



Cardiovascular disease risk factors in the Lubelskie Voivodeship in 2008-2018 – part II: the obesity epidemic

Czynniki ryzyka chorób układu krążenia na terenie województwa lubelskiego w latach 2008-2018 – część II: epidemia otyłości

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Abstract: *Introduction:* All over the world, the problem of excess body weight is being raised more and more frequently. In 2021, the number of obese people has tripled compared to 1975. Due to the constantly growing number of people meeting the criteria for overweight and obesity, it is becoming extremely important to implement preventive measures. Cardiovascular Diseases Prevention Program implemented in Poland as part of the National Health Fund program is a good opportunity to identify patients with abnormal body weight and to correct behavior and health education. *Material:* A retrospective analysis of data obtained by the National Health Fund as part of the implementation of 86,485 preventive cards of the Cardiovascular Diseases Prevention Program in the Lubelskie Voivodeship in 2008-2018 was carried out. The analyzes were performed using the IBM SPSS Statistics for Windows, version 25 program. The chi-square test and the Pearson linear correlation between the quantitative features were used to test the relationship between the two qualitative features. Significant predictors of a risk factor for cardiovascular disease were determined using multivariate logistic regression. The significance level was assumed to be $\alpha = 0.05$ for two-tailed tests. *Results:* The average BMI value was 26.12 kg / m². 1st degree obesity was diagnosed in 14.3% of patients, 2nd degree – 2.9%, 3rd degree – 0.7%. Excess body weight was significantly more often observed among men. With the increase in the number of years in the study population, the occurrence of overweight and obesity was significantly higher. One unit increase in BMI was associated with a 13% increase in the risk of high blood pressure and a 12% increase in the risk of serum glucose ≥ 126 mg/dl. It also increased the risk of hypercholesterolemia by 4.2% and of elevated LDL levels by 5.5%. *Conclusions:* The prevalence of obesity is extremely worrying. Excessive body weight undeniably translates into worse health of the population. The Cardiovascular Diseases Prevention Program at Primary Healthcare Clinics is a convenient opportunity to identify the factors leading to the development of obesity and to promote health-promoting behaviors.

Keywords: cardiovascular disease, obesity, risk factors

Abstrakt: *Wstęp:* Na całym świecie problem nadmiernej masy ciała jest coraz częściej podejmowany. W 2021 r. ilość osób z otyłością uległa potrojeniu w stosunku do roku 1975. Z uwagi na stale rosnącą ilość osób spełniających kryteria nadwagi i otyłości niezwykle istotne staje się wdrażanie działań zapobiegawczych. Profilaktyka CHUK realizowana w Polsce w ramach programu NFZ jest dobrym momentem do identyfikacji pacjentów z nieprawidłową masą ciała oraz korekcji zachowań i edukacji zdrowotnej. *Metoda:* Przeprowadzono analizę retrospektywną danych pozyskanych przez NFZ w ramach realizacji 86 485 kart profilaktycznych Programu „CHUK” na terenie województwa lubelskiego w latach 2008-2018. Analizy wykonano przy pomocy programu IBM SPSS Statistics for Windows, version 25. Do zbadania związku między dwiema cechami ilościowymi wykorzystano test chi-kwadrat oraz korelację liniową Pearsona między cechami ilościowymi. Istotne predyktory czynnika ryzyka chorób sercowo-naczyniowych określono za pomocą wieloczynnikowej regresji logistycznej. Za poziom istotności przyjęto $\alpha = 0,05$ dla testów dwustronnych. *Wyniki:* Średnia wartość wskaźnika BMI wyniosła 26,12 kg/m². Otyłość I stopnia rozpoznano u 14,3% osób, II stopnia – 2,9%, III stopnia – 0,7%. Nadmierna masa ciała istotnie częściej była obserwowana wśród mężczyzn. Wraz ze wzrostem liczby lat w populacji badanej istotnie częściej obserwowano występowanie nadwagi i otyłości. Wzrost BMI o jedną jednostkę wiązał się ze zwiększeniem ryzyka nadciśnienia tętniczego krwi o 13%, a glikemii ≥ 126 mg/dl o 12%. Zwiększał również ryzyko hipercholesterolemii o 4,2%, a podwyższonego stężenia LDL o 5,5%. *Wnioski:* Stopień rozpowszechnienia otyłości jest niezwykle niepokojący. Nadmierna masa ciała w sposób niezaprzeczalny przekłada się na gorszy stan zdrowia populacji. Program profilaktyki CHUK prowadzony w POZ jest dobrym momentem na identyfikację czynników prowadzących do rozwoju otyłości oraz pozwala promować zachowania prozdrowotne.

