

Obesity and poverty paradox in developed countries

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Abstract

Obesity is a civilization disease and the proportion of people suffering from it continues to grow, especially in the developed countries. Number of obese people in Europe has increased threefold over the last 20 years. The paradox of obesity and poverty relationship is observed especially in the developed and developing countries. In developing countries, along with economic development and income growth, the number of people with overweight and obesity is increasing. This paradox has a relationship with both the easy availability and low cost of highly processed foods containing 'empty calories' and no nutritional value. To date, this paradox has been described in the United States and the United Kingdom, although many European countries are also experiencing high percentages of obese people. Among the reasons for the growing obesity in the population of poor people are: higher unemployment, lower education level, and irregular meals. Another cause of obesity is low physical activity, which among the poor is associated with a lack of money for sports equipment. Due to the large rate of deaths caused by diseases directly linked to obesity, the governments of many countries implement prevention programmes of overweight and obesity. These programmes are based primarily on educating the public about a healthy lifestyle based on healthy eating, daily physical activity and avoiding alcohol and cigarettes.

Key words

Obesity, poverty, nutrition, physical activity

INTRODUCTION

Obesity is a disease of civilization on a global scale, and the number of obese people continues to grow, especially in developed countries [1]. The World Health Organization (WHO) has identified obesity as the biggest public health problem and reported that in 2008 the problem of overweight affected 1.4 billion people, and obesity more than 200 million men and 300 million women worldwide. It is estimated that 35% of adults over the age of 20 are overweight or obese, and 11% are obese [2]. In the European Union, 300,000 people die each year because of obesity and diseases caused by excess of body weight [3]. According to the WHO, in Europe the number of obese people has tripled over past 20 years [4].

High-income countries have a higher proportion of people suffering from obesity, compared to countries with medium and low incomes. In developing countries, along with economic development and income growth, number of people with overweight and obesity is increasing [5]. The United States is one of the richest countries in the world and about one third of the American population is obese and another one third is overweight [6].

The aim of this study is to present the paradox of obesity and poverty, depending on socio-economic situation and excessive body weight, resulting from people's lifestyles.

STATE OF KNOWLEDGE

The paradox of obesity and poverty was first observed in the United States where people have been studied in a number of states [7]. The results indicate that poor states are characterized by higher rates of obesity. States where the proportion of the poor was greater than 35% were characterized by a 145% increase in the amount of obese compared to the richer states [6]. Based on the 2010 United States Census, 15.1% of Americans were found to live in poverty [8].

The economic dimension of poverty is spread between the social minimum which provides also needs of a higher order and subsistence minimum providing basic needs, while failing to provide them leads to biological degradation, or is even life-threatening [9]. Research on the budgets of Polish households in 2011, conducted by the Central Statistics Office, shows that about 20% of the Polish population live in a bad financial situation, and their income accounted for only 6.5% of the total income of all respondents. The income situation of households is clearly a differentiating factor in the level and composition of expenditure. In 2011, there was also an increase in the number of people on the verge of extreme poverty (below the poverty line) to 6.7% from 5.7% in 2010. There was also a further decrease in the quantity of consumption of the most basic food, especially sugar, bovine meat, animal fats and apples [10]. Expenditure on food among poor families is limited, and the average value of energy and nutrients are unfavorable due to bad eating habits. Improper feeding structure, consisting mainly of protein deficiency, too little fruit and raw vegetables, and excess fats containing cholesterol leads to a weakening of

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children's mental and physical development opportunities, as well as increasing the risk of obesity. In many households, the deteriorating financial situation also reduces spending on medical and dental services, and the purchase of medicines and vitamin supplements. The reason for such behaviour is also the absence of healthy habits. In some poor families, basic health practices, such as daily washing, exercise and adequate sleep, are not followed. The lack of basic health practices, combined with frequent behaviors such as smoking or drinking alcohol among the poor, leads to the deterioration of their health and the development of various diseases [11].

Most studies of obesity and poverty focus on adults [12, 13]. However, the growing problem of obesity applies also to children and adolescents [14]. The prevalence of obesity in children in the United States has increased dramatically over the last 30 years, from 6% to 17% among young people aged 12–19 years [15, 16]. The problem of overweight and obesity in childhood is associated with risk of developing a number of serious health problems, including diabetes mellitus type II, heart disease, high blood pressure, and increases the risk of obesity in adulthood [17, 18]. The feeding behaviour of parents and their upbringing practices later affect the development of children and their eating habits [19]. Obesity in childhood increases the risk of obesity in adults [20]. The poverty environment in which children are raised also affects other psychosocial and physical risk factors [21]. Their parents monitor food intake of their children's, their regularity, and portion sizes [22]. The low level of sleep is also associated with a higher weight physiologically, acting through hormonal mechanisms [23].

