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A cross-sectional study of cardiovascular disease and associated factors

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Abstract

Objective: Cardiovascular diseases (CVD) are a major cause of mortality and morbidity in Poland. Data on risk factors of CVD in this country are limited. The presented study investigated risk factors of self-reported CVD within the Polish-Norwegian Study (PONS).

Methods: PONS is an ongoing prospective study in Poland. The data used was provided by 3,853 participants, aged 45-64, during baseline interviews.

Results: Prevalence of chronic diseases among participants was as follows: hypertension, 38.4%; diabetes, 5.9%; and CVD, 11.0%. There was no association between CVD and gender and place of residence. CVD was associated with ever-smoking (OR= 1.25; 95% CI: 1.00-1.55), whereas there was an inverse association with alcohol drinking in the year preceding enrolment in the study (OR= 0.50; 95% CI: 0.39-0.63). CVD was associated with body mass index (BMI), as well as with measures of abdominal adiposity, in the following order: waist to height ratio>waist circumference>waist to hip ratio; however, none of these measures showed a stronger association with CVD than BMI. Both hypertension (OR= 1.33; 95% CI: 1.05-1.68) and diabetes (OR= 1.33; 95% CI: 1.05-1.68) were associated with CVD in adjusted models.

Conclusions: This study shows the association between several risk factors and prevalence of self-reported CVD and provides information about distribution of those factors among an adult population in Poland. The results of the ongoing PONS study in a prospective setting will provide more accurate risk estimates for the observed associations, as well as risk estimates for other risk factors of CVD, including dietary factors, and attributable risks for various factors.

Key words

Cardiovascular disease; ischemic heart disease; Poland; PONS Study; stroke

INTRODUCTION

Chronic diseases are now major causes of morbidity and mortality throughout the world [1-4] and a considerable part of the morbidity and mortality results from cardiovascular diseases (CVD) [1,2]. Success in control of many severe communicable diseases, increased life expectancy and aging in many populations, and transitions in lifestyle toward high-risk behaviours, including low physical activity, high-fat diet, overweight, and smoking [5-7], which are risk factors of CVD [8], are among the major factors contributing to the global burden of CVD.

Poland in Eastern Europe has experienced rapid socioeconomic transitions during the past few decades. Consequently, major changes in the distribution of major causes of morbidity and mortality during that period, and for chronic diseases during the following years, were and are expected. CVD is one of the major burdens in Poland [9]. Age-standardized mortality rates due to ischemic heart disease and cerebrovascular disease, 2 major components of CVD, increased in the 1970s until the late 1990s, when the rates started to decrease [9]. On the other hand, the number of hospitalizations for these 2 groups of diseases in Poland is still increasing. The number of hospital discharges for ischemic heart disease and cerebrovascular disease in 2008 was 2.5-times more than in 1980 [10]. As the population of Poland had changed little since 1980 (35.6 million) to 2008 (38.5 million) [11], only a small part of the increase in the hospitalization rate may be attributable to population growth. A more likely reason is an increasing incidence rate of ischemic heart disease and cerebrovascular disease in Poland, probably due to aging of population and increased exposure to risk factors. This suggests that the recent decrease in standardized mortality rates may be mainly due to other factors rather than decreasing incidence rates.

In the current population pyramid in Poland, the majority of the population are in the 20-60 age group, with a peak at

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the 20-35 group; the number of individuals in these groups greatly exceeds the number of people in the older groups [12]. With aging of this population, therefore, it can be expected that the number of CVD cases will increase in Poland. However, very limited data from recent studies [9,13] on risk factors of CVD and their distribution in the population are available. Therefore, the present study aimed to investigate the risk factors of CVD within the Polish-Norwegian Study (PONS), an ongoing prospective study in Poland, using the data collected during baseline interviews.

