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The impact of obesity on cardiovascular disease mortality in the District Sumperk, Czech Republic

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Summary

Objective: The impact of obesity on cardiovascular mortality in the District Sumperk (C2) is assessed.
Methods: A case-control design was selected to study the impact of obesity on cardiovascular mortality among the population of the District Sumperk, Czech Republic. Exposure to obesity was defined as body-mass index (BMI) higher or equal 30. Men and women with BMI lower than 30 were considered nonexposed. Odds ratios were calculated, comparing the probability of exposure among cases and controls. Cases were defined as persons from the studied population who died between 1987–2004, the cause of death being circulatory system diseases. Controls were persons from the studied population who had not died as to December 31, 2004.
Results: Cases were more likely to be obese than controls (OR = 1.68; 95 % CI 1.56–1.80). In men OR was 1.56 (95 % CI 1.40–1.74), in women OR was 1.89 (95 % CI 1.72–2.06). The impact of obesity was decreasing with increasing age.
Conclusions: An increased risk of cardiovascular mortality following exposure to obesity was observed. Younger age groups seem to be the important target population for preventive programmes focusing on treatment of obesity.

Keywords: Obesity – Cardiovascular mortality – Epidemiology.

Cardiovascular diseases represent the leading cause of mortality in developed countries and together with ageing of the population, the number of persons suffering from chronic circulatory diseases is increasing (Reitsma et al. 1999). In the Czech Republic, cardiovascular mortality is roughly three times higher than respective mortality in Western European countries (UZIS CR 2000).
Pathogenesis of cardiovascular diseases is a complex process; a number of genetic, biochemical, behavioural, and socio-economic factors are known to increase the risk of cardiovascular diseases. Obesity is considered one of the most important preventable risk factors, being the most frequently prevalent metabolic disorder in developed countries (Rosolova 2001). However, the magnitude of the impact of obesity on cardiovascular disease occurrence is subject to discussion, as well as the role of age in modifying the risk.
In this study, therefore, assessing the impact of obesity on cardiovascular mortality in a population of one district of the Czech Republic was aimed at.

Methods

The studied population was geographically predefined as the population inhabiting the District Sumperk, Czech Republic. This selection was based on the fact that the majority of the population (98 % of persons aged 30–64 years) had undergone the so-called preventive oncologic check-ups between 1975 and 1986. The aims and methods of the preventive check-ups were described earlier (Machova et al. 2002).
Although originally aimed at early detection of cancer, preventive oncologic check-ups resulted in creating a large database containing information on numerous biochemical and physiological parameters. Data from the database were used in this study to assess the impact of obesity on cardiovascular mortality.
In the course of preventive check-ups in the District Sumperk, men and women aged 30–64 years were examined. The number of examined men and women whose age was 30–64 years

in 1975 was 48 510, that is 98 % of all residents of the District Sumperk in age category. Due to this inconsistency in the methods of the check-ups there were 872 persons (2 % of the database) younger than 30 or older than 64 years. The total number of examined persons was thus 22 836 men and 26 546 women. Mean age of men from the examined population was 45.6 years, standard deviation (sd) 9.8; mean age of women was 44.8 years, sd 10.1.

Parameters measured in the course of the check-ups and relevant for this study included blood pressure, body height, body weight, and levels of cholesterolemia and glycemia. In addition, information concerning smoking was included in analysis.

A case-control design was selected to study the impact of obesity on cardiovascular mortality. Definition of cases was based on the fact that the studied outcome was cardiovascular mortality. Cases were thus defined as persons from the database who died between 1987 (the end of the preventive check-ups) and 2004, the cause of death being circulatory system diseases (diagnoses I00–I99 according to the 10th revision of International classification of diseases). Information on mortality status of the subjects from the studied population was obtained by merging the database from the preventive oncologic check-ups with mortality data collected by the Czech statistical office. Controls were persons from the database who had not died as to December 31, 2004. As information on mortality is collected routinely and compulsorily the probability of misclassification of cases and controls can be practically excluded.

Using the STATISTICA programme, odds ratios were calculated, comparing the probability of exposure among cases and controls.

