

## THE RISK OF OVERWEIGHT AND OBESITY IN CHRONIC DISEASES AMONG WARSAW INHABITANTS MEASURED BY SELF-REPORTED METHOD

Piotr Supranowicz\*, Mirosław J. Wysocki, Justyna Car, Anna Dębska, Anita Gębska-Kuczerowska, Lucyna Gromulska

Department of Health Promotion and Postgraduate Education, National Institute of Public Health – National Institute of Hygiene Warsaw, Poland

### ABSTRACT

**Background.** Obesity is well known cause of various diseases. However, there are only a few studies which enable to compare directly the magnitude of risk in different groups of chronic diseases.

**Objectives.** The aim of presented paper was to identify a magnitude of the risk of chronic diseases attributable to overweight and obesity on the basis of data on weight and height self-reported by respondents.

**Material and methods.** The survey was conducted among 402 Warsaw inhabitants selected by non-random method. Overweight and obesity was measured by Body Mass Index (BMI) on the basis of the data of weight and height reported by respondents. According to WHO criteria the normal weight is defined as BMI 18.5 – 24.9 kg/m<sup>2</sup>, overweight as BMI 25.0 – 29.9 kg/m<sup>2</sup>, and obesity as BMI 30 kg/m<sup>2</sup> or more. The following groups of chronic diseases were included: cancer, diabetes and other endocrine diseases, mental disorders, cardiovascular diseases, respiratory diseases, digestive diseases, arthritis and allergy disorder.

**Results.** Obesity measured by self-reported method was recognised as significant risk factor for diabetes (OR=9.6, CI: 2.0-152.8), respiratory diseases (OR=10.6, CI: 3.0-333.7), cardiovascular diseases (OR=5.2, CI: 1.9-108.3), arthritis (OR=6.3, CI: 2.4-266.7), digestive diseases (OR=3.8, CI: 1.3-83.6) and mental disorders (OR=5.8, CI: 1.5-29.1), while overweight significantly increased the risk of diabetes (OR=4.4, CI: 1.2-10.8), respiratory diseases (OR=3.2, CI: 1.4-22.2), cardiovascular diseases (OR=2.9, CI: 1.2-6.4) and arthritis (OR=3.0, CI: 1.1-9.6)

**Conclusions.** Our findings showed that data on weight and height collected by survey method provide some information about the magnitude of the risk regarding particular groups of diseases attributable to overweight and obesity, nevertheless, underestimation of BMI calculated in this way should be taken into account.

**Key words:** *overweight, obesity, chronic diseases*

### STRESZCZENIE

**Wprowadzenie.** Otyłość jest dobrze poznaną przyczyną różnych chorób. Jednakże istnieje jedynie niewiele badań, które umożliwiają bezpośrednie porównanie wielkości ryzyka w różnych grupach chorób przewlekłych.

**Cel.** Celem niniejszych badań było określenie wielkości ryzyka wystąpienia chorób przewlekłych, które można przypisać nadwadze i otyłości na podstawie danych o masie ciała i wzroście określonych przez respondentów.

**Material i metody.** Badania ankietowe przeprowadzono wśród 402 mieszkańców Warszawy wybranych metodą nielosową. Nadwagę i otyłość mierzono za pomocą wskaźnika Body Mass Index (BMI) w oparciu o dane o wadze i wzroście podane przez respondentów. Zgodnie z kryteriami Światowej Organizacji Zdrowia (WHO) prawidłową masę ciała określono jako BMI 18.5 – 24.9 kg/m<sup>2</sup>, nadwagę jako BMI 25.0 – 29.9 kg/m<sup>2</sup>, a otyłość jako BMI 30 kg/m<sup>2</sup> lub więcej. Włączono następujące grupy chorób przewlekłych: cukrzyca i inne choroby przemiany materii, choroby nowotworowe, układu krążenia, układu oddechowego, układu trawiennego, reumatyczne, zaburzenia psychiczne i alergiczne.