Słowa kluczowe: choroby układu krążenia, czynniki ryzyka, otyłość

Introduction

Nowadays, we can speak of an “obesity epidemic”. In 2021. The number of obese people has tripled since 1975 (WHO, 2021). In 2016, 39% of adults were overweight and 13% were obese. Most of the world's population lives in countries where overweight and obesity kill more people than underweight (WHO, 2021). In 2016, among people aged 20 and over in Poland, 53% of women and 68% of men were overweight, and 23% of women and 25% of men were obese (NCD Risk Factor Collaboration, 2017). Increasingly disturbing data also apply to children. In 2016, 20% of girls and 31% of boys in Poland were overweight among people under 20, and 5% of girls and 13% of boys were obese (NCD Risk Factor Collaboration, 2017).

A commonly recognized criterion for assessing body mass is the body mass index (BMI). In adults, the normal values of BMI were 18.5–24.9 kg / m². Overweight is diagnosed between 25.0 kg / m² and 29.9 kg / m². Obesity takes values equal to and greater than 30.0 kg / m². There are three degrees of obesity: I degree (30.0-34.9 kg / m²), II degree (35.0-39.9 kg / m²), Grade III (greater than 40.0 kg / m²) (WHO, 2021). Obesity is a well-known risk factor for the development of CHSN, which is associated with increased mortality by causing low-grade chronic inflammation, insulin resistance, increased blood pressure, prothrombotic status, and dyslipidemia. (Pischon, Boeing, Hoffmann, Bergmann, Schulze, Overvad, van der Schouw, Spencer, Moons, Tjønneland, Halkjaer, Jensen, Stegger, Clavel-Chapelon, Boutron-Ruault, Chajes, Linseisen, Kaaks, Trichopoulou, Trichopoulos, Riboli, 2008; Sypniewska, 2007).

Diseases related to obesity include type 2 diabetes, gallbladder diseases, dyslipidemia, insulin resistance, sleep apnea, coronary artery disease, hypertension, osteoarthritis of the knees, hyperuricemia and gout, cancer (breast cancer in postmenopausal women, endometrial cancer, colon cancer), sex hormones abnormalities, fertility disorders, lower back pain, increased risk of complications under anesthesia (WHO, 2010). Apart from the projection on the somatic sphere, more and more often the significant influence on the behavioral and psychological sphere is emphasized (Jackson, Steptoe, 2017).

Most of the inhabitants of Poland are covered by the services of Primary Health Care (POZ) doctors (Windak, Nizankowski, Lukas, Tomasik, Panasiuk, Florek-Łuszczki, Paprzycki, Jankowska-Zduńczyk, Jakubiak, Łuczak, Lutomski, Golema, Kijowska, Barańska, Chmura, 2019). High availability of medical services in the conditions of a family doctor's clinic makes these entities a universal place for prophylaxis (GUS, 2018; GUS, 2019). The Cardiovascular Diseases Prevention Program implemented by Primary Healthcare Clinics makes it possible to identify patients at risk of cardiovascular diseases. By 1st July 2022 inclusion program inclusion criteria were age 35, 40, 45, 50 and 55 in a given year, no participation in CHUK program in the last 5 years and no cardiovascular disease diagnosis in the past (Minister Zdrowia, 2019). Prophylactic visit is an opportunity to educate and modify the patient's anti-health behavior.

