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ORIGINAL ARTICLE

# Metabolic syndrome in Poland – the PONS Study

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## Abstract

**Introduction:** In Central and Eastern European countries, cardiovascular disorders (CVD) in middle age are much more common than in Western Europe, and it is imperative to understand the causes underlying this excess disease burden. The metabolic syndrome comprises a constellation of metabolic abnormalities that increase the risk of cardiovascular disease.

**Methods:** Data were obtained by structured interview, and by measurements of anthropometric factors and blood analyses among 3,862 individuals. Metabolic syndrome was defined according the International Diabetes Federation Task Force on Epidemiology and Prevention, as the presence of at least 3 of 5 abnormalities: 1) abdominal obesity, 2) glucose intolerance, 3) high triglycerides, 4) low HDL cholesterol, 5) high blood pressure.

**Results:** Overall, 1,518 participants (39.5%) had metabolic syndrome. The prevalence among females was 34.3% (877 females) vs. 49.9% (641 males) among males, and increased with age in both genders. Abdominal obesity was the most common abnormality (2,897 participants, 75.1%), followed by high blood pressure (2,741 participants, 71%), glucose intolerance (1,437 participants, 37.3%), elevated triglycerides (817 participants, 21.2%) and low HDL (615 participants, 15.9%).

**Conclusion:** The prevalence of metabolic syndrome and metabolic abnormalities is high and represents strong risk factors for CVD morbidity and mortality. However, these factors are all potentially preventable by lifestyle modification and/or by pharmacological treatment. There is an urgent need for the health service to act, and to increase public awareness of metabolic syndrome.

## Keywords

cross sectional study, population study, metabolic syndrome, Poland

## INTRODUCTION

Compared to western European countries, there is a much higher rate of premature deaths in Poland and in other eastern European countries[1]. There is an urgent need for research that can provide a foundation for effective preventive measures to narrow the gap related to all issues concerning health and disease between eastern and western Europe. The Polish Norwegian Study (PONS) conducted in Poland represents an effort to this effect.

One typical characteristic is the rapid increase in the prevalence of metabolic disorders that often culminate in type 2 diabetes mellitus, and subsequent cardiovascular disease. Perhaps the most important mediating condition for type 2 diabetes is the metabolic syndrome [2-6]. This is a syndrome consisting of a number of separate factors that appear to act in concert: obesity, dyslipidemia, hypertension, and hyperglycemia; however, the contribution of each factor to the metabolic syndrome may vary substantially.[7] According to a recent meta-analysis, among people diagnosed with metabolic syndrome, the risk of death from cardiovascular disorders is 74% higher compared to people without the syndrome [8].

In this cross-sectional analysis of the first collected data from the PONS study in Poland, we assess the prevalence of the metabolic syndrome and its correlates.

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## MATERIALS AND METHODS

The PONS study is an open-ended prospective study with very broad research aims. The main purpose of the PONS project is to study the impact of lifestyle factors and biological risk factors on aspects of health, such as the incidence of chronic diseases and quality of life. The design and execution of the PONS study is described in more detail in another paper in this Supplement (Mańczuk et al.). This is a preliminary report of the first 3,862 participants.

Briefly, the participants were invited to participate in the study and respond to a systematic questionnaire, go through a number of clinical measurements (height, weight, hip and waist circumference, blood pressure), and to have a blood sample taken, followed by lipid measurements (total serum cholesterol, HDL cholesterol, serum triglycerides). The blood sampling was performed non-fasting, but the time since last meal was recorded.

The questionnaire information was collected as a systematic interview, and the responses were entered on an electronic form, and after completion of the interview, the data were sent directly to a data server for processing and further management.

Metabolic syndrome was defined according to the

recommendations of the International Diabetes Federation Task Force on Epidemiology and Prevention (joint interim statement in 2009).[7] According to the definition, 3 of the following 5 criteria should be met to qualify for metabolic syndrome: waist circumference ≥94 cm among males, and ≥80 cm among females; fasting glucose ≥5.5 mmol/L or known diabetes; serum triglycerides ≥1.7 mmol/L; HDL cholesterol ≤1.0 mmol/L among males, and ≤1.3 mmol/L among females; systolic blood ≥130 mmHg, and diastolic blood pressure <85 mmHg.

## STATISTICAL ANALYSIS

The prevalence of metabolic syndrome was estimated using the presence of 3 out of the 5 criteria to qualify as a case. Comparisons of continuous variables between those with and without metabolic syndrome were made by t-test, and chi-square test was used to compare categorical data.