**Wyniki.** Otyłość określona na podstawie pomiarów dokonanych przez samych respondentów rozpoznano jako istotny czynnik ryzyka cukrzycy (OR=9.6, CI: 2.0-152.8), chorób układu oddechowego (OR=10.6, CI: 3.0-333.7), chorób układu krążenia (OR=5.2, CI: 1.9-108.3), chorób reumatycznych (OR=6.3, CI: 2.4-266.7), chorób układu trawiennego (OR=3.8, CI: 1.3-83.6) i zaburzeń psychicznych (OR=5.8, CI: 1.5-29.1). Nadwaga znacząco zwiększała ryzyko cukrzycy (OR=4.4,

\* **Corresponding author:** Piotr Supranowicz, Department of Health Promotion and Postgraduate Education, National Institute of Public Health – National Institute of Hygiene, Chocimska street 24, 00-791 Warsaw, Poland  
phone: + 48 22 54 21 334, fax: +48 22 54 21 375,  
e-mail: psupranowicz@pzh.gov.pl

CI: 1.2-10.8), chorób układu oddechowego (OR=3.2, CI: 1.4-22.2), chorób układu krążenia (OR=2.9, CI: 1.2-6.4) i chorób reumatycznych (OR=3.0, CI: 1.1-9.6).

**Wnioski.** Wyniki niniejszych badań pokazały, że dane o wadze i wzroście zebrane metodą ankietową mogą w pewnym stopniu dostarczyć informacji o wielkości ryzyka, jakie można przypisać nadwadze i otyłości, niemniej jednak należy uwzględnić niedoszacowanie BMI obliczonego w ten sposób.

**Słowa kluczowe:** *nadwaga, otyłość, choroby przewlekłe*

## INTRODUCTION

Obesity is one of the most dangerous risk factors of premature death and morbidity of the large number of chronic diseases, simultaneously creating the high costs in community, as well as at individual level. In the high-income countries obesity are recognised as the third risk factor caused death (after tobacco use and high blood pressure) and annually have been responsible for 700 000 deaths, i.e. 8.4% of all deaths [47]. The prevalence of obesity in Europe and many other industrialised countries outside Europe has significantly increased over the past several decades [12]. The data available from Health Interview Survey (HIS), which has been carried out simultaneously in 19 European countries, found the proportion of overweight and obese people in adult population varied between 51% and 69% for men, and 51% and 57% for women, while prevalence of obesity ranged from 8% to 25% for men, and from 8% to 24% for women [9].

The prospective and methodologically reliable studies conducted on the large cohorts provided evidences that obesity, and in the certain cases overweight, were significant risk factors for mortality and morbidity. The wide range of chronic diseases was recognised as obesity-related. Increased risk of developing diabetes [1, 6, 14, 17, 22] and other endocrine diseases [6], cardiovascular diseases [1, 8, 17, 22, 33, 38], respiratory diseases [4, 6, 17, 34], digestive diseases [5, 17, 22, 31], arthritis [1, 6, 16, 23], and some cancers [1, 17, 24, 25] by overweight and obesity was generally confirmed. Obesity increases the risk of all-cause mortality [3, 13, 30], as well as cause-specific mortality [46]. As opposed to obesity, the existing studies did not confirm that overweight is a risk factor for mortality. Furthermore, some investigations may suggest that overweight could protect against premature death [30].

Obesity is seen as a serious threat to health also in Poland [20, 40]. However, to our knowledge, there were no studies in Poland that estimated the risk of chronic diseases related to obesity. The aim of presented paper was to define the risk of wide range of chronic diseases attributable to overweight and obesity, with BMI measured by self-reported weight and height.

## MATERIAL AND METHODS

The presented analysis is a part of the wider scientific project concerning social participation in health reform [39]. One of the main purposes of the project was to assess the usefulness of information collected by self-administrated questionnaire for developing more effective health policy. Data were collected during April – June 2011. The participants were selected by non-random method. The questionnaires (with return envelopes) were delivered to 1700 households located in the buildings inhabited at different time in order to obtain the sample varied by age and the level of affluence. The house were selected by all authors, according to their knowledge of inhabitants. All districts were included in proportion to the number of residents. Participation in the study was voluntary and anonymous, therefore, the data were completed by non-addressed questionnaires. Inhabitants returned 406 questionnaires, of which 402 correctly completed were analysed. The low response rate was discussed in our previous article [39]. Compared to the structure of Warsaw population, in our sample women, older persons (over 44 years), the high educated, pensioners and chronically ill were over-represented. A more detailed description of the sample and content of questionnaire was presented in our previous studies [39].