The obesity epidemic is progressing also in other countries, for example, in the UK Project 'Foresight Obesity' predicts an increase in the prevalence of obesity in the population of the UK. The results of the project estimated that by 2050, 60% of men and 50% of women will be obese. The results also indicate differences in the prevalence of obesity among the different social classes [24].

In Western and Northern Europe, lower rates of obesity, compared to the countries of Eastern Europe and the Mediterranean countries, are observed. The highest proportion of obese people in the population (over 25%) was recorded in Italy, Spain, Poland and the Czech Republic [25].

In Poland, the obesity problem has been studied in national projects, such as NATPOL, HFCAS and WOBASZ [26, 27, 28, 29]. In the NATPOL project, the study was conducted among adults between 1997 – 2002. Studies have shown that the incidence of obesity has increased mainly among men, from 16% to 19%, while women remained relatively stable at about 19% [26, 27]. The research carried out under the Household Food Consumption and Anthropometric Survey (HFCAS) in 2000 gave comparable results, with obesity among 15.7% of men and 19.9% of women [28]. In 2003–2005, the problem of obesity in Poland was studied by the WOBASZ project. The results indicated that obesity was present in 40.4% of men and 27.9% of women, and obesity in 21.2% and 22.4%, respectively [29]. Comparison of results of national surveys indicate a growing prevalence of obesity, especially among men. It was found that excessive weight in 1997 was characterized by 54% of men (NATPOL), in 2000 – 56.7% (HFCAS), in 2002 – 58% (NATPOL), and in 2003–2005, another increase was observed in the number of men with excessive weight – up to 61.6% (WOBASZ) [26, 27, 28, 29]. After the nationwide questionnaire survey EHIS

(The European Health Interview Survey), conducted by the Central Statistical Office in 2009, it was found that excessive body weight concerned 61.4% of men and 44.6% of women [30] (Tab. 1). Research projects were also conducted in specific regions, such as Pol-MONICA in the Warsaw region, and the CINDI-WHO among the residents of the city of Łódź [31].

Table 1. Excessive body weight of adult Polish citizens with distinction in terms of gender, based on results of national surveys: NATPOL, HFCAS, WOBASZ, EHIS [26, 27, 28, 29, 30]

Year	Research name	Percent of women [%]		Percent of men [%]	
		Overweight	Obesity	Overweight	Obesity
1997	NATPOL	30.0	19.0	38.0	16.0
2000	HFCAS	28.7	19.9	41.0	15.7
2002	NATPOL	29.0	19.0	39.0	19.0
2003–2005	WOBASZ	27.9	22.4	40.4	21.2
2009	EHIS	29.4	15.2	44.8	16.6

The above-cited results allow the observation of a growing trend of obesity among men, and a small downward trend among obese women, as presented in the following Figure 1.

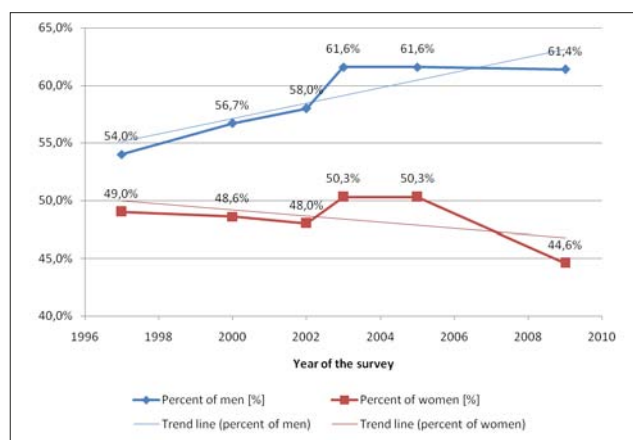


Figure 1. Percent of women and men with excess body weight (total: overweight and obesity) in 1997–2009, based on the studies: NATPOL, HFCAS, WOBASZ and EHIS [26, 27, 28, 29, 30].

