

**Derewiecki Tomasz<sup>1,2,4</sup>, Duda Marta<sup>1,2</sup>, Mroczek Krzysztof<sup>1,2</sup>,  
Chmiel-Derewiecka Danuta<sup>3</sup>, Majcher Piotr<sup>4</sup>**

<sup>1</sup>Zamość Rehabilitation Department, College of Management and Public Administration, Zamość, Poland

<sup>1</sup> Zamojska Klinika Rehabilitacji WSZiA Zamość, Polska

<sup>2</sup>Department of Physiotherapy, College of Management and Public Administration, Zamość, Poland

<sup>2</sup> Katedra Fizjoterapii WSZiA Zamość, Polska

<sup>3</sup>Department of Pedagogy, College of Management and Public Administration, Zamość, Poland

<sup>3</sup>Katedra Pedagogiki WSZiA Zamość, Polska

<sup>4</sup>Division of Rehabilitation and Physiotherapy, Department of Rehabilitation, Physiotherapy and Balneotherapy, Medical University of Lublin, Poland

<sup>4</sup>Zakład Rehabilitacji i Fizjoterapii Katedry Rehabilitacji, Fizjoterapii i Balneoterapii, Wydział Pielęgniarstwa i Nauk o Zdrowiu Uniwersytetu Medycznego w Lublinie, Polska

## **Risk factors determining appearing of the obesity among residents of the Zamość district**

### **Czynniki ryzyka determinujące występowanie otyłości wśród mieszkańców powiatu zamojskiego**

#### **Summary**

**Introduction.** The civilization progress in many European and World countries contributed to changing of whole societies` way of life. It caused a dramatic growth of share of obese people. The overweight and obesity make a timeless problem. The XXIth century man, apart from deriving a hedonistic pleasure from eating, avoids any physical effort, what causes decreasing of physical fitness and increasing of body mass.

**Aim.** The goal of the present paper is the analysis of risk factors determining occurrence of obesity.

**Material and Methods.** Conducted was an author`s survey. Tested were 1014 inhabitants of Zamość district, Poland. The results were statistically analyzed, on the level of significance  $p < 0,05$ .

**Results.** 34,51% of the tested group distinguished themselves with the value of BMI index from 25 to 30 (overweight), whereas in 10,39% of the respondents found was  $BMI > 30$ , what indicated obesity. The analysis of results showed, that the most exposed to overweight and obesity are men 65-and- over-years-old, living in towns, hired as white collar workers, having vocational education.

**Conclusions.** Appropriate is promoting an active way of life, oriented for maintaining a proper body mass. The society should be made aware of the importance of problem and consequences of lack of knowledge about this subject.

**Key words:** risk factors, BMI (Body Mass Index), obesity

#### **Streszczenie**

Wstęp Postęp cywilizacyjny w wielu krajach Europy i Świata przyczynia się do zmiany sposobu życia całych społeczeństw, a co za tym idzie wzrasta drastycznie odsetek osób cierpiących na otyłość. Nadwaga i otyłość stanowią problem ponadczasowy. W XXI wieku człowiek, oprócz hedonistycznej przyjemności

jedzenia, wykazuje niechęć do wysiłku fizycznego, co sprzyja zmniejszeniu sprawności i wzrostowi masy ciała.

Cel Celem pracy jest analiza czynników ryzyka determinujących występowanie otyłości.

Materiał i metoda Przy pomocy autorskiej ankiety zostało przebadanych 1014 mieszkańców powiatu zamojskiego (Polska). Wyniki badań poddano analizie statystycznej. Przyjęto poziom istotności statystycznej  $p < 0,05$ .

Wyniki W badanej grupie osób 34,51% charakteryzował wskaźnik BMI o wartości 25-30 (nadwaga), zaś 10,39% ankietowanych posiadało wskaźnik BMI > 30 (otyłość). Analiza wyników ukazała, iż najbardziej narażeni na nadwagę i otyłość są mężczyźni po 65 roku życia, mieszkający w mieście, pracujący umysłowo z wykształceniem zawodowym.