METHODS AND MATERIALS

The design of this study has been described in detail in another article in this issue of Annals of Agriculture and Environmental Medicine. Briefly, the PONS study is an ongoing study in the Świętokrzyski Province in south-east Poland. Of the participants enrolled to date, data were available from 3,862 participants aged 45-64. Data on a wide range of socio-demographic and life-style factors, including smoking and alcohol use, were collected in face-to-face interviews using structured questionnaires. Ever-tobacco use was defined as smoking daily for at least 6 months. Data on alcohol drinking during the year preceding enrollment were collected and used in analyses. Self-reported data on past medical history, including history of hypertension, diabetes, coronary heart disease (ischemic heart disease, angina, myocardial infarction), and cerebral stroke, were also collected. Anthropometric indices, including weight, height, and waist and hip circumferences were measured. Informed written consent was obtained from all participants. The study was approved by the Ethics Committee at the Cancer Centre and Institute of Oncology in Warsaw, Poland.

Statistical analysis. After exclusion of 9 participants who lacked certain information, data from 3,853 individuals were included in the analyses: numbers and percentages were calculated and presented for variables; waist circumference and waist to hip and waist to height ratios were categorized as quartiles; body mass index (BMI), as a measure of overall obesity, was calculated by dividing measured weight (kg) by the square of the measured height (m), and categorized as underweight (BMI<18.5 kg/m^2), normal (18.5≤BMI<25 kg/m^2), overweight (25≤BMI<30kg/m^2), obese (30≤BMI<35 kg/m^2), and severely obese (BMI≥ 35 kg/m^2); waist circumference (cm), waist to hip ratio, and waist to height ratio were used as measures of abdominal obesity.

Prevalence of CVD, was defined as having a self-reported history of coronary heart disease or stroke, or both. Unadjusted and adjusted odds ratios (ORs) and corresponding 95% confidence intervals (CIs) were calculated using logistic regression models. In adjusted models, we included gender, age (categorical), place of residence (urban vs. rural), smoking (ever vs. never), alcohol use (drinking vs. not drinking during the last year), BMI (categorical), and history of hypertension and diabetes (yes vs. no for both). For age groups and measures of abdominal obesity, p values for trend were obtained from adjusted regression models by assigning consecutive numbers to categories within each variable. All statistical analyses were 2-sided and performed using STATA software, version 11.1 (StataCorp., College Station, TX, USA).

RESULTS

Distributions of demographic, life-style, and medical factors and their associations with risk of self-reported CVD are shown in Table 1. More females (66.7%) then males were enrolled in this study. Approximately 65% of participants were 55 years old or older. More than half of participants (51.5%) had ever smoked tobacco products. 75% of participants were overweight or obese. Prevalence of hypertension and diabetes was 38.4% and 5.9%, respectively. The number of participants with CVD was 423 (11.0% of all participants).

There was no statistically significant association between risk of CVD and gender and place of residence. Age was strongly associated with CVD (p for trend < 0.001). Ever-smoking was also associated with CVD (OR= 1.25; 95% CI: 1.00-1.55). A significant correlation was seen among former-smokers (OR= 1.33; 95% CI: 1.05-1.68) but not among current smokers (OR= 1.06; 95% CI: 0.77-1.47). There was an inverse correlation between alcohol drinking in the year preceding enrolment in the study and CVD (OR=0.50; 95% CI: 0.39-0.63). High BMI was associated with CVD. The correlation was statistically significant for BMI ≥ 35 kg/m^2, even after adjustments for history of diabetes and other factors (OR= 1.58; 95% CI: 1.03-2.41). Both hypertension (OR= 1.33; 95% CI: 1.05-1.68) and diabetes (OR= 1.33; 95% CI: 1.05-1.68) were associated with the risk in adjusted models.

In analyses stratified by gender, waist circumference, waist to hip ratio, and waist to height ratio in both sexes were associated with CVD in unadjusted models. In models adjusted for diabetes and other factors, only the association for the highest quartile of waist to height ratio (OR= 2.13; 95% CI: 1.14-3.96) and waist circumference (OR= 1.87; 95% CI: 1.00-3.49) in females remained statistically significant. Overall, the point estimates in both sexes for quartiles of waist to height ratio were bigger than those for waist circumference, which in turn were larger than those for waist to hip ratio. BMI 30.0-34.9 kg/m^2 (OR= 1.93; 95% CI: 1.07-3.50) and ≥ 35 kg/m^2 (OR= 2.10; 95% CI: 1.03-4.28) was associated with CVD in females.