Currently, the proportion of men with excess body weight is among the highest in the European Union, while in 2004, Poland ranked in the bottom half of the statement. The problem of excess body weight among women places Poland in the middle of the ranking EU countries [32].

Overweight and obesity among Polish children and adolescents are less common than in adults. The HFCAS study also identified children and adolescents under 18 years of age who are overweight and obese: overweight was found among 16% of boys and 11% girls, and obesity in 4% and 3.5%, respectively [33]. It should be emphasized that the development of overweight and obesity is also observed more frequently among children, and in the future it can lead to serious consequences [28]. In 2010, the percentages of young people with overweight and obesity increased in all age groups. In studies in 2010, the percentage of young people aged 15–16, excessive body weight accounted for 18% of boys and 11% of girls. The worst situation is in the case of the oldest boys – every fifth boy who entered into adult life had excessive body weight [32]. According to the sanitary-

epidemiological data from 2001, children and young people are more likely buying sweets or sodas in school-shops, and typically, access to healthier products, such as fruit, is limited. This can also lead to poor dietary habits [34].

Among the major causes of mortality in obese people, cardiovascular diseases like coronary heart disease, hypertension and heart failure are mentioned. The risk of myocardial infarction in obese women is 3 times higher compared to women whose weight is within the normal range [35]. Obese people are more likely to suffer from high blood pressure [36] and type II diabetes. In patients with a BMI higher than 35, a 20-fold increased risk of developing diabetes was observed [37]. Obesity is also often associated with gastrointestinal diseases, such as gastric reflux disease, nonalcoholic fatty liver, esophageal cancer and colon cancer. It is estimated that 30–40% of these cancers are caused by overweight and obesity [38]. Excessive body weight in adults and in children can lead to mental disorders, depression and eating disorders. Obesity in children can also lead to disorders of puberty [39].

It is suggested that the compound of obesity and poverty is associated with poor access to fresh food in poor regions [6]. Non-availability of healthy food for the poor is a major cause of increasing obesity among them. The poor often buy the cheapest food which is often highly processed and referred to as 'empty calories'. The Association of obesity and poverty has a physiological substrate, as regular eating using healthy food provides us with the appropriate body. The body needs a constant supply of energy which could be disposed of throughout the day. Irregular eating causes body to be unable to predict whether the next meal will be provided; therefore, it gathers energy in the form of body fat [40]. Poor people play less sports, mainly for the sake of lack of money, which could be used, for example, to buy a ticket to the gym or exercise equipment. The highest rates of obesity are not only in the USA, but also in other countries that are among the least educated population and the poorest [41].

Among the causes of increasing obesity among the poor are worse access to knowledge, power and resources, to enable a healthier lifestyle are mentioned [42]. Education allows for a better understanding of health issues, the impact of diet and physical activity on health. Better education also allows for a better understanding of medical advice and recommendations [43]. As shown in the 'Diet and Nutrition Survey', uneducated people eat less fruit and vegetables, compared with those with even the lowest level of education and qualifications. Among the social classes with higher incomes, a lower risk of obesity is observed. This is directly linked to the amount of income and belonging to the upper classes where a healthy diet is promoted and access to healthy foods is facilitated [44]. Access to parks and squares can also shape the risk of obesity. Districts with low incomes often have fewer green areas, which may discourage physical activity. In addition, poorer neighborhoods have limited access to healthy food, and the diet of their population is usually worse in quality and lower in nutrients [45]. Some studies even suggest that access to macro- and micro-nutrients in the early stages of development may be particularly important for determining the risk of obesity in later life [46]. Food shortages and malnutrition during adolescence may have a psychological impact that increases the risk of obesity in later life [47].

In Poland, different eating habits are observed among families living in poverty in major cities, compared to those in rural areas, where there are high percentages of structural unemployment. The poor from a city eat 1–3 meals a day, whereas more meals are eaten in the country, from 3 to 4–5 meals a day. The poor in a city eat less fruit, stressing that they cannot afford it. People living in rural areas eat more seasonal often own-grown fruit. Both the poor rural and urban families do not eat brown bread because it is too expensive, and in the villages it is not available. Rural families consume more milk and dairy products due to better availability of these products. In both types of families, the cheapest food, like sausages with a low content of meat (bologna, liver, blood, and Vienna or Frankfurter) are consumed. In rural families, homemade sausage is sometimes eaten. Dinner with meat is eaten more often in rural families, compared to urban families. Poultry is mainly eaten due to its low price.