The Body Mass Index (BMI), recommended by the WHO for health survey, was used to define overweight and obesity. BMI was calculated by the weight in kilograms divided by squared height in metres. According to the WHO recommendations,  $BMI < 18.5$  is classified as underweight,  $18.5 \leq BMI < 25.0$  normal weight,  $25.0 \leq BMI < 30.0$  overweight,  $BMI \geq 30$  obese [18]. In our study only the five respondents were underweight (1.3%), therefore this group has been excluded from further analyses. In order to collect information on the chronic diseases, the respondents were asked, whether they are under continuous medical supervision due to their illness. Then, they pointed to which group of diseases includes the disease they suffer from. When preparing the list of chronic diseases, it was assumed that the list should include the basic groups of diseases covered by ICD-10. Therefore, the following groups of diseases were included: cancer, diabetes and other endocrine diseases, mental disorders, cardiovascular di-

seases, respiratory diseases, digestive diseases, arthritis and allergic disorders.

The Epi Info processing, database and statistical system for epidemiology for microcomputer was applied for establishing database and statistical analyses. The *Kruskal-Wallis* non-parametric test for differences between medians was used for the analyses of differences in BMI indicators, while Chi-square test was used to determine the prevalence of obesity and overweight. The risk value of overweight or obesity for chronic diseases was estimated by odds ratios (OR). Both the unadjusted OR and adjusted for gender, age and education (*Mantel-Haenszel* summarised stratified OR) were presented. The significance was accepted at the level of  $p < 0.05$ .

## RESULTS

Out of the 382 respondents, who reported their height and weight, less than half had body mass within the norm, every third was overweight, and one in seven was obese (Table 1). The prevalence of overweight was considerably higher in men, while the difference between genders in obesity was slight. The percentage of overweight people increased with age, while in the obese the noticeable difference was found between the youngest group and those over 44 years. Although the average BMI scores significantly differentiated the respondents varied by the level of education (the lower level of education the higher BMI), nevertheless the differences in distribution of overweight and obese in relation to education were too small to reach statistical significance.

People suffering from diabetes, respiratory diseases, cardiovascular diseases and arthritis were characterised by the highest BMI scores (Table 2). Obesity and also overweight were found to be significant risk factors for

the most chronic diseases. Obesity increased the risk of occurrence of diabetes and respiratory diseases 10 times, while cardiovascular diseases, arthritis, digestive diseases and mental disorders from almost 4 to 6 times. Overweight increased 4 times the risk of occurrence of diabetes, and 3 times the risk of respiratory diseases, arthritis and cardiovascular diseases. The risk of obesity in cancers analysed together, as well as for endocrine disorders (without diabetes) and allergic disorders was not found.

## DISCUSSION

Results of our study showed that obesity generated highest risk for diabetes and respiratory diseases, followed for arthritis, mental disorders, cardiovascular diseases and digestive diseases. The previous studies have generally confirmed this sequence, regardless of how the risk was defined. If the population-attributable fraction (PAF) was used, 39% - 79% of diabetes, 11% - 39% of cardiovascular diseases, 13% - 23% of arthritis and 12% - 48% of digestive diseases found to be attributed to obesity [1, 22, 26, 43].

