Risk factors for adiposity in the urban population and influence on the prevalence of overweight and obesity

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Abstract. Obesity and overweight are major contributors to the morbidity and mortality of modern civilization. This study determined the prevalence of certain risk factors for adiposity and assesses their impact on overweight/obesity prevalence. Nine hundred individuals were evaluated, aged between 18-65 years, including clinical examination, evaluation of medical history, BMI determination and completion on questionnaires assessing nutritional intake and presence of depression symptoms. Overweight prevalence was 29.56% and obesity prevalence was 21.33%. Fast-food consumption was the most frequent risk factor for adiposity found in 61.67% of individuals, eating <3 meals/day was found in 58.89%, sedentary lifestyle in 53.33%, sleeping time <6 h/day in 44.22%, hypercaloric nutrition in 43.56%, excessive alcohol consumption in 42.89% and depression symptoms in 31.78%. Unhealthy lifestyle a composite risk factor was identified in 67.33% of individuals. Fast-food consumption increases the risk for adiposity by 1.85-fold while sedentary lifestyle by 1.79-fold. Risk factors for adiposity play an important role in increasing the prevalence of overweight and obesity. Public health measures are necessary in order to educate the general population regarding the importance of healthy nutrition and physical exercise.

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Introduction

The increasing prevalence of obesity and overweight is a public health problem, it has been estimated that in 2038 approximatively 38% of the world population will be overweight and 20% will be obese (1). However, PREDATORR study, a study performed on a Romanian population sample between 2012 and 2014, revealed that already these predictions have come true, with a prevalence of obesity and overweight of 31.90 and 37.40% (2).

Obesity and overweight have a multi-factorial aetiology, but the most important factor appears to be the shift in the environmental and socioeconomic conditions in the last century with unlimited access to hypercaloric food and decreased physical activity (3). Current data point to the fact that although genetic factors contribute to the risk of obesity, the influence is modest with an average difference of only 2.7 kg/m^2 between individuals with high genetic risk and those with low genetic risk (4). On the other hand, the weight gain is strongly associated with unhealthy diet consisting of high intake of fast-food, sugar-sweetened beverages, processed meat and low intake of whole grains, fruits and vegetable (5). Sedentary behaviour is another important risk factor for weight gain, studies indicate that at least 150-200 min per week of physical exercise is necessary in order to prevent weight gain (6). The reason why the study of obesity is so intense in the last decades is that adipose tissue is associated with increased risk of cardiovascular morbidity. Obesity is associated with increased inflammation as a result of production of proinflammatory cytokines, insulin resistance, endothelial dysfunction, increased reactive oxygen species production and reactive, sympathetic nervous system activation and coagulation activation that result in high incidence of type 2 diabetes mellitus, dyslipidaemia, hypertension and atherosclerosis (7).

This study determined the prevalence of the risk factors for adiposity in a population from Oradea, Bihor County, Romania, and determined their impact on the prevalence of obesity and overweight. The evaluated risk factors in our study

included fast-food consumption, alcohol intake, sleeping duration, presence of depression, family history of obesity, caloric consumption, and level of physical activity.

Materials and methods

An observational study was conducted. The subjects included in the study were individuals registered on the patient lists of two general practitioners from Oradea, Romania. All the individuals aged between 18-65 years in these lists were considered for inclusion in the study. The inclusion criteria were: individuals that gave their written accept for participation in the study, individuals with the age criteria specified above. The exclusion criteria were: individuals with psychiatric diseases, individuals with neurodegenerative disorders, subjects with neoplastic diseases, subjects with endocrine diseases (hypothyroidism, hyperthyroidism, Cushing disease, etc.), patients with liver cirrhosis, patients with end stage kidney disease and subjects that in the past 3 months were under treatment with drugs that can significantly increase/decrease weight. An initial 1,120 number of individuals were considered for inclusion in the study. After applying the inclusion and exclusion criteria 900 individuals remained in the study.

The research was performed according the WMA Declaration of Ethics, Helsinki - Medical Research Involving Human Principles for Subjects. All the subjects signed a written consent giving their acceptance to participate in the study. The study was approved by the Ethics Council of the Clinical Emergency Hospital of Oradea (Oradea, Romania).