Overweight and obesity is more common among the urban poor, which may be due to the healthier diet of villagers, richer in dairy products and vegetables which are readily available to them. They also eat more often but healthier, compared to urban residents. Their regular and healthy meals are also rooted in the tradition of work regularity in the countryside. Lower rates of obesity among rural residents may also result from the fact that country-living requires more work and burns more calories. Residents of large cities have easier access to very cheap and highly processed food and therefore they are much more likely to gain weight. The diet of poor people from big cities is low in fruit, vegetables, fish, dark bread and cereals. The poor, urban dwellers consume significant amounts of highly processed foods, high in calories but low in nutritional value. Additional risk factors for obesity are the frequent consumption of sugar-sweetened beverages (juices, cola), lack of physical activity, and not eating breakfast [9]. Central Statistical Office research into the situation of households in 2010 confirms that the richest people consume more than twice as much fruit than families with the lowest incomes. Also evident is the difference in the consumption of fruit and vegetables among urban and rural areas. Town residents consume more fruit (19%) and less vegetables (18%) than people living in rural areas [48]. The results of the CSO are worrisome because of the low intake of fruit and vegetables among school children. It is estimated that in the group of 10–14-year-old children, fruit is eaten every day by 73% of them, and vegetables (excluding potatoes) by 66%, and in the group of 15–19-year-old children, these percentages are 67% and 63%, respectively. Girls more often than boys eat fruits and vegetables every day [30].

Many scientists in their research have focused on the diversity of the diet of older people, which also depends on their socio-economic situation. In Poland, the elderly are a group of people with the lowest levels of education: over 50% have only primary education and a poor financial situation. Research shows that low income, low education level, and residence in a rural area or small town negatively affect the nutrition of the elderly. People with a higher economic status eat more varied meals consisting of a larger number of products that have a positive effect on health. Higher education levels also foster a more varied diet [49].

The World Health Organization (WHO) forecasts predict a steady increase in the body weight of inhabitants, and if no action is taken, human life expectancy will shorten, not lengthen, because of the frequent incidence of cardiovascular

disease, diabetes and other diseases. Attempts are being made worldwide to tackle obesity and prevent its effects. From a public health perspective, it is best to intervene early. Efforts are also being made to promote a healthy lifestyle, proper diet and physical activity. The effectiveness of these measures is often conditioned by the efforts of families, schools and the media in raising awareness of the human health. One of the most important action to combat obesity was the Global Strategy on Diet, Physical Activity and Health, which was adapted by WHO in 2004 during the World Health Assembly in Geneva [50].

SUMMARY

As is well known, not only the excess of calories in general, but also the quality of food affects our health and weight. High quality food is characterized by the desired nutrient density, and is usually quite expensive: marine fish, low fat meat, much of the fresh fruit and vegetables. However, sweet drinks, pies, sausages and refined oils are tasty and relatively cheap, but packed with calories and dyes and deprived of valuable nutrients. Such foods lead to overweight and obesity. To live healthily, one must consume a healthy diet, engage in physical activity, and avoid stimulants such as alcohol and tobacco [41].

To combat the growing problem of obesity, governments put a lot of effort into programmes of obesity prevention. Studies show that public health education and the introduction of fashion for a healthy lifestyle is very important for achieving the goals [50].

Since Poland is a developing country, it would be interesting to conduct national research on obesity and eating habits, and to distinguish the differences between the social classes, as none of the previous studies checked this compound for a large population.