In the previous studies using the risk assessment (calculating as odds ratio – OR or risk ratio – RR), the dispersion of the risk of diabetes caused by obesity was high and the estimated risk ranged from 1.6 to 19.6, however, in most of the studies the risk was higher than 3.0 [6, 14, 17, 44]. In the research, in which the obesity class II and III were separately analysed, the risk of diabetes for these groups ranged from 4.2 to 23.4 [6]. The estimated risk of all respiratory diseases ranged from 1.3 to 2.1 [6]. Among these diseases, the obesity hypoventilation syndrome occurs only in the obese, because one of the criteria of diagnosis is  $BMI > 30$ , and from 15% to 60% of subjects had morbid obesity ( $BMI > 40$ ) [29]. As

Table 1. Differences in body mass in relation to demographic characteristics

Demographic characteristics	BMI		Category of body mass			p <sup>2</sup>
	Mean	p <sup>1</sup>	Norm (n=181) %	Overweight (n=143) %	Obesity (n=53) %	
Total (n=377)	25.82		48.0	37.9	14.1	
Gender		<0.001				0.009
Male (n=144)	26.6		38.2	46.5	15.3	
Female (n=233)	25.4		54.1	32.6	13.3	
Age		<0.001				0.002
18-44 (n=63)	23.9		62.2	26.5	11.3	
45-64 (n=153)	26.3		47.7	35.9	16.3	
65 or more (123)	26.7		37.4	49.6	13.0	
Education		0.019				0.252
Secondary or lower (n=183)	26.4		50.8	37.8	11.4	
High (n=193)	25.3		44.8	38.3	16.9	

<sup>1</sup> *Kruskal-Wallis* test

<sup>2</sup> *Chi*<sup>2</sup> test

Table 2. Differences in body mass in relation to chronic diseases

Chronic diseases	BMI Mean	Risk of diseases			
		Overweight		Obesity	
		Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Healthy (n=75)	24.2	1.0	1.0	1.0	1.0
Diabetes (n=41)	28.2	4.1 (1.5-11.4)	4.4* (1.2-10.8)	12.9 (2.6-62.8)	9.6* (2.0-152.8)
Respiratory diseases (n=36)	27.1	3.1 (1.1-8.9)	3.2* (1.4-22.2)	11.8 (2.6-57.9)	10.6** (3.0-333.7)
Cardiovascular diseases (n=191)	27.1	2.6 (1.4-5.0)	2.9* (1.2-6.4)	6.5 (2.0-23.3)	5.2** (1.9-108.3)
Arthritis (n=104)	27.1	2.8 (1.4-5.7)	3.0* (1.1-9.6)	6.2 (1.8-24.0)	6.3** (2.4-266.7)
Digestive diseases (n=84)	26.9	2.1 (1.1-4.5)	2.1 (0.7-4.2)	5.7 (1.6-22.6)	3.8* (1.3-83.6)
Other endocrine diseases (n=73)	26.2	1.8 (0.8-3.9)	2.3 (0.7-6.7)	4.4 (1.2-17.0)	3.3 (0.8-18.5)
Mental disorders (n=66)	25.9	1.1 (0.5-2.6)	1.2 (0.5-3.9)	4.2 (1.1-17.0)	5.8* (1.5-29.1)
Cancer (n=22)	25.2	0.9 (0.3-2.9)	1.6 (0.3-7.1)	1.7 (0.2-12.8)	2.1 (0.2-82.4)
Allergic disorders (n=96)	25.0	1.2 (0.6-2.4)	1.3 (0.7-3.8)	2.8 (0.7-11.1)	2.5 (0.9-14.1)

OR – odds ratio (adjusted for gender, age and education)

The level of significance (*Mantel-Haenszel* chi-square test):

