia (Greer et al., 2008).

The first and most important liquid with which the newborn comes into contact is breast milk, which is the only food really adapted to the needs of the newborn and infant. Breastfeeding is recommended for at least 6 months, after which diversification can begin. Breastfeeding can continue in parallel to diversified foods up to two years of age.

The child's nutritional needs change with age. It is remarkable that the composition of breast milk: colostrum, which is produced during the first five days after birth, is also changing over time and favors the elimination of meconium; transitional milk between days 6 and 15 and mature milk between day 16 and the next 15 months (***, 2006). These three varieties of breast milk are distinct from the point of view of the content of carbohydrates, lipids, proteins, minerals, vitamins, etc. Moreover, the milk composition changes during sucking, triggering towards its end the feeling of satiety and voluntarily stopping the baby from sucking, with stronger significance for the child's health. Although the macronutrient composition of breast milk is slightly altered depending on nutrition, the fine composition of the juice is sensitive to food additives (E), artificial flavors, chemical contaminants (radionuclides), chemicals (pesticides, artificial chemical fertilizer residues, hormones, antibiotics, dioxins, benzpyrenes, monomeric acrylamide, phthalates, bisphenol A etc.), smoking, alcohol consumption, drugs. These substances reach the breast milk ingested with food, inhaled or through the skin - with all the damaging consequences for the baby.

Human milk has the highest amount of lactose needed for the development of the newborn's brain. Mother's milk is very rich in essential polyunsaturated fatty acids (linoleic acid - omega 6, alpha linoleic acid - omega 3, and gamma-linoleic acid). These fatty acids are also essential, together with galactose, in the growth and myelination of the central nervous system. The mother's lifestyle and nutrition are essential for the future child and adult (Couperus & Nelson, 2006).

*Childhood* - The development of human fat is due to the increase in the number and size of adipocytes. After birth, in the first two years of life, fatty tissue growth occurs both in the number and in the size of adipocytes, which is triggered by triglycerides. A new increase in adipocyte counts occurs during adolescence, while in adulthood, weight variations are only due to the increase in adipocyte size. This is why two forms of obesity are present:

- Hypertrophic obesity, through an increase in the size of pre-existing adipocytes during intrauterine life without a new numerical increase, the form of obesity successfully treated through diet and lifestyle. Adipocytes can grow in volume about one hundred times (Gustafson et al., 2013).

- Hyperplastic obesity, through an increase in the number of adipocytes during intrauterine life and adolescence, followed by an increase in adipocyte size, which is the most serious and the most difficult to treat (Stupin & Arabin, 2014).

*Adolescence* - Adolescence may be a particularly sensitive period because unhealthy lifestyle behaviors (e.g.

smoking, poor diet, and eating disorders) often develop in the years of adolescence (Stephenson et al., 2018). The basic senses - taste, smell, and vision - have a powerful hedonic function, shaping food behavior, by inducing pleasure-rejection sensations, influencing food choices. The taste is affected by artificial flavors, synthesis sweeteners, taste-enhancing agents, because they do not function in the same way and the same receptors, while metabolic pathways control and process nutrients other than those induced by natural flavors and nutrients in foods. Thus, any disturbance of the taste and intestinal messages reaching the regulatory centers in the brain causes behavioral malfunctions, which will disregard food consumption in quantitative terms (Melis & Barbarossa, 2017).

Mechanisms within the conscious, unconscious and memorable processes are disturbed by these artificial tastes, which translate the truncated-thalamus-hypothalamus-cortex messages into truncated messages. Thus, the body loses the natural control of ultrafine and complex regulation of natural eating behavior, based on the proper appearance of the satiety-hunger sensation. Deregulation of the satiety-hunger sensation through artificial aroma of food, which causes excessive food consumption, is the deep physiological cause of the difficulty in managing weight and the occurrence of overweight and obesity (Amin & Mercer, 2016).

Adolescence is the period during which frequent disturbances in eating behavior occur that can be corroborated with addictive pathology. These adolescent eating behavior disorders often precede anorexia or nervous bulimia. Recent studies in the US show that 37% of young girls are perceived to be "too fat." Of these, 57% want to lose weight and 14% of them follow an ultra-restrictive diet, 2.3% use an anorexic medicine and 3.1% use laxatives (Ahmadpour et al., 2018).

At the age of adolescence, the disorder occurs in the form of sudden and violent hunger crises, which often precede the bulimic crisis. This hyperphagic behavior has consequences on body weight. Bulimia and anorexia have a common trait, in addition to being a disturbance of eating behavior - a severe disorder of "perception of the image of one's own body." This disorder may manifest itself as a negative distortion of self-esteem. These cases require early psychiatric consultation.

Currently, there are plenty of means by which food can be used to manipulate human behavior. For example, chocolate cocoa contains theobromine and, in small quantities, a substance called phenyl-ethylamine, which has a slightly hallucinogenic activity, giving a state of euphoria and creating dependence on this product. It seems that phenyl-ethylamine is able to induce the sometimes bulimic attraction that chocolate creates, particularly in depressed people. This effect is also potentiated by another substance present in chocolate - salsolinol, which is an antidepressant with inhibitory action on biogenic amines, also possessing some affinity for opioid receptors. Recently, the presence of anandamide, which has a cannabinoid-like action, has been highlighted in chocolate, explaining the sensory exacerbation and euphoria induced by excessive chocolate consumption (Simion et al., 2018; Rada, 2017).

Recent Romanian studies showed that physical activities are associated with young age groups, male gender, rural areas, higher educational level and non-smoking status (Rada, 2017; Bădău et al., 2018; Roman et al., 2017), and worldwide researchers agree that eating pattern management, regular exercise and proper nutrition education in schools are important to overcome these lifestyle risks (Ahmadpour et al., 2018; Bădău et al., 2018; Roman et al., 2017).

In order to optimize services in wellness centers, it is required to use modern technologies for screening the levels of health, nutrition, fitness and lifestyle characteristics, to jointly develop customized profiles and programs. We recommend the usage of educational and physical applications and also, internet programs as practical tools focused on physical wellness. Wellness requires implementation of good lifestyle habits to improve health and quality of life, prolong life and achieve total well-being. It incorporates factors such as adequate fitness, proper nutrition, stress management, disease prevention, spirituality, no smoking or alcohol abuse, personal safety, regular physical examination, health education and environmental support (Bădău et al., 2018; Chwałczyńska et al., 2017; Byrne et al., 2016).

## Conclusions

1. Lifestyle means conscious development and adoption of responsible, strictly personalized behaviors in order to meet biological, physiological and socio-cultural needs, under optimal conditions, in terms of nutrition, physical activity, mental/emotional activity, professional activity, recreational activity, health and social status. A proper lifestyle (from childhood to the senior period of life) will sustain health and will avoid obesity and other chronic diseases related to it.

2. Physical wellness depends on a strong connection between health and regular exercise, completed by a tailored program of nutrition. In our view, an efficient wellness program is the result of precocious education with the participation of an interdisciplinary team of specialists in physical education, nutrition, kinesiotherapy and psychology.

**Conflicts of interest**

No conflict of interest and no funding to declare.

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