Wnioski Celowe jest promowanie aktywnego trybu życia ukierunkowanego na utrzymanie prawidłowej masy ciała. Należy również uświadomić społeczeństwu skalę problemu i konsekwencje wynikające z braku wiedzy na ten temat.

**Słowa kluczowe:** czynniki ryzyka, BMI (Body Mass Index), otyłość

## Introduction

The civilization progress in many European and World countries contributed to changing of whole societies` way of life. It caused a dramatic growth of share of obese people. According to the WHO definition, the obesity is a chronic disease, that never subsides spontaneously. Its symptom are determined by external factors, like stress, improper nutrition, lack of physical activity, as well as by internal factors, as genetic predispositions, metabolic malfunctions and deteriorating processes. The overweight and obesity make a timeless problem. The XXIth century man, apart from deriving a hedonistic pleasure from eating, avoids any physical effort, what causes decreasing of physical fitness and increasing of body mass (Buczyjan et al. 2007; Ogińska-Bulik, 2004).

Despite the obesity is considered as a problem of highly developed societies, it begins, however, to concern also poorer developing regions (Lee, Pratley, 2005). The epidemiological research deliver more and more proofs for growing frequency of obesity occurrence as well in Poland, as in the whole World. According to those data, about 30% of Americans suffer from obesity, whereas including the people with overweight – the number grows to 67% of the population. In Europe about 50% of the population battle against an overweight, whereas 22% of women and 15% of men are evaluated as obese ones. Similar traits were found for the adult population of Poland. In the study conducted by Pol-MONICA Bis among the inhabitants of Warsaw in the age of 20-74 years obesity was found in 26% of men and 34% of women (Broda, 2003; Buczyjan et al. 2007; Kujowska-Łuczak, Pupek-Musialik, 2006; Lee, Pratley, 2005; Szostak-Węgierek, 2007).

The overweight and obesity are the result of co-operation of metabolic, environmental and biological factors, such as sex and genetic predispositions. To the environmental factors belong primarily: availability of cheap and highly processed food, containing much fat and simple carbohydrates; socially-economical status; education; living conditions; a kind of a job; limitation of daily physical activity. Genetic factors include

a tendency to a faulty fat tissue storage and slowing down of the basal metabolism. The conducted research proved, that obesity occurs in 2/3 of progeny out of both obese parents, in 1/2 of progeny of one obese parent, whereas only in 9% of children, when the both parents are slim. Obesity isn't passed on by one gene, there are many genes appearing in different combinations (Araujo, 2003; Bryła and others 2006; Munir, Shuldiner, 2003; Obuchowicz, Zięba, 2011; Olszewska et al. 2011).

There are some simple anthropometrical methods, enabling us to evaluate a correct weight. Measured can be BMI (Body Mass Index), waist size or thickness of fat tissue fold (Bernas, 2007; Bryła, 2012)

Epidemiological research explicitly proved, that obesity is a non-questioned cause of a general mortality. It causes growth of incidence rate for Type II diabetes, respiratory and digestive tract diseases, bone – articular system malfunctions, increasing of risk of a cancer, heart ischaemia and hypertension. The study conducted among American women proved, that more than half (53%) of deaths in people with BMI>29 could be directly attributed to obesity. Moreover, obesity influences also social and emotional life of an affected person, as the way of self-perceiving or relations with other people (Kujowska-Łuczak, Pupek-Musialik, 2006; Ogińska-Bulik, 2004).

### Aim

The aim of the present paper is the analysis of risk factors for occurrence of obesity.

### Research tasks

1. Evaluating of BMI value in a tested group.
2. Checking, if the kind of a job performed by tested people influences their body mass.
3. Checking, whether the occurrence of obesity is influenced by sex, age and education level of respondents.
4. Testing the statistical significance of interdependence between above mentioned risk factors and occurrence of an improper body mass.