\*  $p > 0.05$

\*\*  $p > 0.01$

regards other specific respiratory diseases, the previous studies have brought inconsistent results, nevertheless, obesity seems to increase the risk of asthma between 1.4 and 2.7 [7, 17, 34], sleep apnea syndrome between 1.6 and 1.8 [48] and breathlessness – 2.5 [4]. The estimated risk of all cardiovascular diseases ranged from 1.2 to 4.3 [6, 8, 10, 33, 44], while separately for class II and III obesity – from 2.2 to 4.4 [6]. In this group of diseases the risk of hypertension was found between 1.7 and 5.9 [6, 17, 33, 44], myocardial infarction between 1.5 and 2.1 [6], stroke between 1.2 and 4.2 [8, 17, 33, 38], coronary artery disease between 1.3 and 3.1 [17, 33], and congestive heart failure between 1.4 and 3.1 [6, 33]. The estimated risk of arthritis ranged from 1.1 to 5.7 [6, 16, 17, 23]. In the study of *Calza* et al. the risk of obesity type I for arthritis was 1.6, while of obesity class II and III – 2.0 [6]. *Grotle* et al. collected some evidences that obesity higher increased the risk of osteoarthritis of hand and knee than osteoarthritis of hip (respectively: 2.6, 2.2 and 1.1) [16]. Among digestive diseases, the satisfactory evidence was found for significant association between obesity and gallbladder diseases. The estimated risk of gallbladder diseases ranged from 1.2 to 5.4 [17, 31, 42]. As regards other digestive diseases the current finding are conflicting, nevertheless obesity seems to increase the risk of chronic erosive esophagitis or colorectal adenoma. The estimated risk ranged respectively be-

tween 1.3 and 5.4, and between 1.2 and 2.7 [5, 19, 21]. Besides diabetes, the risk of certain other non-neoplastic endocrine diseases are well documented, especially for thyroid diseases (hypothyroidism, nodular goiter), for which the risk varied from 1.8 to 4.0 [6, 15, 32]. As regards mental disorders, some studies confirmed obesity as a risk factor. The estimated risk of obesity for depression ranged from 1.1 to 2.0 [27, 28, 70], for anxiety from 1.1 to 1.5 [27, 35], for bipolar affective disorder from 1.5 to 1.9 [28, 37], and for post-traumatic stress disorder – 2.7 [37]. On the other hand, *Scott* et al. in the international comparative study observed that value of the risk was largely country-specific. The risk differentiation of depression due to obesity ranged from 0.7 in Italy and the Netherlands to 2.0 in Japan, and for anxiety from 0.7 in Italy to 2.5 in the Netherlands [35].

The risk for chronic diseases caused by obesity, reported in our study, was comparable to results from the other studies, with the exception of respiratory diseases and mental disorders, where the risk identified in our study was much higher. As regards respiratory diseases, the previous studies, in contrary to our study, usually excluded sufferers from obesity hypoventilation syndrome, among whose all are obese. Therefore, in our study, in comparison to other chronic diseases, the percents of obese patients with respiratory diseases was the highest.

The issue of obesity risk for cancers requires separate discussion. The authors of several prospective and methodologically excellent studies confirmed that obesity existing at baseline of the research significantly increases the risk of occurrence of certain cancers in people healthy at baseline. The estimated risk of obesity ranged from 1.1 to 1.4 for post menopausal breast cancer, from 1.1 to 4.8 for endometrial cancer, from 1.1 to 1.9 for ovarian cancer, from 1.2 to 3.1 for colorectal cancer, from 1.4 to 3.3 for kidney cancer, from 1.1 to 4.2 for pancreatic cancer, from 1.2 to 1.5 for prostate cancer [17], from 1.2 to 4.4 for gallbladder cancer [24], from 1.5 to 2.4 for liver cancer [25]. It is known that some cancers develop in thin people, and almost all cancers lead to emaciation of the body and to weight loss [49]. Therefore, in the cross-sectional studies, and that was also our research, the risk of all cancers has been more frequently found associated with underweight, than obesity, even severe obesity [6]. It explains the lack of risk of obesity for cancers analysed together reported in our study.

The association between overweight and chronic diseases seems to be more complicated. The previous studies confirmed in general that overweight significantly increased the risk of diabetes, and the estimated risk lay in the interval 1.2 – 5.5 [6, 11, 17]. As regards other chronic diseases, the current results are inconclusive, and reported risk ranged from 0.9 to 1.6 for respiratory diseases [6, 17], from 0.6 to 2.7 for cardiovascular diseases [6, 11, 44], from 1.3 – 3.4 for osteoarthritis [6, 17], and from 0.9 to 2.2 for digestive diseases [6]. In the studies, like ours, in which weight and height were self-reported by respondents, the risk of chronic diseases caused by overweight was usually higher than measured by anthropometric methods, because respondents were likely to underestimate their weight or overestimate height [45]. Thus, many of them were really obese.