The prevalence was stratified by 5-year age groups. In a separate analysis, the factors which were the most important contributors for meeting the criteria for metabolic syndrome were assessed. Analyses were conducted in SAS, version 9.2.

## RESULTS

The overall prevalence of metabolic syndrome in the PONS population was 39.5%: among 3,862 individuals, 1,518 had metabolic syndrome (Table 1). The prevalence was 34.3% (877 females) among females, and 49.9% (641 males) among males. There was a strong, graded inverse association between metabolic syndrome and education. The prevalence of metabolic syndrome decreased with higher-attained education.

In both genders, the prevalence increased with age (Figure 1). In the youngest age group (45-49 years), the prevalence was 27.0%, and in the oldest age group (60-64 years); the prevalence was 47.1%.

In a separate analysis (Figure 2), which factors contributed most to the metabolic syndrome were assessed. Among the factors, abdominal obesity contributed the most, followed by high blood pressure. The factors that contributed the least were serum triglycerides and HDL cholesterol. Thus, the most common abnormality was abdominal obesity as indicated by a wide waist circumference (2897 participants, 75.1%), followed by high systolic or diastolic blood pressure (2741 participants, 71%), glucose intolerance as indicated by high fasting glucose level (1437 participants, 37.3%), elevated serum triglyceride levels (817 participants, 21.2%) and low HDL cholesterol (615 participants, 15.9%).

## DISCUSSION

In this cross-sectional study of 3,862 middle-aged (45-64 years) males and females in Poland, the metabolic syndrome was present in nearly 40% of the total population; nearly 50% of the men had the metabolic syndrome.

The prevalence of metabolic syndrome in the present study is high in an international perspective, and especially high when comparing it to Western Europe [9-11]. In Western European cohorts with a similar age and using identical or similar definitions of metabolic syndrome, the prevalence

**Table 1.** General characteristics of participants with and without metabolic syndrome

| | Metabolic syndrome | | |
|---|---|---|---|
| | No | Yes | p value* |
| Number | 2,327 | 1,518 | |
| | Mean (SD) | Mean (SD) | |
| Age | 55.9 (5.4) | 57.5 (5.0) | <0.001 |
| Body-Mass Index (kg/m$^2$) | 26.7 (4.1) | 30.6 (4.4) | <0.001 |
| Waist circumference (cm) | 87(11) | 99 (11) | <0.001 |
| Hip circumference (cm) | 102 (9) | 107 (9) | <0.001 |
| Systolic Blood Pressure (mmHg) | 135 (20) | 150 (19.0) | <0.001 |
| Diastolic Blood Pressure (mmHg) | 79 (11) | 85 (11) | <0.001 |
| Total cholesterol (mg/dL) | 208 (37) | 210 (41) | 0.15 |
| HDL cholesterol (mg/dL) | 65 (14) | 52 (13) | <0.001 |
| LDL cholesterol (mg/dL) | 125 (34) | 127 (36) | 0.08 |
| Triglycerides (mg/dL) | 92 (34) | 154 (97) | <0.001 |
| Fasting glucose (mg/dL) | 92 (10) | 111 (30) | <0.001 |
| | Number (%) | Number (%) | |
| Gender: | | | |
| Female | 1,638 (65.7) | 877 (34.3) | |
| Male | 644 (50.1) | 641 (49.9) | <0.001 |
| Education: | | | |
| Basic/incomplete | 120 (53.1) | 106 (46.9) | |
| Vocational | 377 (55.2) | 306 (44.8) | |
| Secondary | 1,002 (58.8) | 701 (41.2) | |
| Higher incomplete | 89 (61.8) | 55 (38.2) | |
| Higher (Master's degree) | 739 (67.9) | 350 (32.1) | <0.001 |
| Diabetes: | | | |
| Yes | 29 (12.9) | 195 (87.1) | |
| No | 2,298 (63.5) | 1,322 (36.5) | <0.001 |
| Family history of CAD: | | | |
| Yes | 1,054 (61.4) | 663 (38.6) | |
| No | 1,273 (59.8) | 855 (40.2) | 0.324 |
| Current smoking: | | | |
| Yes | 374 (57.4) | 278 (42.6) | |
| No | 1,953 (61.2) | 1,240 (38.8) | 0.07 |

* t-test or Chi square test, respectively.