Exposure to obesity was defined as body-mass index (BMI) higher or equal 30. Body-mass index is obtained when dividing body weight in kg by body height in m^2. Men and women with BMI lower than 30 were considered nonexposed. Logistic regression was performed to adjust for hypertension, hypercholesterolemia, and smoking. Definitions of factors adjusted for are presented in Tab. 1.

Controls were not matched with cases by sex and age; instead, the effect of confounding was prevented by calculating odds ratios separately for each gender and age category and by using logistic regression. The following age categories were used: 30–39, 40–49, 50–59, and 60–69 years.

Table 1 The definitions of risk factors

Risk factor	Definition
obesity	BMI ≥30
hypertension	systolic blood pressure >140 and/or diastolic blood pressure >90 mm
hypercholesterolemia	cholesterolemia ≥5.2 mmol/l
smoking	1 or more cigarettes per day

Results

From the studied population, 6 963 men and 5 850 women had died by the end of the year 2004. Cardiovascular disease was the cause of death in 2 806 men (40 % of deceased men) and 2 935 women (50 % of deceased women).

There were 5 733 cases in the studied population, i. e. persons who had died from cardiovascular disease by the end of 2004. Mean age of cases was 50.9, sd 8.5 for men and 53.9, sd 7.7 for women. As controls, 36 359 men and women who had not died by the end of 2004 were chosen. Mean age of controls was 43.7, sd 9.7 for men and 42.6, sd 9.5 for women. In Tab. 2a, 2b the age structure, mean values of BMI, blood pressure, cholesterolemia, and glycemia, and proportions of smokers in cases and controls are summarised.

As a first step, probability of exposure to obesity was assessed for both genders and all age groups together. Cases were more likely to be obese than controls (OR = 1.68; 95 % CI 1.56–1.80). When men and women were considered separately, obesity was also associated with cardiovascular mortality, with OR = 1.56 (95 % CI 1.40–1.74) in men and OR = 1.89 (95 % CI 1.72–2.06) in women.

When logistic regression was used to control for hypertension, hypercholesterolemia, glycemia, and smoking, an increased risk of cardiovascular mortality following exposure to obesity was found in younger age groups. The impact was decreasing with increasing age (Tab. 3).

Discussion

In our study, an increased risk of cardiovascular mortality was observed in the obese. A retrospective case-control design was used, however, the only available information on BMI came from the commencement of the preventive check-ups. Therefore, a possibility of misclassification of exposure cannot be completely excluded. That could lead to both over- and underestimation of the true association, depending on magnitude of changes of proportions of the obese among cases and controls. Nevertheless, our findings are supported by the results of several prospective studies.

In a prospective study from China (Yuan et al. 1998), a twofold risk of cardiovascular mortality was found in the overweight (body-mass index over or equal 26). Three times

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Table 2a Mean values and standard deviations of risk factors in cases and controls – men*

age category	**30–39**		**40–49**		**50–59**		**60–69**	
	cases	**controls**	**cases**	**controls**	**cases**	**controls**	**cases**	**controls**
No.	299	6029	834	5173	1199	3449	470	1151
%	10.7	38.2	29.8	32.7	42.8	21.8	16.8	7.3
age	35.1±2.9	34.1±2.9	45.1±2.9	44.1±3.0	54.3±2.7	53.9±2.7	62.7±1.6	62.8±1.8
BMI	27.6±3.8	26.4±3.2	27.3±3.9	26.9±3.3	27.3±3.7	27.0±3.5	27.0±3.4	26.7±3.9
systolic pressure	133.4±16.4	126.9±14.6	137.2±17.3	132.8±17.2	143.4±20.0	141.2±19.3	147.5±19.0	149.5±20.3
diastolic pressure	85.5±10.8	81.0±9.5	85.3±10.8	83.4±10.7	86.6±10.6	85.9±10.8	87.3±10.0	87.5±10.9
cholesterolemia	6.3±1,2	5.9±1.2	5.9±1.3	5.7±1.2	5.8±1.2	5.7±1.1	5.6±1.0	5.8±1.1
glycemia	5.1±1,8	4.9±0.9	5.1±1,9	4.8±1.3	5.1±1.4	5.1±1.9	5.0±13	5.3±2.1
% of smokers	71.6	63.4	68.7	56.4	56.0	55.9	44.3	54.6