1. Material and methods

A retrospective analysis of the data obtained by the National Health Fund as part of the Cardiovascular Diseases Prevention Program (CHUK) in the Lublin Province in 2008-2018 was carried out. The study population consisted of patients who met the criteria and were included in the Cardiovascular Disease Prevention Program. The sociodemographic variables (age, sex, place of residence, occupation, education), anthropometric variables (height, weight, BMI, arm circumference, waist circumference), family history (occurrence of a father's heart attack and stroke before the age of 55, for mother age of 60) were assessed. The form helped to obtain data on current and past smoking physical activity over 30 minutes a day during the week, blood pressure, heart rate, laboratory test results (total cholesterol, LDL and HDL cholesterol, triglycerides, fasting glucose). The analyzes were performed using IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA). The compliance with the normal distribution of a given feature was assessed using the Shapiro-Wilk test. The distribution of qualitative variables was described by giving absolute and relative frequencies.

The chi-square test was used to test the relationship between the two qualitative features, and the Pearson linear correlation between the quantitative features. Significant predictors of cardiovascular disease risk factor were determined using multivariate logistic regression. The results of the analysis are presented as the odds ratio (OR) together with the 95% confidence interval (95% CI). The significance level was assumed to be $\alpha = 0.05$ for two-tailed tests.

2. Aim of the study

The aim of the study was to assess the occurrence of excessive body weight in the studied population as a risk factor for cardiovascular diseases.

3. Results

Data on 86,485 preventive visits were analyzed. The study population was dominated by women (61.3%), and men constituted 38.7% of the population. The highest reporting rate was observed in the 35 and 40-year-old age group—they constituted 48.6% of all respondents. 45-year-olds accounted for 19.8% of cases, 50-year-olds—17.8%, and 55-year-olds—14.3%. People with secondary education prevailed (36.7%), while nearly every fourth respondent had higher education. Manual workers accounted for 31.4% of the respondents, white-collar workers—27.5%, farmers—19.7%, and 4.5% of the respondents on retirement / disability pension.

The mean value of the BMI index for the study population was 26.12 kg / m² (\pm 4.43). The minimum value was 13.3 kg / m² and the highest recorded result was 71.5 kg / m². Excess body weight was diagnosed in over half of the respondents—56.1%. Obesity of the 1st degree was diagnosed in 14.3% of patients, 2nd degree—2.9%, 3rd degree—0.7%.

Excess body weight was significantly more often observed among men than women (69.7% vs 47.5%; $p < 0.001$). Both overweight and obesity were more

frequently reported among men. However, grade III obesity was more common in women (M: 0.5% vs F: 0.8%; $p < 0.001$).

With the increase in the number of years in the study population, the prevalence of overweight and obesity was significantly higher. The exception was grade III obesity, with occurrence comparable in all age categories (Table 1).

Higher levels of education were associated with lower spread of overweight and obesity. A significant difference was observed in the case of 3rd degree obesity, which affects more than two times more people with primary education than people with higher education (Table 2).

The highest prevalence of overweight was recorded in the group of blue-collar workers. Obesity was most often observed among farmers (Table 3).

One unit increase in BMI was associated with a 13.2% increase in the risk of hypertension (95% CI: 1.127-1.137, $p < 0.001$), and a risk of blood glucose ≥ 126 mg/dl by 12.2% (95% CI: 1.110 -1.135, $p < 0.001$). There was an effect of BMI on the lipid profile—an increase in BMI value by one unit increased the risk of hypercholesterolaemia (T-Chol concentration ≥ 190 mg / dl) by 4.2% (95% CI: 1.038-1.046, $p < 0.001$) and LDL 115 mg/dl concentration by 5.5% (95% CI: 1.052-1.059, $p < 0.001$).

4. Discussion

Data on the obesity epidemic are highly disquieting. In the European region, the prevalence of obesity is estimated at around 23%¹, and the 2017 Global Burden of Disease Study classifies excess body weight as the third most common cause of loss of life years (YLL) (Foreman, Marquez, Dolgert, Fukutaki, Fullman, McGaughey, Pletcher, Smith, Tang, Yuan, Brown, Friedman, He, Heuton, Holmberg, Patel, Reidy, Carter, Cercy, Chapin, Murray, 2018).

In representative epidemiological studies conducted in Poland, a lower prevalence of overweight in men was found in relation to the results obtained

1 Obesity Rates Across Europe – World Atlas, 2019, <https://www.worldatlas.com/articles/the-fattest-countries-in-europe.html#:~:text=The average obesity rate,in Europe is 23.3%25>. (access: 20.05.2020).