### Material and methods

The survey embraced 1014 inhabitants of Zamość district in the age of 18 – 88 years. The group of respondents consisted of 572 women (56,41%) and 442 men (43,59%). 588 of them lived in a town, whereas 426 heads in rural areas (Table 1).

Tab.1. Characteristics of a research material.

Wiek/Age	Lata/Years	
Min/minimum	18	
Max/maximum	88	
Płeć/Sex	Liczba osób/ people number	%
Kobiety/Woman	572	56,41
Mężczyźni/Man	442	43,59
Miejsce zamieszkania/Living place	Liczba osób/ people number	%

Miasto/City	588	57,99
Wieś/Country	426	42,01
Poziom wykształcenia/Education	Liczba osób/ people number	%
Podstawowe/Basic	43	4,24
Zawodowe/ Professional	126	12,43
Średnie/Average	509	50,20
Wyższe/Higher	336	33,14
Charakter wykonywanej pracy/Work character	Liczba osób/ people number	%
Uczeń/student	215	21,20
Fizyczna/physical	270	26,63
Umysłowa/intellectual	280	27,61
Mieszana/Mixed	109	10,75
Bezrobotny/Unemployed	12	1,18
Emeryt/rencista/Retired	128	12,62

As the research tool used was the author's survey questionnaire. The results were statistically analyzed, using the program Microsoft Excel. The accepted level of statistical significance amounted  $p < 0,05$ .

## Results

34,51% respondents from the tested population had BMI between 25 and 30 (what indicated overweight), whereas in 10,39% of the tested people BMI exceeded 30, what indicated obesity. The detailed results are shown in the Table 2.

Tab.2. Division of respondents according to the values of BMI.

Value of BMI/Wartość BMI	People number/Liczba osób	%
Underweight/Niedowaga (<19)	76	7,24
Norm/Norma (19-25)	502	47,86
Overweight/Nadwaga (25-30)	362	34,51
Obesity/Otyłość (>30)	109	10,39

The analysis of results proved, that overweight and obesity appears more often in urban than in rural areas. Among town dwellers 37,10% showed excessive weight, whereas in 10,98% occurred obesity. Among country dwellers overweight occurred in 31,03% from the tested population, whereas obesity in 9,60%, respectively. Nevertheless, a hypothesis about an interdependence between dwelling place and frequency of overweight and obesity cases couldn't be accepted because of the level of statistical significance. The results in detail were introduced in the Table 3.

Tab.3. The impact of place of residence on BMI.

Value of BMI/Wartość BMI	City/Miasto		Country/Wieś	
	People number /Liczba osób	%	People number /Liczba osób	%
Underweight/Niedowaga	42	6,99	34	7,59
Norm/Norma	270	44,93	232	51,79
Overweight/Nadwaga	223	37,10	139	31,03
Obesity/Otyłość	66	10,98	43	9,60

The excessive weight problem occurs more often in men than in women. 50,79% of tested men showed overweight, whereas 13,71% were obese; in women the corresponding results reached 22,52% and 7,95%, respectively. The hypothesis, however, about an interdependence between sex and frequency of overweight and obesity, should be cancelled because of the statistical significance level (Table 4).

Tab.4. The impact of gender on BMI.

Value of BMI/Wartość BMI	Women/Kobiety		Men/Mężczyźni	
	People number /Liczba osób	%	People number /Liczba osób	%
Underweight/Niedowaga	72	11,92	4	0,90
Norm/Norma	348	57,62	154	34,61
Overweight/Nadwaga	136	22,52	226	50,79
Obesity/Otyłość	48	7,95	61	13,71

The overweight and obesity problem more often concerns white-collar than blue-collar workers. Among office workers excessive weight was found in 45,22%, whereas obesity in 12,13%. In the group of manual workers the corresponding results amounted 36,88% and 9,57%, respectively. The influence of kind of a job on frequency of occurring overweight and obesity was statistically proved (Table 5).

Tab.5. The impact on the nature of the work on the BMI.