REFERENCES

1. Suchocka Z. Obesity – reasons and treatment. *Biul Wydz Farm AMW*. 2003; 1(1): 1–17 (in Polish).
2. WHO 2008 Fact sheet no 311: Obesity and overweight. <http://www.who.int/mediacentre/factsheet/fs311/en/index.html> (access: 2013.03.19).
3. Cichońska A. Obesity – epidemic of the XXI century. *Przem Spoż*. 2004; 58(7): 6–9. (in Polish).
4. Hyde R. Europe battles with obesity. *Lancet*. 2008; 371(9631): 2160–2161.
5. James WP. The epidemiology of obesity: the size of the problem. *J Intern Med*. 2008; 263(4): 336–352.
6. Levine JA. Poverty and obesity in the U.S. *Diabetes*. 2011; 60(11): 2667–2668.
7. Low S, Chin MC, Deurenberg-Yap M. Review on epidemic of obesity. *Ann Acad Med Singapore*. 2009; 38(1): 57–59.
8. Income, poverty and health insurance in the United States. Washington: U.S. Census Bureau; 2010.
9. Uramowska-Żyto B, Kozłowska-Wojciechowska M. Nutrition behavior of poor families. *Roczn PZH*. 2003; 54(2): 221–229 (in Polish).
10. Household budget survey in 2011. Warsaw: Central Statistical Office; 2012.
11. Komorska M. The living conditions of poverty-stricken families. *Ann Univ Mariae Curie Skłodowska*. 2001; 23(11): 143–152 (in Polish).
12. Zhang Q, Wang Y. Socioeconomic inequality of obesity in the United States: Do gender, age and ethnicity matter? *Soc Sci Med*. 2004; 58(6): 1171–1180.
13. Paeratakul S, Lovejoy JC, Ryan DH, Bray GA. The relation of gender, race and socioeconomic status to obesity and obesity comorbidities in a sample of US adults. *Int J Obes Relat Metab Disord*. 2002; 26(9): 1205–1210.
14. Lee H, Harris KM, Gordon-Larsen P. Life course perspectives on the links between poverty and obesity during the transition to young adulthood. *Popul Res Policy Rev*. 2009; 28(4): 505–532.
15. Ogden CL, Yanovski SZ, Carroll MD, Flegal KM. The epidemiology of obesity. *Gastroenterology*. 2007; 132(6): 2087–2102.
16. Troiano RP, Flegal KM. Overweight children and adolescents: description, epidemiology, and demographics. *Pediatrics*. 1998; 101(3 Pt 2):497–504.
17. Must A, Anderson SE. Effects of obesity on morbidity in children and adolescents. *Nutr Clin Care*. 2003; 6(1): 4–12.
18. Freedman DS, Khan LK, Dietz WH, Srinivasan SR, Berenson GS. Relationship of childhood obesity to coronary heart disease risk factors in adulthood: the Bogalusa Heart Study. *Pediatrics*. 2001; 108(3): 712–718.
19. Birch LL, Fisher JO. Development of eating behaviors among children and adolescents. *Pediatrics*. 1998; 101(3–2): 539–549.
20. Reilly JJ, Methven E, McDowell ZC, Hacking B, Alexander D, Stewart L, Kelnar CJH. Health consequences of obesity. *Arch Dis Child*. 2003; 88(9): 748–52.
21. Evans GW. The environment of childhood poverty. *Am Psychol*. 2004; 59(2): 77–92.
22. Berkey CS, Rockett HR, Gillman MW, Field AE, Colditz GA. Longitudinal study of skipping breakfast and weight change in adolescents. *Int J Obes Relat Metab Disord*. 2003; 27(10): 1258–1266.
23. Spiegel K, Tasali E, Penev P, Van Cauter E. Brief communication: Sleep curtailment in healthy young men is associated with decreased leptin levels, elevated ghrelin levels, and increased hunger and appetite. *Ann Intern Med*. 2004; 141(11): 846–850.
24. El-Sayed AM, Scarborough P, Galea S. Unevenly distributed: a systematic review of the health literature about socioeconomic inequalities in adult obesity in the United Kingdom. *BMC Public Health*. 2012; 12: 18.
25. Berghöfer A, Pischon T, Reinhold T, Apovian CM, Sharma AM, Willich SN. Obesity prevalence from a European perspective: a systematic review. *BMC Public Health*. 2008; 8: 200.
26. Zdrojewski T, Babińska Z, Bandosz P, Kąkol M, Szpakowski P, Gnacińska M, Krupa-Wojciechowska B, Wyrzykowski B. Association of overweight and obesity with elevated blood pressure in studies of representative groups of adults in Poland in 1997 and 2002 (NATPOL II. NATPOL III). *Med Metabol*. 2002; 6(4): 32 (in Polish).
27. Zdrojewski T, Bandosz P, Szpakowski P, Konarski R, Manikowski A, Wołkiewicz E, Jakubowski Z, Łysiak-Szydłowska W, Bautembach S, Wyrzykowski B. The prevalence of major risk factors of diseases of the cardiovascular system in Poland. The results of the study NATPOL PLUS. *Kardiol Pol*. 2004; 61(4): 1–26 (in Polish).
28. Szponar L, Sekuła W, Rychlik E, Ołtarzewski M, Figurska K. Household food consumption and anthropometric survey. Warsaw: Instytut Żywności i Żywienia 2003 (in Polish).
29. Biela U, Pająk A, Kaczmarczyk-Chałas K, Głuszek J, Tendera M, Waśkiewicz A, et al. Incidence of overweight and obesity in women and men between the ages of 20–74. Results of the WOBASZ program. *Kardiol Pol*. 2005; 63(6 Suppl 4): 632–635 (in Polish).
30. Health Status of Polish population in 2009. Central Statistical Office, Warsaw 2011 (in Polish).
31. Jarosz M, Rychlik E. Obesity epidemic – what will our future look like? *Gastroenterol Pol*. 2010; 17(1): 47–52 (in Polish).
32. Wojtyński B, Goryński P, Moskalewicz B. The health situation of the Polish population and their implications. National Institute of Public Health-National Institute of Hygiene, Warsaw 2012 (in Polish).
33. Jarosz M, Szponar L, Rychlik E, Respondek W, Ołtarzewski MG, Dziensiszewski J, Wardak J. Overweight, obesity, malnutrition in Poland. In: Jarosz M (eds.). Obesity, nutrition, physical activity, health of the Poles. Instytut Żywności i Żywienia; Warszawa 2006, p.45–114 (in Polish).
34. Gajewska M, Ignar-Golinowska B. Evaluation of pupil's nutrition in Poland on the basis of the data for the year 2001 gathered by the sanitary-epidemiological stations. *Roczn PZH*. 2003; 54(2): 183–96 (in Polish).
35. Rosenbaum M, Leibel RL, Hirsch J. Obesity. *N Engl J Med*. 1997; 337(6): 396–407.
36. Aneja A, El-Atat F, McFarlane SI, Sowers JR. Hypertension and obesity. *Recent Prog Horm Res*. 2004; 59: 169–205.
37. Mokdad AH, Ford ES, Bowman BA, Dietz WH, Vinicor F, Bales VS, et al. Prevalence of obesity diabetes and obesity-related health risk factors 2001. *JAMA*. 2003; 289(1): 76–79.
38. Calle EE, Rodriguez C, Walker-Thurmond K, Thun MJ. Overweight, obesity and mortality from cancer in a prospectively studied cohort of U.S. adults. *N Engl J Med*. 2003; 348(17): 1625–1638.