Table 1. BMI categories by age

Age [years]	35		40		45		50		55	
	n	%	n	%	n	%	n	%	n	%
underweight	532	2,4%	273	1,4%	155	0,9%	117	0,8%	97	0,8%
normal	11 148	50,1%	8 885	45,0%	6 881	40,3%	5 616	37,3%	4 254	34,4%
overweight	7 358	33,1%	7 226	36,6%	6 802	39,8%	6 288	41,8%	5 371	43,4%
obesity I	2 509	11,3%	2 698	13,7%	2 594	15,2%	2 423	16,1%	2 104	17,0%
obesity II	542	2,4%	551	2,8%	520	3,0%	480	3,2%	443	3,6%
obesity III	145	0,7%	123	0,6%	131	0,8%	118	0,8%	101	0,8%

p<0,001

Table 2. BMI categories by education

Education	primary		vocational		secondary		higher	
	n	%	n	%	n	%	n	%
underweight	113	1,8%	262	1,0%	380	1,2%	389	1,8%
normal	2 478	38,9%	9 464	37,7%	12 886	41,5%	11 155	50,9%
overweight	2 359	37,0%	10 126	40,3%	12 195	39,3%	7 509	34,2%
obesity I	1 063	16,7%	4 181	16,6%	4 461	14,4%	2 323	10,6%
obesity II	290	4,6%	878	3,5%	891	2,9%	440	2,0%
obesity III	70	1,1%	219	0,9%	201	0,6%	117	0,5%

p<0,001

Table 3. BMI categories by occupation

Occupation	blue-collar worker		white-collar worker		farmer		retired/pensioner		other	
	n	%	n	%	n	%	n	%	n	%
underweight	257	1,0%	370	1,6%	158	1,0%	72	1,8%	272	2,0%
normal	10 244	39,1%	11 398	49,6%	6 115	37,1%	1 426	35,9%	6 330	45,5%
overweight	10 806	41,2%	8 045	35,0%	6 594	40,0%	1 586	40,0%	4 888	35,1%
obesity I	3 974	15,2%	2 544	11,1%	2 843	17,2%	666	16,8%	1 916	13,8%
obesity II	779	3,0%	480	2,1%	614	3,7%	174	4,4%	418	3,0%
obesity III	166	0,6%	129	0,6%	158	1,0%	45	1,1%	101	0,7%

p<0,001

by me (WOBASZ–40.4%; WOBASZ II–43.1%; LIPIDOGRAM2015–45%), while among women higher (respectively: 27.9%; 29.5%; 36%) (Stepaniak, Micek, Waškiewicz, Bielecki, Drygas, Janion, Kozakiewicz, Niklas, Puch-Walczak, Pająk, 2016; Kolegium Lekarzy Rodzinnych w Polsce, Polskie Towarzystwo Medycyny Rodzinnej, Polskie Towarzystwo Badań

Nad Otyłością, 2017). Obesity in men was much more frequent than in the population I studied (23.6-38.5%), and among women the prevalence ranged from 19.7-33% [Stepaniak et al., 2016; Kolegium Lekarzy Rodzinnych w Polsce et al., 2017; Zdrojewski, Rutkowski, Bandosz, Gaciong, Solnica, Drygas, Wojtyniak, Stokwiszewski, Pencina, Wołkiewicz,

Piwonski, Jędrzejczyk, Grodzicki, Wyrzykowski, 2015). Summing up overweight and obese patients gives a higher incidence of excess body weight in the above-mentioned studies compared to my results. In the European Health Surveys (EHIS) in 2014, Polish women had a higher prevalence of excessive body mass (overweight–30%, obesity–16%) and similar for men (44% and 18% respectively) than in the authors' own material (GUS, 2015).

In other studies on the Polish population, a lower prevalence of obesity was reported. A study by Gallus et al. determined the spread of obesity at 12.3% among men and 8.3% among women (Gallus, Lugo, Murisic, Bosetti, Boffetta, La Vecchia, 2015). According to the latest OECD report, the percentage of obese individuals was estimated at 16.7% (OECD, 2017). However, both reports were based on the values of body weight and height declared by the respondents, which may be associated with underestimating body weight and overestimating height.