DISCUSSION

These results show that 'classic' risk factors for CVD, including age, smoking, obesity, hypertension, and diabetes, are associated with CVD in the PONS study. An inverse association was observed between alcohol drinking in the year preceding enrolment in the study and self-reported CVD. For measurements of central obesity, the associations with CVD in order of overall strength (for quartiles) were as follows: waist to height ratio>waist circumference>waist to hip ratio. None of these measures showed a stronger correlation with CVD than BMI.

Smoking is a well known risk factor for CVD [14], which was confirmed in our analyses. However, this association was observed only among former smokers. This suggests that many smokers with CVD may have stopped smoking following diagnosis of their disease. There was an inverse correlation between alcohol drinking during the year preceding the interview and risk of CVD. However, it is not clear if this is a causal association, or – as was suggested for smoking – the participants with CVD might have stopped drinking after their disease being diagnosed. Data on

Table 1. Distribution of demographic, life-style, and medical factors, and their associations with risk of cardiovascular disease in the PONS Study

Variables	No. (%) total	No. (%) with CVD	No. (%) without CVD	Unadjusted OR (95% CI)	Adjusted OR (95% CI)*
Gender					
Females	2,568 (66.7)	268 (63.4)	2,300 (67.1)	Reference	Reference
Males	1,285 (33.3)	155 (36.6)	1,130 (32.9)	1.18 (0.95-1.45)	1.17 (0.93-1.48)
Age group (years)					
45-49	500 (13.0)	13 (3.1)	487 (14.2)	Reference	Reference
50-54	874 (22.7)	48 (11.3)	826 (24.1)	2.18 (1.17-4.06)	1.80 (0.96-3.38)
55-59	1,146 (29.7)	126 (29.8)	1,020 (29.7)	4.63 (2.59-8.27)	3.46 (1.91-6.24)
60-66	1,333 (34.6)	236 (55.8)	1,097 (32.0)	8.06 (4.56-14.23)	5.32 (2.98-9.53)
P for trend				< 0.001	< 0.001
Place of residence					
Rural	1,176 (30.5)	129 (30.5)	1,047 (30.5)	Reference	Reference
Urban	2,677 (69.5)	294 (69.5)	2,383 (69.5)	1.00 (0.80-1.25)	0.85 (0.67-1.07)
Smoking					
Never	1,869 (48.5)	187 (44.2)	1,682 (49.0)	Reference	Reference
Ever	1,984 (51.5)	236 (55.8)	1,748 (51.0)	1.21 (0.99-1.49)	1.25 (1.00-1.55)
Former	1,333 (34.6)	176 (41.6)	1,157 (33.7)	1.37 (1.10-1.70)	1.33 (1.05-1.68)
Current	651 (16.9)	60 (14.2)	591 (17.2)	0.91 (0.67-1.24)	1.06 (0.77-1.47)
Alcohol use (last year)					
No use	696 (18.1)	127 (30.0)	569 (16.6)	Reference	Reference
Some use	3,154 (81.9)	296 (70.0)	2,858 (83.4)	0.46 (0.37-0.58)	0.50 (0.39-0.63)
Body mass index (kg/m^2)					
< 18.5	9 (0.2)	1 (0.2)	8 (0.2)	1.84 (0.23-15.0)	1.95 (0.23-16.50)
18.5-24.9	944 (24.5)	60 (14.2)	884 (25.8)	Reference	Reference
25.0-29.9	1,719 (44.6)	180 (42.7)	1,539 (44.9)	1.72 (1.27-2.33)	1.21 (0.88-1.67)
30.0-34.9	875 (22.7)	126 (29.9)	749 (21.8)	2.48 (1.80-3.42)	1.32 (0.93-1.87)
≥ 35	304 (7.9)	55 (13.0)	249 (7.3)	3.25 (2.20-4.82)	1.58 (1.03-2.41)
Hypertension Hx					
No	2,372 (61.6)	141 (33.3)	2,231 (65.0)	Reference	Reference
Yes	1,481 (38.4)	282 (66.7)	1,199 (35.0)	3.72 (3.00-4.61)	2.69 (2.13-3.38)
Diabetes Hx					
No	3,626 (94.1)	362 (85.6)	3,264 (95.2)	Reference	Reference
Yes	227 (5.9)	61 (14.4)	166 (4.8)	3.31 (2.42-4.53)	1.70 (1.21-2.39)
Total	3,853 (100)	423 (100)	3,430 (100)	-	-