## CONCLUSIONS

Our studies that data on weight and height collected through survey method may provide some information about the magnitude of the risk of particular groups of diseases attributable to overweight and obesity. In particular, the self-reported weight and height by Warsaw inhabitants indicated that:

1. Obesity strongly increased the risk of several chronic diseases, to the greatest extent of diabetes and respiratory diseases, and also cardiovascular diseases, arthritis, digestive diseases, other (except diabetes) endocrine diseases and mental disorders.
2. Overweight was found to be the significant risk factor of diabetes. The higher than expected risk for respiratory diseases, cardiovascular diseases,

arthritis and digestive diseases would indicate that self-reported weight may be underestimated or self-reported height overestimated, and many of overweight people were really obese. Nevertheless, the underestimation of BMI calculated by self-reported weight and height should be taken into account.

## Acknowledgements

*The study was performed under the scientific project of the National Institute of Public Health – National Institute of Hygiene, Warsaw, Poland (No 3/ZP.1, 2013 'Evaluation of usefulness of health survey for analysing determinants of chronic diseases').*

## Conflict of interest

*The authors declare no conflict of interest.*

## REFERENCES

1. Allender S., Rayner M.: The burden of overweight and obesity-related ill health in UK. *Obes Rev* 2007;8:467-473.
2. Bender R., Zeeb H., Schwarz M., Jockel K.H., Berger M.: Causes in death in obesity: relevant increase in cardiovascular but not in all-cancer mortality. *J Clin Epidemiol* 2006;59:1064-1071.
3. Bernington de Gonzalez A., Hardge P., Cerhan R., Flint A.J., Hannan L., MacInnis R.J., Moore S.C.: Body-mass index and mortality among 1.46 million white adults. *N Engl J Med* 2010;363:2211-2219.
4. Bowden J.A., To T.H.M., Abernethy A.P., Currow D.C.: Predictors of chronic breathlessness: a large population study. *BMC Publ Health* 2011;11:33-42.
5. Cai N., Ji G-Z., Fan Z-N., Wu Y-F., Zhang F-M., Zhao Z-F., Xu W., Liu Z.: Association between body mass index and erosive esofagitis. *World J Gastroenterol* 2012;18:2545-2553.
6. Calza S., Decarli A., Ferraroni M.: Obesity and prevalence of chronic diseases in the 1999-2000 Italian National Health Survey. *BMC Publ Health* 2008;8:140-149.
7. Chen Y., Rennie D., Cormier Y., Dosman J. Sex specificity of asthma associated with objectively measured body mass index and waist circumference: the Humboldt Study. *Chest* 2005;128:3048-3054.
8. Emerging Risk Factors Collaboration: Separate and combined associations of body-mass index and abdominal adiposity in cardiovascular disease: collaborative analysis of 58 prospective studies. *Lancet* 2011;377:1085-1095.
9. Eurostat: Overweight and obesity – BMI statistics. [http://epp.eurostat.ec.europa.eu/statistics/index.php/Overweight\\_and\\_obesity\\_-\\_BMI](http://epp.eurostat.ec.europa.eu/statistics/index.php/Overweight_and_obesity_-_BMI)
10. Falkstedt D., Hemmingsson T., Rasmussen F., Lundberg I.: Body mass index in late adolescence and its associations with coronary heart disease and stroke in middle age among Swedish men. *Int J Obes* 2007;31:777-783.