The authors of the WOBASZ study described the occurrence of excessive body weight and abdominal obesity with a division into provinces. In Lublin region, the percentage of overweight patients was comparable to the own results (M: 46.0%, F: 26.7%), while obesity was a more common phenomenon and more frequently observed among women (26.2%) than men (22, 9%) (Stepaniak et al., 2016).

The WOBASZ II study showed that obesity was present in 27.0% of men and 17% of women aged 35–44.9 years, and overweight in 44.7% and 26.7%, respectively. In the age group 45–54.9 years, obesity was observed in 29.5% of men and 26.2% of women, while overweight in 45.1% and 35.2% of them (Stepaniak et al., 2016). This confirms my observation that the percentage of people with excess body weight increases with age.

Grade III obesity is associated with a significantly higher rate of total mortality compared to normal weight subjects. The main causes of death are cardiovascular diseases, malignant neoplasms and diabetes (Kitahara, Flint, Berrington de Gonzalez, Bernstein, Brotzman, MacInnis, Moore, Robien, Rosenberg, Singh, Weiderpass, Adami, Anton-Culver, Ballard-Barbash, Buring,

Freedman, Fraser, Beane Freeman, Gapstur, Gaziano, Hartge, 2014). Considerable accumulation of adipose tissue, expressed as BMI ≥ 40 kg / m² is also associated with the presence of advanced osteoarthritis requiring arthroplasty (Wendelboe, Hegmann, Biggs, Cox, Portmann, Gildea, Gren, Lyon, 2003), making it difficult to undertake physical activity and change lifestyle. Grade III obesity was not widespread in the analyzed population and its higher percentage was found among women (M: 0.5%, F: 0.8%). The authors of the WOBASZ and WOBASZ II studies reported the occurrence of this disorder almost twice as often, with the same trend in the distribution among sexes–M: 0.8% and 1.3%, respectively, and F: 1.9% and 1.8% (Stepaniak et al., 2016).

Such a large percentage of patients with excess body weight, which was described in the above study, has another practical implication. Many of these individuals may suffer from obesity-related psychological problems – among them weight stigmatization (Pearl, Walton, Allison, Tronieri, Wadden, 2018). Patients facing social devaluation experience apart from lowered self-esteem, decreased motivation to maintain diet and their everyday dietary habits are substandard (Seacat, Dougal, Roy, 2016). A parallel mechanism associated to weight stigmatisation leads to low physical activity. According to English Longitudinal Study of Aging, social mistreatment, independently of BMI value, was connected with 59% higher odds of lack of any exercises and 30% lower odds of developing moderate or vigorous activity (Jackson, et al., 2017). Excessive body weight generates body dissatisfaction (Weinberger, Kersting, Riedel-Heller, Luck-Sikorski, 2016), and social devaluation results in elevated stress (Simone, Lockhart, 2016), being a risk factor of cardiovascular complications as well. Noteworthy, this may reduce self-regulation properties of individuals (Hunger, Major, Blodorn, Miller, 2015) which has been described as a prognostic of calorie-rich diet (Araiza, Wellman, 2017). Depicted phenomenon makes a positive feedback loop, when obesity itself produces well-known psychological and physiological drivers of obesity. Very high incidence of excessive body weight in study group along with highlighted psychological problems is still relevant

in the context of COVID-19 pandemics and limitations in social live activities. A large meta-analysis provided evidence that even 65% of patients suffering from eating disorders met exacerbation of symptoms during lockdown. Moreover, one half of individuals with excessive body weight reported increased snacking and diminished physical activity. (Sideli, Lo Coco, Bonfanti, Borsarini, Fortunato, Sechi, Micali, 2021). It has long been known that general distress do not affect all individuals to same level and obese patients are more vulnerable population in context of anxiety and depression (Pierce et al., 2020) leading to additional weight gain and increased cardiovascular risk.

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Conclusions

The data on the prevalence of obesity in the population are extremely disturbing. Obesity undeniably contributes to the development of many somatic diseases, but also affects the mental sphere of people, contributing to poor health of the population. Continuous analysis of the prevalence of excess body weight helps to identify factors contributing to the development of obesity and allows the implementation of preventive programs and promoting pro-health behavior at an early stage. The Cardiovascular Diseases Prevention Program program at Primary Healthcare Clinics is an excellent moment for this

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