The initial 1,120 individuals were asked to come for a first presentation at the general practitioners. The subjects that were eligible for participation in the study, were instructed to come on a specific day for further evaluation and to keep a journal of the entire food intake two days before that day (for evaluation of caloric intake). At the second presentation, the subject was clinically evaluated, and blood was collected for laboratory work-up. Body-mass index was calculated, abdominal circumference was measured, and blood pressure was taken. The patients completed a questionnaire regarding their lifestyle and Beck's questionnaire for depression. Food intake in the past two days before presentation was evaluated and caloric intake average between the 2 days was determined. Frequent fast-food consumption was defined as buying, ordering fast-food products at least three times a week. Excessive alcohol consumption was defined as consumption of >2 measures (12 g pure alcohol) of alcohol for men and 1 measure of alcohol for women a day. Hyper caloric diet was defined as consumption of more calories than the recommended daily intake according to BMI and physical activity. Sedentary lifestyle was defined as performing physical exercise <150 min/week. Presence of depression was defined as a Beck's score ≥14. Unhealthy lifestyle was defined as the presence of at least 4 of the 6 criteria: hypercaloric nutrition, frequent fast-food consumption, <3 meals/day, excessive alcohol consumption, sedentary lifestyle and <6 h of sleep/day. Statistical analysis was done using Biostat software. Relative risk was calculated with the formula $RR=P_e/P_u$, where P_e is the prevalence in the exposed group while P_u is the prevalence in the unexposed group. A value of P<0.05 was considered statistically significant.

Table I. Prevalence of risk factors for adiposity according to sex: women/men (432/468).

General characteristics	%		
	Women	Men	P-value
Family history of obesity	35.65	30.34	0.09
Hypercaloric nutrition	41.20	45.73	0.17
<3 meals/day	60.19	59.62	0.86
Frequent fast-food consumption	59.49	63.68	0.83
Excessive alcohol consumption	25.93	58.55	<0.01
Sedentary lifestyle	61.11	44.23	<0.01
Depression	35.88	27.99	0.01
Sleeping time <6 h/day	48.84	39.96	<0.01
Unhealthy lifestyle	65.97	68.59	0.40

Results

In the current study, 48% (432 individuals) were females, and 52% (468 individuals) were males. Overweight prevalence was 29.56% (266 individuals), while obesity prevalence was 21.33% (192 individuals). The prevalence of normal weight was 49.11%. Overall the prevalence of overweight and obesity was 50.89% (458 ndividuals).

Overweight prevalence was statistically significantly higher among men than among women (34.40 vs. 24.31%, P<0.01) while the prevalence of obesity was statistically non-significantly higher among women (21.53 vs. 20.51%, P=0.70) (Fig. 1).

The prevalence of risk factors for overweight and obesity was the fallowing: sleeping time <6 h/day in 44.22% of the included individuals, depression in 31.78%, sedentary lifestyle in 52.33%, excessive alcohol consumption in 42.89%, frequent fast-food consumption in 61.67%, <3 meals/day in 59.89%, hypercaloric nutrition in 43.56% and family history of diabetes in 32.89% (Fig. 2).

Comparing the frequency of risk factors for adiposity in the men and women it was observed that family history of obesity was statistically non-significantly more prevalent among women (35.65 vs. 30.34%, P=0.09), hypercaloric nutrition was statistically non-significantly more prevalent among men (45.73 vs. 41.20%, P=0.17), eating <3 meals/day was statistically non-significantly more prevalent among women (60.19 vs. 59.62%, P=0.86), frequent fast-food consumption was statistically non-significantly more prevalent among men (63.68 vs. 59.49%, P=0.83), excessive alcohol consumption was statistically significantly more prevalent among men (58.55 vs. 25.93%, P<0.01), sedentary lifestyle was statistically significantly more prevalent among women (61.11 vs. 44.23%, P<0.01), depression was statistically significantly more prevalent among women (35.88 vs. 27.99%, P=0.01), sleeping time <6 h/day was statistically significantly more prevalent among women (48.84 vs. 39.96%, P<0.01), unhealthy lifestyle was non-significantly more prevalent among men (68.59 vs. 65.97%, P=0.40). The data are summarized in Table I. As shown in Table II unhealthy lifestyle was defined

Table II. Influence of risk factors for adiposity on the prevalence of overweight and obesity.