Value of BMI/Wartość BMI	Physical/Fizyczna		Inttelectual/Umysłowa	
	People number /Liczba osób	%	People number /Liczba osób	%
Underweight/Niedowaga	15	5,32	6	2,21
Norm/Norma	136	48,23	110	40,44
Overweight/Nadwaga	104	36,88	123	45,22
Obesity/Otyłość	27	9,57	33	12,13

As well overweight, as obesity, occurred more often in the group of people with a vocational education. 47,62% of respondents from this group had an excessive weight, whereas in 24,60% obesity was found. The difference, however, wasn't statistically significant, so the hypothesis must be cancelled (Table 6).

Tab.6. The impact of level of education on BMI.

Value of BMI/Wartość BMI	Basic /Podstawowe		Professional /Zawodowe		Average /Średnie		Higher /Wyższe	
	n	%	n	%	n	%	n	%
Underweight/Niedowaga	7	16,28	3	2,38	40	7,49	26	7,51
Norm/Norma	20	46,51	32	25,40	278	52,06	172	49,71
Overweight/Nadwaga	8	18,60	60	47,62	180	33,71	114	32,95
Obesity/Otyłość	8	18,60	31	24,60	36	6,74	34	9,83

n-people number/liczba osób

To the lowest degree affected with overweight or obesity were the youngest respondents. In the age group from 18 to 35 years found were only 22,20% people with an overweight and 4,77 with obesity. Let's compare those data with an age group of 65 y.o. and over, where found were 43,86% cases of overweight and 26,32% cases of obesity. Nevertheless, its statistically significance level indicated that the hypothesis should be given up. The results in detail are collected in Table 7.

Tab.7. The impact of age on the BMI.

Value of BMI/Wskaźnik BMI	Age 18-35 years/ Wiek 18-35 lat		Age 36-50 years/Wiek 36-50 lat		Age 51-65 years/ Wiek 51-65 lat		Age >65 years/Wiek > 65 lat	
	n	%	n	%	n	%	n	%
	Underweight/Niedowaga	69	12,66	4	1,59	3	1,53	0
Norm/Norma	329	60,37	102	40,64	54	27,55	17	29,82
Overweight/Nadwaga	121	22,20	122	48,61	94	47,96	25	43,86
Obesity/Otyłość	26	4,77	23	9,16	45	22,96	15	26,32

## Discussion

The overweight and obesity make a great epidemiological problem as well in Poland, as in other developed countries (Jarosz, Respondek, 2009; Krupienicz and others 2007). Obesity became one of the greatest health threats in contemporary World, despite millions of people starting losing weight. In Poland nearly 60% of people in their fifties suffer from excessive weight. Too high fat concentration is a well-known risk factor of such civilization diseases, as hypertension, heart ischemia, hyperlipidemia, Type II diabetes or the majority of cancers. It also influences appearing many muscular- skeletal malfunctions, what results in increasing of sick leaves frequency or earlier retirement, what, in turn, indicates another growth of socio-economical costs (Barbe, 2011; Belfiore et al. 2010; Braulio et al. 2011; Cyganek et al. 2007).

Widely used for evaluation a correct body weight in epidemiological studies is the method of calculating BMI indicator (Dźygadło, Łepecka-Klusek, 2012). In the tested group 34,51% of respondents had BMI from 25 to 30 (overweight), whereas in 10,39% BMI exceeded 30 (obesity). The research conducted for the time being confirmed the interdependence between increasing of BMI value in obese people and higher frequency of occurring a hypertension, ischaemia and hypercholesterolemia in them (Chmiel-

Perzyńska et al. 2010). That method, however, has such a disadvantage, that it doesn't differ fat tissue from the mass of remaining parts of our body. For example, high values of BMI might be caused either by high fat contain, or the contain of remaining tissues in relation to body weight (Chwałczyńska et al. 2010).