39. Maffei C, Tato L. Long-term effects of childhood obesity on morbidity and mortality. *Horm Res.* 2001; 55(Suppl 1): 42–45.
40. Thorp AA, Owen N, Neuhaus M, Dunstan DW. Sedentary behaviors and subsequent health outcomes in adults: a systematic review of longitudinal studies. 1996–2011. *Am J Prev Med.* 2011; 41(2): 207–215.
41. Drewnowski A, Specter SE. Poverty and obesity: the role of energy density and energy costs. *Am J Clin Nutr.* 2004; 79(1): 6–16.
42. Link BG, Phelan J. Social conditions as fundamental causes of disease. *J Health Soc Behav.* 1995; 36(Extra Issue): 80–94.
43. Galesic M, Garcia-Retamero R. Statistical numeracy for health: a cross-cultural comparison with probabilistic national samples. *Arch Intern Med.* 2010; 170(5): 462–468.
44. Nelson M, Erens B, Bates B, Church S, Boshier T. Low income diet and nutrition survey. TSO, London 2007.
45. Black JL, Macinko J. Neighborhoods and obesity. *Nutr Rev.* 2008; 66(1): 2–20.
46. Huang JS, Lee TA, Lu MC. Prenatal programming of childhood overweight and obesity. *Matern Child Health J.* 2007; 11(5): 461–473.
47. Ravelli AC, van Der Meulen JH, Osmond C, Barker DJ, Bleker OP. Obesity at the age of 50 y in men and women exposed to famine prenatally. *Am J Clin Nutr.* 1999; 70(5): 811–816.
48. Situation of households in 2010 in light of results the household budget survey. Central Statistical Office, Warsaw 2011.
49. Niedźwiedzka E, Wądołowska L. Analysis of food intake variety in relation to the socio-economic status of elderly Polish citizens. *Probl Hig Epidemiol.* 2010; 91(4): 576–584 (in Polish).
50. Global strategy on diet, physical activity and health. Geneva: World Health Organization; 2004. http://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf (access: 2013.03.19).