| Risk factors and protective factors	Patients No.	Prevalence %			Relative increase of risk for being overweight/obese
		Overweight	Obesity	Overweight + obesity	
Without family history of obesity	604	25.16	18.70	43.86	1.46
Family history of obesity	296	38.17	26.01	64.18	
Normocaloric diet	508	21.06	19.09	40.16	1.61
Hypercaloric diet	392	40.56	24.23	64.80	
3 meals/day	361	20.78	16.07	36.84	1.63
<3 meals/day	539	35.44	24.86	60.30	
Without frequent fast-food consumption	345	20.29	13.04	33.33	1.85
Frequent fast-food consumption	555	35.32	26.49	61.80	
Without excessive alcohol consumption	514	21.40	20.04	41.44	1.53
Excessive alcohol consumption	386	40.41	23.06	63.47	
Active lifestyle	429	19.58	16.32	35.90	1.79
Sedentary lifestyle	471	38.64	25.90	64.54	
Without depression	614	21.99	18.89	40.88	1.77
Depression presence	286	45.80	26.57	72.38	
Sleep ≥6 h/day	508	21.51	17.13	38.65	1.71
Sleep <6 h/day	392	39.70	26.63	66.33	
Healthy lifestyle	294	10.88	9.86	20.75	3.15
Unhealthy lifestyle	606	38.61	26.90	65.51	
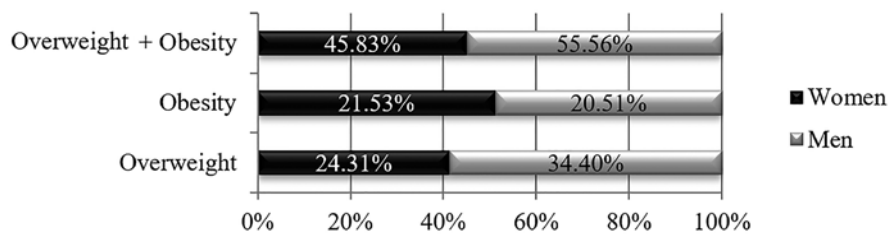
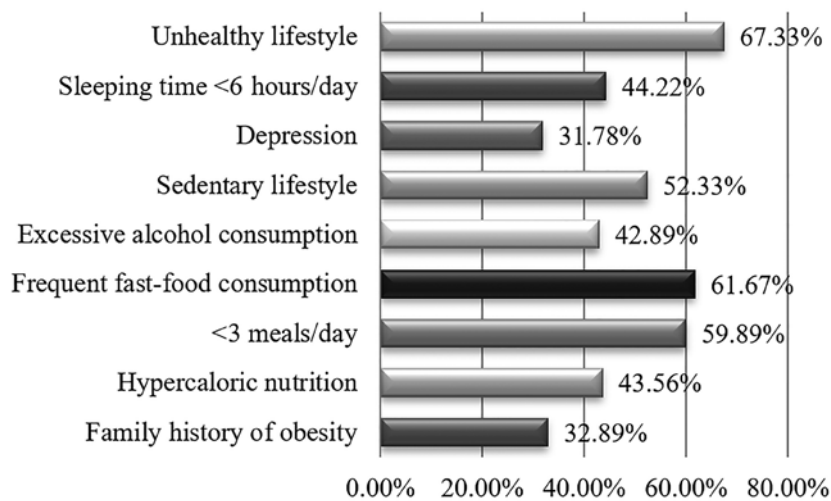Figure 1. Prevalence of overweight and obesity according to sex.

Figure 2. Prevalence of risk factors for adiposity.

as the presence of at least 4 of the 6 criteria: hypercaloric nutrition, frequent fast-food consumption, <3 meals/day, excessive alcohol consumption, sedentary lifestyle and <6 h of sleep/day, was associated with the greatest risk of overweight and obesity, a 3.15-fold higher risk compared to the persons with healthy lifestyle. Family history of obesity was associated with a 1.46-fold higher risk of overweight and obesity, hypercaloric diet with a 1.61-fold higher risk, eating <3 meals/day with a 1.63-fold higher risk, frequent fast-food consumption with a 1.85-fold higher risk, excessive alcohol consumption with a 1.53-fold higher risk, sedentary lifestyle with a 1.79-fold higher risk, depression with a 1.77-fold higher risk, sleeping <6 h/day with a 1.71-fold higher risk.

Discussion

In this study, the prevalence of obesity and overweight was lower compared to the prevalence of obesity and overweight identified in PREDATORR study (2). Percentarge of 29.56 of the individuals in our study were overweight while 21.33% were obese. However, when comparing to the prevalence of obesity worldwide of 13% in 2016 according to WHO (8), it can be concluded that in Romania according to our study which reports a prevalence of obesity of 21.33% and to PREDATORR study which reports a prevalence of 31.90%, the population is significantly more frequently obese and therefore exposed to a higher risk of early death. In our study overweight prevalence was statistically significantly higher in men compared to women, while the prevalence of obesity was higher in women. Similar observations were confirmed in the NHANES study (9) were the prevalence of overweight in the USA population was 38.7% in men and 26.5% in women while the prevalence of obesity was 35% in men and 40.4% in women.