The analysis of results showed, that urban dwellers more often suffer from overweight or obesity. In the group of town dwellers excessive weight was found in 37,10% of cases, whereas obesity in 10,98% of respondents. In rural areas overweight was found in 31,03% of cases, whereas obesity in 9,60%, respectively. Similar results were obtained by Gajewska, Goryński and Wysocki, who tested main causes of hospitalization of Polish patients. According to their calculations, in 2008 more often hospitalized were town dwellers than country dwellers (19,9 vs 14,4 in 100 000 with regards to obesity and 115,8 vs 109,3 in 100 000 regarding Type II of diabetes (Gajewska et al. 2011).

In the tested population men had more often problems with their body mass. 50,79% of tested men had excessive weight, whereas 13,71% were obese. In women corresponding shares were spread out in the following way: 22,52% had overweight, whereas 7,95% were obese. The hypothesis about interdependence of sex and frequency of overweight and obesity occurrence wasn't, however, statistically significant. The epidemiological data for recent 20 years in the US pointed out, that during that period the frequency of obesity cases doubled. In European countries in more than 50% inhabitants recognized was overweight, whereas in 30% found was obesity (Andreyeva et al. 2007; Elmadfa, 2009). The weight problems had the greatest intensity in Greece, where 51% of men and 37% of women weighed too much, whereas 28% of men and 38% of women were obese. Also in Poland those problems occurred more often. The research conducted in 2000 by Food and Nutrition Institute proved, that overweight occurred in 41% of men and 28,7% of women, whereas obesity was found in 15,7% of men and 19,9% of women (Jarosz, 2006; Sekuła, 2003).

The overweight and obesity problem is much more common in white collar workers. Among them found were 45,22% cases of overweight and 12,13% of obesity cases. In the group of blue collar workers 36,88% of them had overweight, whereas 9,57% were obese. Moreover, the influence of work character on frequency of overweight and obesity confirmed the statistical significance level  $p < 0,05$  ( $p = 0,03483$ ).

Overweight and obesity were decidedly more frequent in the group of people with a vocational education. In that group found were 47,62% cases of overweight and 24,60% cases of obesity. Similar data were found by Waśkiewicz and Sygnowska, whose research results proved, that frequency of obesity cases (BMI from 30 kg/m<sup>2</sup>) decreased simultaneously with education level growth. It diversified as follows: in men – 33% together with essential education, 27% in secondary school graduates and 19% with university education. In women the respective indicators were arranged as follows: 39%, 25% and 16%. At the same time education influenced significantly life style and nutritional habits (Sygnowska, Waśkiewicz, 2006).

In the tested group the youngest respondents were the least affected by the overweight and obesity problem. In an age group from 18 to 35 y.o. found were 22,20% of overweight cases and 4,77% of obesity cases. Let's compare those results with corresponding data obtained for the age group of 65 y.o. and over. It was found, that 43,86% of that group

suffered from overweight, whereas 26,32% were obese. Nevertheless, the hypothesis about interdependence between age and overweight or obesity should be cancelled because of the level of statistical significance  $p > 0,05$ . Similar results were obtained in studies of the Food and Nutrition Institute. Evaluated was, that obesity problem may affect every age group. In the years 1991-2000 the obesity rate in adults below 60 years of age increased by about 5%. The growing intensity of appearing of overweight and obesity in children and youth makes another serious problem. On the basis of research conducted by the Food and Nutrition Institute evaluated was, that overweight occurs in 15,9% of boys and 11,1% of girls, whereas obesity in 4% of boys and 3,4% of girls (Apovian et al. 2012; James, 2008; Kłosiewicz-Latoszek, 2010; WHO, 2012).

The society should be made aware of importance of a correct body mass. It involves not only aesthetic advantages or better feeling, but can reduce the risk of many diseases or improve the prognosis in the case of existing ones. Kubsik and Kowalski pointed out the relation between obesity and asthma. According to them, obesity increases the risk of occurrence of asthma, whereas reducing the body mass reduces also the asthma symptoms (Kowalski, Kubsik, 2010). That's why the battle against obesity should become one of priorities of contemporary medical science.