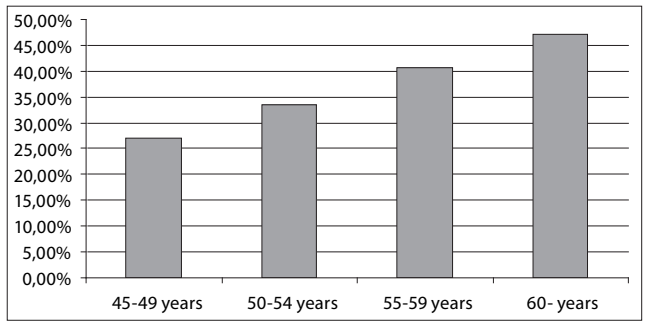


**Figure 1.** Prevalence of metabolic syndrome in different age groups

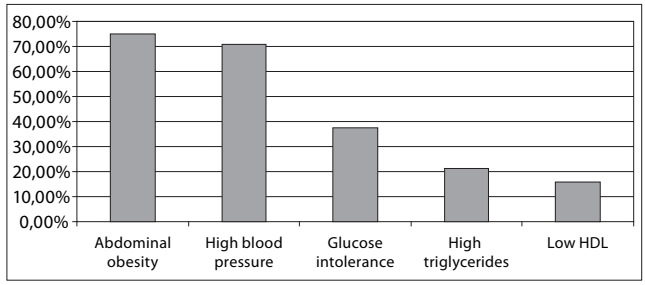


**Figure 2.** Prevalence of metabolic metabolic abnormalities.
Abdominal obesity = waist circumference ≥94 cm among men; ≥80 cm among women. Glucose intolerance = fasting glucose ≥5.5 mmol/L or known diabetes. High triglycerides serum triglycerides ≥1.7 mmol/L. Low HDL =HDL cholesterol ≤1.0 mmol/L among men; ≤1.3 mmol/L among women. High blood pressure (systolic blood pressure ≥130 mmHg, and/or diastolic blood pressure <85 mmHg)

generally varies between 15-40% [11]. However, the prevalence of metabolic syndrome in the present study is comparable with that found in an earlier Polish study conducted in Wroclaw [12].

Several strong correlations of metabolic syndrome were found. The occurrence of metabolic syndrome increased with age. This pattern was also generally observed in other studies, and is explained by the strong age-dependency of glucose intolerance and blood pressure [9-11].

A strong male predominance was found in the prevalence of metabolic syndrome that was more pronounced in the presented study than in most previous studies in other populations. This is in line with the fact that the mortality crisis of the transforming Central and Eastern European countries is mainly, or in a large part, due to premature male mortality [1,13]. While female middle-aged mortality reflects the economic and social developmental stage of these countries, the middle-aged male mortality rates are considerably higher than could be expected based on the economical development of Central and Eastern Europe [14,15]. The reasons for this gender difference is not clear, but these findings suggest that the high prevalence of metabolic syndrome can be an important mediating factor.

The prevalence of metabolic syndrome decreased with increasing years of education in a clear dose-dependent manner. This corresponds with the findings of a recent large international study [16], which showed that social inequalities in mortality are very high in Eastern European and the Baltic States, considerably higher than these inequalities in Western or Southern European countries.

All individual metabolic factors had a high prevalence in the PONS study. Abdominal obesity and high blood pressure were the most common among the metabolic abnormalities, both with a prevalence above 70%. This calls for urgent action on the public health level since all these metabolic abnormalities are potentially preventable by lifestyle modification [17] and/or by pharmacological treatment. The potential for prevention is not only theoretical, as demonstrated by the great success of the North Karelia Project in Finland [18].

## LIMITATIONS

This report is a preliminary cross-sectional analysis of the participants of an on-going cohort study in Poland. As observed from the results, more females than males have so far been recruited to the study, and a very large proportion of the males who have attended, had metabolic syndrome. It is not unreasonable to assume that a skewed distribution of the population has been recruited during the initial phase of the study; it is therefore possible that the estimated results for metabolic syndrome are biased compared to the situation in the underlying population from which the participants were recruited.

## CONCLUSION

In the present study, the prevalence of metabolic syndrome and metabolic abnormalities is high and represents strong risk factors for CVD morbidity and mortality. However, these factors are all potentially preventable by lifestyle modification and/or by pharmacological treatment. There is an urgent need for the health service to act, and to increase public awareness of metabolic syndrome.

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