This study revealed that the unhealthy lifestyle was a composite risk factor for adiposity and was present in 67.33% of the individuals. It was observed that frequent fast-food consumption was the most prevalent risk factor for adiposity in our study being identified in 61.67% of the individuals and also it was the most important factor that increased the risk for overweight and obesity 1.85 times. Data from literature is abundant regarding the association between fast-food consumption and obesity. Research demonstrated that compared to non-consumers individuals that consume fast-food products have a risk of obesity increased by 20-129% (10). Consumption of fast-food products is not only associated with obesity but also with cardiovascular disease, increasing the prevalence of these pathologies with 52-162% (10). Individuals with fast-food consumption also consume a high quantity of sweetened beverages (11). Nutrition interventions are effective measures to improve diet quality (12). One meta-analysis evaluating 14 studies carried out on college students demonstrated that nutrition education provided as lectures, web education or giving informative supplements, significantly improves nutrition knowledge and dietary practices (13). Obesity and overweight are also associated with a high oncogenic and/or infections risk. It was demonstrated that the antioxidants have an important role related to the mechanistic approach of the metabolic disorders (14,15). Sedentary lifestyle in our study was associated

with a 1.79 higher risk for being obese or overweight. Studies demonstrate that among sedentary behaviours TV viewing was strongly associated with obesity (16). Physical inactivity is also associated, by reducing energy expenditure and increasing visceral adiposity, with a high risk of diabetes mellitus type 2 and cardiovascular disease (17). The association between depression and obesity was observed in many studies, one study reporting that individuals with depression had a 26% higher risk of being obese (18). However, the relationship is complex and is not completely understood weather depression causes obesity or obesity causes depression by generation of inflammatory biomarkers that disrupt the hypothalamus-pituitary-adrenal axis. Sleep disturbances are associated with obesity, as demonstrated in our study, because they disrupt the orexin system being associated with increased appetite (19). A study that explored the effects of sleep restriction demonstrated that it is associated with statistically significant lower levels of leptin, a hormone that decreases appetite, and higher ghrelin levels, a hormone that increases appetite (20). Epidemiological evidence from >50 studies demonstrates that short sleep (<6 h/day) is associated with obesity risk (19). Short sleep duration is highly prevalent in modern society because longer working hours, working during the night, longer time needed for commuting and long hours spent in front of TV (21).

Research regarding risk factors for adiposity is of maximum importance because overweight or obesity once installed is extremely difficult to combat. Research demonstrates that diet and physical effort are efficient for weight loss, but weight-loss maintenance has a low prevalence, the only effective method for a long-term weight-loss maintenance is bariatric surgery (22). Therefore, preventive measures (informative and educative programs, changing of the diet and of the life-style, politics and legislation) are necessary in order to decrease the prevalence of overweight and obesity in the general population. The most worrying aspect is the high prevalence of overweight and obesity among children, it is considered that 1 in every 3 children from United States of America is either overweight or obese (23).

In conclusion, in the present study, which included 900 individuals from Oradea, Romania, the prevalence of overweight was 29.56%, while the prevalence of obesity was 21.33%. Unhealthy lifestyle was highly prevalent among the included persons being reported in 67.33%. Having an unhealthy lifestyle increases the risk of being overweight or obese by 3.15-fold. Fast-food consumption was a major contributor to unhealthy lifestyle being reported in 61.67% of persons.

Availability of data and materials

At the private medical offices where the data were collected.

Authors' contributions

ARP, OF, MR, RACA and CMV collected, analysed and interpreted the patient data regarding BMI determination and completion of questionnaires. CP, CCD, OB, SB and SN made substantial contributions to the conception of the work and interpretation of data; also, they drafted the manuscript and were major contributors in writing the manuscript. All authors read and approved the final manuscript to be published. All the authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethics approval and consent to participate

The research was performed according the WMA Declaration of Ethics, Helsinki - Medical Research Involving Human Principles for Subjects. All the subjects signed a written consent giving their acceptance to participate in the study. The study was approved by the Ethics Council of the Clinical Emergency Hospital of Oradea (Oradea, Romania).

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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