### **Conclusions**

1. The society should be made aware of the scope of problem and consequences of lack of knowledge about that subject.
2. Obesity causes many civilization diseases, like diabetes, hypertension, heart ischaemia and cancer.
3. Purposeful is promotion of an active life style, oriented to maintaining a correct body mass.

### **Bibliography**

1. Andreyeva T., Michaud PC., van Soest A. (2007) Obesity and health in Europeans aged 50 years and older. *Public Health*. 121: 497-509.
2. Apovian CM., Fujioka K., Hill JO. (2012) The evolution of obesity therapies: New application of obesity therapies: New application for existing drugs. *Medscape CME Diabetes & Endocrinology*. <http://cme.medscape.com/wievaricle/722366> (dostęp: 2012.09.22)
3. Araujo S., Liu YJ., Recker RR, et al. (2003) Molecular and genetic mechanisms of obesity: implications for future management. *Curr Mol Med*. 3: 325-40.
4. Barbe P., Petersen M., Verdich C., et al. (2011) Changes in body composition during weight loss in obese subjects in the NUGENOB study: comparison of bioelectrical impedance v. dualenergy X-ray absorptiometry. *Diabetes Metab*. 37(3): 222-229.
5. Belfiore A., Savastano S., Di Somma C., et al. (2010) Validity of bioelectrical impedance analysis to estimate body composition changes after bariatric surgery in premenopausal morbidly women. *Obes Surg*. 20: 332-339.

6. Braulio VB., Furtado VC., Silveira MG., et al. (2010) Comparison of body composition methods in overweight and obese Brazilian women. *Arq Bras Endocrinol Metabol.* 54: 398-405.
7. Broda G., Pająk A., Rywik S. (2003) Częstość występowania nadwagi i otyłości w wybranych populacjach Polski – Pol MONICA Bis Project. *Med Me-tab.* 2: 8-15.
8. Bryła M., Drygas W., Maniecka-Bryła I. (2006) Epidemiological situation in the field of cardiovascular diseases in the beginning of the 21st century. *Zdrowie Publiczne.* 116(3): 427-30.
9. Bryła M., Kardjalik K., Maniecka-Bryła I. (2012) Zachowania zdrowotne związane z odżywianiem oraz występowanie nadwagi i otyłości w grupie studentów. *Prob Hig Epidemiol.* 93(1): 71-79.
10. Buczyjan A., Makara-Studzińska M., Moryłowska J. (2007) Jedzenie – przyjaciel i wróg. Korelaty psychologiczne otyłości - przegląd piśmiennictwa. *Zdrowie Publiczne.* 117(3): 392-396.
11. Chmiel-Perzyńska I., Derkacz M., Marczewski K. (2010) Otyłość jako interdyscyplinarny problem medyczny (część II) wpływ otyłości na zdrowie człowieka. *Problemy medyczne i społeczne środowiska życia i pracy. Medycyna Ogólna.* 16: 2-12.
12. Chwałczyńska A., Karmińska K., Socha M. (2010) Porównanie zawartości tkanki tłuszczowej u młodych nieotyłych kobiet i mężczyzn oznaczonej metodą bioimpedancji (wersja bi-i tetrapolarna) i metodą fotooptyczną. *Endokr Otył Zab Przem Mat.* 6(1): 18-25.
13. Czech A., Bernas M., Tatoń J. (2007) Otyłość, zespół metaboliczny. PZWL, Warszawa.
14. Cyganek K., Kutra B., Sieradzki J. (2007) Porównanie pomiarów tkanki tłuszczowej u otyłych pacjentów z zastosowaniem metody bioimpedancji elektrycznej i densytometrycznej. *Diabetol Prakt.* 8: 473-478.
15. Dżygadło B., Łepecka-Klusek C., Pilewski B. (2012) Wykorzystanie analizy impedancji bioelektrycznej w profilaktyce i leczeniu nadwagi i otyłości. *Probl Hig Epidemiol.* 93(2): 274-280.
16. Elmadfa I. (2009) Health and life style indicators in the European Union. *European Nutrition and Health Report 2009.* Forum Nutr. Basel, Krager. 62: 157-201.
17. Gajewska M., Goryński P., Wysocki MJ. (2011) Otyłość i cukrzyca typu 2 jako główne przyczyny hospitalizacji w polskich szpitalach w 2008 roku. *Probl Hig Epidemiol.* 92(1): 132-136.
18. James WPT. (2008) The epidemiology of obesity: the size of the problem. *J Intern Med.* 263: 336-352.
19. Jarosz M., (2006) Otyłość, żywienie, aktywność fizyczna, zdrowie Polaków. Diagnostyka stanu odżywiania, aktywności fizycznej i żywieniowych czynników ryzyka otyłości oraz przewlekłych chorób niezakaźnych w Polsce (1960-2005) Instytut Żywności i Żywienia, Warszawa.
20. Jarosz M., Respondek W. (2009) Rola żywienia i aktywności fizycznej w profilaktyce otyłości i przewlekłych chorób niezakaźnych. W: Gawęcki J, Roszkowski W (red). *Żywienie człowieka a zdrowie publiczne.* PWN, Warszawa, s.90-118.
21. Kłosiewicz-Latoszek L. (2010) Otyłość jako problem społeczny, zdrowotny