11. Field A.E., Coakley E.H., Must A., Spadano J.L., Laird N., Dietz W.H., Rimm E., Colditz G.A.: Impact of overweight on the risk developing common chronic diseases during a 10-year period. *Arch Int Med* 2001;161:1580-1586.
12. Finucane M.M., Stevens G.A., Cowan M., Danaei G., Li J.K., Paciorek C., Singh G.M., Gutierrez H.R., Lu Y., Bahalim A.N., Farzadfar F., Riley L.M., Ezzati M.: National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9,1 million participants. *Lancet* 2011;377:557-567.
13. Freedman D.M., Ron E., Ballard-Barbasch R., Doody M.M., Linet M.S.: Body mass index and all-cause mortality a nationwide US cohort. *Int J Obes* 2006;30:822-829.
14. Freemantle N., Holmes J., Hockey A., Kumar S.: How strong is the association between abdominal obesity and the incidence of type 2 diabetes. *Int J Clin Pract* 2008;62:1391-1396.
15. Gopinath B., Wang J.J., Kifley A., Wall J.R., Eastman C.J., Leedre S.R., Mitchel P.: Five-year incidence and progression of thyroid dysfunction in an older population. *Inter Med* 2010;12:642-649.
16. Grotle M., Hagen K.B., Nutwig B., Dahl F.A., Kvien T.K.: Obesity and osteoarthritis in knee, hip and/or hand: an epidemiological study in the general population with 10 years follow-up. *BMC Musculoskelet Disor* 2008;9:132-137.
17. Guh D.P., Zhang W., Bansback N., Amarsi Z., Birmingham L., Anis A.H.: The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. *BMC Publ Health* 2009;9:88-109.
18. Health interview surveys: toward international harmonization of methods and instruments. Ed. DeBruin A., Picavet H.S.J., Nossikov A. WHO, Copenhagen 1996, 83-86.
19. Jacobs E.T., Martine M., Alberts D.S., Jiceng R., Lance P., Lowe K., Thompson P.A.: Association between body size and colorectal adenoma recurrence. *Clin Gastroenterol Hepatol* 2007;5:982-990.
20. Jarosz M., Rychlik E.: Overweight and obesity among adults in Poland, 1983-2005. *Adv Med Sci* 2008;53:54-66.
21. Kim Y, Kim Y, Lee S.: An association between colonic adenoma and abdominal obesity. *BMC Gastroenterol* 2009;15:1-6.
22. Konnopka A., Bodemann M., König H.H.: Health burden and costs of obesity and overweight in Germany. *Eur J Health Econom* 2011;12:345-352.
23. Lahri M., Morgan C., Symons D.P.M., Bruce I.N.: Modifiable risk factors for RA: prevention, better than cure? *Reumatol* 2012;51:499-512.
24. Larsson S.C., Wolk A.: Obesity and the risk of gallbladder cancer: a meta-analysis. *Br J Cancer* 2007;96:1457-1461.
25. Larsson S.C., Wolk A.: Overweight, obesity and risk of liver cancer: a meta-analysis of cohort studies. *Br J Cancer* 2007;97:1005-1008.
26. Luo W., Morrison H., de Groh M., Waters C., DesMeules M., Jones-McLean E., Ugnat A.M., Dysjardins S., Lim M., Mao Y.: The burden of adult obesity in Canada. *Chronic Dis Can* 2007;27:135-144,
27. Luppino F.S., de Wit L.M., Bouvy P.F., Stijnen T., Cuijpers P., Penninx B.W.J.H., Zitmar F.G.: Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Arch Gen Psychiatry* 2010;67:220-229.
28. Mather A.A., Cox B.J., Enns M.W., Sareen J.: Association between obesity with psychiatric disorders and suicidal behaviours in a nationally representative sample. *J Psychosom Res* 2009;66:277-285.
29. Mokhlesi B.: Obesity hypoventilation syndrome: a state-of-the-art review. *Respir Care* 2010;55:1347-1362.
30. Orpana H.M., Berthelot J.M., Kaplan M.S., Feeny D.H., McFerland B., Ross N.A.: BMI and mortality: results from a national longitudinal study of Canadians. *Obesity* 2010;18:214-218.
31. Ostrowska L., Czapska D., Stefańska E., Karczewska J., Wyszyńska U.: Cholecystitis risk factors at obesity and normoweight persons. *Rocz Panstw Zakl Hig* 2005;56(1):67-76 (in Polish).
32. Phytayakorn R., Super D.M., McHenry C.R.: An investigation of epidemiological factors associated with large nodular goiter. *J Surg Res* 2006;133:16-21.
33. Poirer P., Giles T.D., Bray G.A., Mong Y., Stern J.S., Pi-Sunyer X., Eckel R.H.: Obesity and cardiovascular diseases: pathophysiology, evaluation and effect of weight loss. *Circulation* 2006;113:898-918.
34. Rabec C., Ramos P., Veale D.: Respiratory complication of obesity. *Arch Broncopneumol* 2011;47:252-261.
35. Scott K.M., Bruffaerts R., Simon G.E., Alonso J., Angermeyer M., de Giralomo G., Demyttenaere K., Gasquet I., Haro J.M., Karam E., Kessler M.C., Levinson D., Mora M.E.N., Oakley-Browne M., Ormel J.H., Pasada-Villa J., Uda H., Von Korff M.: Obesity and mental disorders in the general population: results from the world mental health survey. *Int J Obes* 2008;32:192-200.
36. Scott K.M., McGee J.E., Oakley-Browne M.A.: Obesity and mental disorders in the adult general population. *J Psychosom Res* 2008;64:97-105.
37. Simon G.E., Von Korff M., Saunders K., Miqlioretti D.L., Crane P.K., Van Belle G., Kessler R.C.: Association between obesity and psychiatric disorders in the USA adult population. *Arch Gen Psychiatry* 2006;63:824-830.
38. Strazzullo P., D'Elia L., Cairella G., Garbagnati F., Capucino F.P., Scalfi L.: Excess body weight and incidence of stroke: meta-analysis of prospective studies with 2 million participants. *Stroke* 2010;41:c418-c426.
39. Supranowicz P., Wysocki M.J., Car J., Dębska A., Gębska-Kuczerowska A.: Willingness of Warsaw inhabitants to cooperate with health service. I. Opinions on health reforms. *Przeegl Epidemiol* 2012;66:139-148 (in Polish).
40. Szponar B., Krzyszycha R.: Evaluation of the knowledge of atherosclerosis prevention among the inhabitants of the Lublin region. *Rocz Panstw Zakl Hig* 2009;60(1):79-85 (in Polish).
41. Tishler P.V., Larkin E.K., Schluchter M.D., Redline S.: Incidence of sleep-disordered breathing in an urban adult population: the relative importance of the risk factors in the development of sleep-disordered breathing. *JAMA* 2003;289:2230-2237.