CVD – cardiovascular disease
Hx – history
* – Adjusted for other variables in the Table

whole life drinking were not available; therefore, the role of earlier alcohol drinking could not be investigated. The above correlations should be examined in future studies within the PONS, using prospectively collected information.

Consistent with the previous literature [8,15,16], hypertension, diabetes, BMI, and measures of abdominal adiposity were associated with CVD in this study. Abdominal obesity is a marker of metabolic syndrome, and some studies have indicated that it may be a more important predictor for risk of CVD than general obesity, for which BMI is an indicator [17]. Some studies have also suggested that waist to height ratio may be a better predictor of CVD than the other measures of abdominal adiposity, including waist circumference [16,18]. In this study, the association between waist to height ratio was slightly stronger than that of the other measurements of abdominal obesity. However, none of these measurements showed a stronger correlation with CVD than BMI. Nevertheless, these correlations need to be examined in a prospective setting, with anthropometric indices and potential confounding factors, including tobacco use, being measured prior to development of the disease.

This study has several limitations. Alcohol drinking data reflected the exposures at the time of enrollment or a short period before it, and anthropometric indices were measured at enrollment. As the pattern of alcohol drinking in CVD patients may have changed after the disease being diagnosed, it is not clear whether or not the observed association is casual. For this reason, we did not examine the association between CVD and diet, for which data were also collected in the PONS. Similarly, some of the anthropometric indices, including weight and waist and hip circumferences, may have changed following diagnosis of CVD. For example, they may decrease because of diet and regular exercise following physicians' advice, or they may increase as a result of limitation of physical activity due to severe symptoms. However, the observed correlations for

Table 2. Association of anthropometric indices with risk of cardiovascular disease, stratified by gender