- i leczniczy”, *Probl Hig Epidemiol*, 91(3): 339-343.
22. Kowalski M., Kubsik B. (2010) Astma i otyłość. *Alergia astma immunologia*. 15(1): 19-25.
  23. Krupienicz A., Lewitt A., Mądro E. (2007) Podstawy teoretyczne i zastosowania analizy impedancji bioelektrycznej (BIA). *Endokr Otył Zab Przem Mat*. 4: 79-84.
  24. Kujowska-Łuczak M., Pupek-Musialik D. (2006) Otyłość i jej powikłania-poważny problem zdrowotny współczesnych kobiet. *Med Dopl*. 22: 20-24.
  25. Lee YH., Pratley RE. (2005) The evolving role of inflammation in obesity and the metabolic syndrome. *Curr Diab Rep*. 5: 70-75.
  26. Munir KM., Shuldiner AR. (2003) Genetics of obesity: more complicated than initially thought. *Lipids*. 38: 97-101.
  27. Obuchowicz A., Zięba M. (2011) Wiedza młodzieży szkół ponadgimnazjalnych powiatu nowotarskiego na temat przyczyn i skutków nadwagi i otyłości oraz ich profilaktyki. *Zdrowie Publiczne*. 121(3): 253-257.
  28. Ogińska-Bulik N. (2004) *Psychologia nadmiernego jedzenia*. Wydawnictwo Uniwersytetu Łódzkiego; Łódź.
  29. Olszewska D., Saczuk J. (2011) Wasiluk A, Olszewski J. Sprawność fizyczna chłopców z nadwagą i otyłością zamieszkujących wschodnie województwa Polski. *Zdrowie Publiczne*. 4: 350-354.
  30. Rychlik E., Szponar L., Sekuła W., et al. (2003) Badania indywidualnego spożycia żywności i stanu odżywienia w gospodarstwach domowych. *Wyd Instytut Żywności i Żywienia*, Warszawa.
  31. Szostak-Węgierek D. (2007) Atherosclerosis prevention of children and young adults: *Pediatrics Polska*, 82(7): 550-8.
  32. Waśkiewicz A., Sygnowska E. (2006) Wpływ poziomu wykształcenia na zachowania zdrowotne i czynniki żywieniowe związane z powstawaniem otyłości - badanie POLMONICA bis Warszawa. *Zdrowie Publiczne*. 116(2): 227-231.
  33. World Health Organization. (2006) Obesity and overweight. Fact. Sheet. No. 311. September 2006: <http://www.who.int/mediacentre/factsheets/JSs311/en/index.html>. Accessed January 13.2009 (dostęp: 2012.09.22)

Number of signs with spaces: 25 480