Table 2b Mean values and standard deviations of risk factors in cases and controls – women*

age category	**30–39**		**40–49**		**50–59**		**60–69**	
	cases	**controls**	**cases**	**controls**	**cases**	**controls**	**cases**	**Controls**
No.	175	8908	525	6192	1466	4457	765	1000
%	6.0	43.3	17.9	30.1	50.0	21.7	26.1	4.9
age	35.3±2.8	33.8±2.9	45.8±2.7	44.5±2.8	54.6±2.6	53.7±2.6	62.6±1.6	62.5±1.7
BMI	27.4±4.7	26.0±4.2	29.1±5.0	28.0±4.4	29.4±5.2	28.5±4.4	28.2±4.6	27.9±4.6
systolic pressure	128.6±16.0	125.7±15.4	143.3±20.2	136.5±18.3	151.5±20.4	146.2±19.9	154.1±18.9	156.2±20.2
diastolic pressure	82.4±10.3	79.3±9.4	87.5±11.6	84.0±10.7	89.6±10.7	87.3±10.7	89.3±10.3	89.5±10.5
cholesterolemia	5.7±1.3	5.5±1.0	5.9±1.2	5.7±1.1	6.2±1.3	6.1±1.2	6.2±1.1	6.2±1.2
glycemia	4.7±1.6	4.7±1.0	5.2±2.1	4.7±1.2	5.3±1.9	5.1±1.8	5.2±1.8	5.4±2.2
% of smokers	26.9	23.5	21.1	11.2	7.9	8.4	3.9	5.5

higher coronary heart disease mortality in obese men and women was described in a large prospective study, following almost 50000 men and women (Seidell et al. 1996). Among middle-aged industrial population, relative risk of cardiovascular mortality in the obese was 2.22 when compared to those with BMI 18.5–24.9 (Tsai et al. 2006).

On the other hand, no association was found between BMI and the risk of mortality in a Finish study (Haapanen-Niemi et al. 2000). Little impact of obesity on cardiovascular mortality was observed in another study dealing with this association (Selmer & Tverdal 1995); when age was adjusted for, however, higher mortality was found in the obese belonging to younger age groups. Such a finding is in agreement with our observations, according to which obesity in younger age groups leads to the highest increase in risk of cardiovascular mortality.

Table 3 The impact of obesity on cardiovascular mortality in age groups*

		Age group			
		30–39	**40–49**	**50–59**	**60–69**
Men	**No. of cases**	299	834	1199	470
	No. of controls	6029	5173	3449	1151
	OR	1.91	1.44	1.24	0.94
	95 % CI	1.39–2.63	1.17–1.76	1.03–1.49	0.68–1.30
Women	**No. of cases**	175	525	1466	765
	No. of controls	8908	6192	4457	1000
	OR	2.25	1.32	1.28	1.12
	95 % CI	1.54–3.23	1.07–1.64	1.11–1.47	0.88–1.42

adjusted for hypercholesterolemia, hypertension, hyperglycemia, and smoking

The reason why the impact of obesity as a risk factor is decreasing with increasing age requires further research. According to the FINE study (Menotti et al. 1996) possible explanations include preselection of elderly people due to preceding mortality, modifying role of other diseases, and changes in homeostatic mechanisms in the elderly.

A so-called 'obesity paradox' was described by some authors (Lavie et al. 2005; Gustafsson et al. 2005), characterized as better survival of obese patients with heart failure. This problem could not be addressed by our study because mortality, not survival data were available.

To summarise the findings of our study, it can be concluded that an increased risk of cardiovascular mortality following exposure to obesity was observed. Further research is necessary to clarify the role of age in modifying the impact of obesity. Younger age groups seem to be the important target population for preventive programmes focusing on avoiding and treatment of obesity.

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