Variables	No. (%) with CVD	No. (%) without CVD	Unadjusted OR (95% CI)	Adjusted OR (95% CI)*
Females				
BMI (kg/m^2)				
< 18.5	1 (16.4)	6 (0.2)	2.59 (0.31-22.0)	NC
18.5-24.9	44 (0.4)	684 (29.7)	Reference	Reference
25.0-29.9	105 (39.2)	944 (41.1)	1.73 (1.20-2.49)	1.28 (0.74-2.24)
30.0-34.9	73 (27.2)	478 (20.8)	2.37 (1.60-3.51)	1.93 (1.07-3.50)
≥ 35	45 (16.8)	187 (8.1)	3.74 (2.40-5.84)	2.10 (1.03-4.28)
Waist circumference				
Q1: < 80 cm	35 (13.1)	567 (24.7)	Reference	Reference
Q2: 80-86 cm	52 (19.4)	568 (24.7)	1.48 (0.95-2.31)	0.98 (0.49-1.97)
Q3: 87-95 cm	75 (28.0)	616 (26.8)	1.97 (1.30-2.99)	1.40 (0.75-2.62)
Q4: ≥ 96 cm	106 (39.5)	546 (23.8)	3.15 (2.11-4.69)	1.87 (1.00-3.49)
P for trend			< 0.001	0.02
Waist/hip ratio				
Q1: < 0.80	44 (16.4)	559 (24.3)	Reference	Reference
Q2: 0.80-0.83	59 (22.0)	569 (24.8)	1.32 (0.88-1.98)	1.32 (0.70-2.50)
Q3: 0.84-0.88	81 (30.2)	642 (28.0)	1.60 (1.09-2.35)	1.45 (0.78-2.68)
Q4: ≥ 0.89	84 (31.3)	525 (22.9)	2.03 (1.38-2.98)	1.26 (0.67-2.39)
P for trend			< 0.001	0.53
Waist/height ratio				
Q1: < 0.50	33 (12.3)	609 (26.5)	Reference	Reference
Q2: 0.50-0.54	62 (23.1)	657 (28.6)	1.74 (1.13-2.69)	1.13 (0.58-2.18)
Q3: 0.55-0.59	61 (22.8)	485 (21.1)	2.32 (1.49-3.60)	1.50 (0.79-2.86)
Q4: ≥ 0.60	112 (41.8)	546 (23.8)	3.79 (2.52-5.68)	2.13 (1.14-3.96)
P for trend			< 0.001	0.006
Males				
BMI (kg/m^2)				
< 18.5	0 (0.0)	2 (0.2)	-	-
18.5-24.9	16 (10.4)	200 (17.7)	Reference	Reference
25.0-29.9	75 (48.7)	595 (52.6)	1.58 (0.90-2.77)	1.06 (0.51-2.22)
30.0-34.9	53 (34.4)	271 (24.0)	2.44 (1.36-4.40)	1.28 (0.59-2.80)
≥ 35	10 (6.5)	62 (5.5)	2.02 (0.87-4.67)	1.39 (0.48-4.03)
Waist circumference				
Q1: < 93 cm	26 (16.8)	292 (25.9)	Reference	Reference
Q2: 93-98 cm	33 (21.3)	256 (22.7)	1.45 (0.84-2.49)	0.96 (0.47-1.98)
Q3: 99-105 cm	46 (29.7)	306 (27.1)	1.69 (1.02-2.80)	0.90 (0.45-1.78)
Q4: ≥ 106 cm	50 (32.2)	274 (24.3)	2.05 (1.24-3.38)	1.20 (0.62-2.32)
P for trend			0.004	0.54
Waist/hip ratio				
Q1: < 0.92	33 (21.3)	295 (26.2)	Reference	Reference
Q2: 0.92-0.95	32 (20.7)	271 (24.1)	1.05 (0.63-1.76)	0.90 (0.45-1.80)
Q3: 0.96-1.00	41 (26.5)	308 (27.3)	1.19 (0.73-1.93)	0.86 (0.44-1.66)
Q4: > 1.00	49 (31.6)	253 (22.4)	1.73 (1.08-2.78)	1.05 (0.55-2.01)
P for trend			0.02	0.86
Waist/height ratio				
Q1: < 0.53	20 (12.9)	283 (25.1)	Reference	Reference
Q2: 0.53-0.56	37 (23.9)	277 (24.6)	1.89 (1.07-3.34)	0.80 (0.37-1.71)
Q3: 0.57-0.60	44 (28.4)	298 (26.4)	2.09 (1.20-3.60)	1.21 (0.60-2.43)
Q4: ≥ 0.61	54 (34.8)	270 (23.9)	2.83 (1.65-4.85)	1.11 (0.55-2.25)
P for trend			< 0.001	0.45

BMI - body mass index
CVD - cardiovascular disease
NC - logistic regression model did not converge
Q - quartile;
* - Adjusted for age group, place of residence, ever-smoking, alcohol use over last year, history of hypertension and diabetes

anthropometric indices were consistent with the previous literature, suggesting that the above-changes in the study population were not extensive. Furthermore, such a bias, if any, is likely to be towards the null, as it is more plausible that risk factors after disease diagnosis changed to a favorable direction. Another limitation was that the health outcomes were assessed by self-reports. However, this could have induced non-differential misclassification, which leads to estimates biased towards the null [19]. Therefore, emerging of false positive correlations as a result of this bias were unlikely. Finally, the cross-sectional nature of the study did not allow the establishment of any temporal relationships.

In conclusion, this study shows the association between several factors and risk of CVD and provides information concerning the distribution of those factors among an adult population in Poland. However, the results of the ongoing PONS study, in identifying incident cases of CVD and investigating risk factors using exposure information collected in a prospective setting, will provide more accurate risk estimates for the correlations observed. In addition, the correlation between several other factors and risk of CVD, including dietary and psychosocial factors, as well as the attributable risks for various factors, can be investigated in such a setting.

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