42. *Torgerson J.S., Lindroos A.K., Naslund I., Peltonen M.*: Gallstones, gallbladder disease, and pancreatitis: cross-sectional and 2-year data from the Swedish Obese Subjects (SOS) and SOS Reference Studies. *Am J Gastroenterol* 2003;98:1032-1041.
43. *Tsai A.G., Abbo E.D., Ogden L.G.*: The time burden of overweight and obesity in primary care. *BMC Health Serv Res* 2011;11:191.
44. *Tsai A.G., Williamson D.F., Glick H.A.*: Direct medical cost of overweight and obesity in the United States: a quantitative systematic review. *Obes Rev* 2011;12:50-61.
45. *Villanueva E.V.*: The validity of self-reported weight in U.S. adults: a population based cross-sectional study. *BMC Publ Health* 2001;1:11.
46. *Whitlock G., Lewingstone S, Clark R., Emberson J., Halsey J., Oiziblash N., Collins R., Peto R.*: Body-mass index and cause-specific mortality in 900 000 adults: collaborative analysis of 57 prospective studies. *Lancet* 2009;373:1083-1096.
47. World Health Organization: Global health risk: mortality and burden of disease attributable to selected major risk. WHO, Geneva 2009.
48. *Young T., Shahar E., Nieto F.J.*: Predictors of sleep-disordered breathing in community-dwelling adults: the Sleep Heart Health Study. *Arch Int Med* 2002;162:893-900.
49. *Zhang J., Su X.Q., Wu X.J., Liu Y.H., Wang H., Zong X.N., Wang Y., Ji J.F.*: Effect of body mass index on adenocarcinoma of gastric cardia. *World J Gastroenterol* 2003;9:2658-2661.

Received: 17.01.2013

Accepted: 27.06.2013