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ORIGINAL ARTICLE

EPIDEMIOLOGY OF CORONARY ARTERY DISEASE IN PATIENTS FROM THE DISTRICT OF ŻYWIEC IN SOUTHERN POLAND

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ABSTRACT

Background. Cardiovascular diseases are currently the leading cause of premature mortality both in Poland and worldwide. Among the most severe conditions are acute cardiac events, which pose a direct threat to patients' lives and health. One of these is coronary artery disease, which predisposes individuals to myocardial infarction. Prevention relies primarily on maintaining a well-balanced diet, engaging in daily physical activity and in more severe cases, pharmacotherapy and invasive treatments.

Objective. The aim of this study was to analyze the prevalence of coronary artery disease among patients of the Cardiology Department in a hospital located in the district of Żywiec in southern Poland.

Materials and Methods. A survey study was conducted using a proprietary questionnaire consisting of three sections. The sections addressed patients' health status, their quality of life assessment. The study included 158 individuals aged 33-101, of whom only 150 met the selection criteria – being residents of the district of Żywiec. The obtained results were analyzed using correlation coefficients.

Results. Coronary artery disease was diagnosed in 41.8% (N = 66) of patients. The majority were men (N = 44). The highest proportion of the studied group were individuals aged 40 to 80 years (N = 128). A total of 40% (N = 59) of respondents were overweight, 34% (N = 50) were obese, and 26% (N = 38) had a normal body weight. The most common comorbidity was hypertension – affecting 67% (N = 101) of patients – most of whom had not experienced myocardial infarction (57%, N = 58).

Conclusions. Coronary artery disease was more prevalent among men. Arterial hypertension was the most common comorbid condition, confirming its strong association with coronary artery disease. Abnormal body weight is also a significant factor, increasing the risk of developing CHD.

Keywords: *coronary artery disease, cardiovascular diseases, diet, prevention, epidemiology, hypertension, diet-related diseases*

INTRODUCTION

Coronary artery disease (CAD) is a condition affecting the myocardium, characterized by the formation of atherosclerotic plaques within the coronary arteries [1]. Its pathophysiology is based on an inflammatory process in which lipid-laden macrophages, known as foam cells, infiltrate the vessel wall, damaging its endothelium [2]. This process activates cytokines and releases T cells. As inflammation progresses, the foam cell population increases, leading to the formation of a subendothelial plaque. A fibrous cap then develops, indicating the stabilization of the atherosclerotic plaque, followed by its calcification [3]. The progressive narrowing of the vessel lumen results in significant hemodynamic complications. Oxygen supply to cardiomyocytes becomes insufficient relative to the body's demand, leading to myocardial ischemia, which is why CAD is also referred to as ischemic heart disease (IHD) [4]. Some atherosclerotic plaques may detach from the vessel wall, releasing tissue factors and causing partial or complete occlusion of the artery's lumen [5]. Depending on the extent of the changes, CAD is categorized into stable ischemic heart disease (SIHD) and acute coronary syndrome (ACS). ACS, based on electrocardiogram findings, can be classified into non-ST elevation myocardial infarction (NSTEMI) or ST elevation myocardial infarction (STEMI). Unstable angina also falls under ACS [6]. Until the

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early 20th century, the pathogenesis of CAD remained unexplained. From the mid-20th century, the disease became the leading cause of death worldwide, peaking in the 1960s. Over time, there has been a significant decline in mortality due to heart disease, which continues to this day [7]. However, despite this progress, IHD remains a major global health concern [8]. In Poland, the first statistical analyses and epidemiological studies on CAD date back to the 1950s. These were initially local due to financial constraints. National studies assessing the prevalence of cardiovascular risk factors were conducted only in the 1990s [9]. In Poland, the increase in cardiovascular mortality continued until the early 1990s, however, the following years saw a sharp decline in cardiovascular mortality. Between 1999 and 2018, standardised death rates declined by an average of 2.8% per year among men and by 3.0% per year among women. A particularly pronounced decline in mortality from heart disease was observed in the 25-64 age range - after 2014 for women and one year later for men [10, 11]. These risk factors include hypertension, hypercholesterolemia, diabetes, obesity, physical inactivity, smoking, male gender, and family predisposition [12, 13]. The first large-scale epidemiological study conducted in Poland was the Pol-MONICA study (1983-1994), followed by another edition in 2001. Since then, Poland has actively participated in initiatives to improve public health and quality of life. Nationwide studies such as POLKARD, WOBASZ, and CINDI WHO emphasize the importance of patient education, lifestyle modifications, dietary changes, and increased physical activity to prevent cardiovascular diseases. According to data from the Institute for Health Metrics and Evaluation, in 2021, approximately 2 million people in Poland suffered from ischemic heart disease, accounting for 5.5% of the total population. The average annual incidence of coronary artery disease was between 250 and 300 new cases per 100,000 inhabitants. Men particularly those aged 40 to 55 are more likely to develop the condition. Among older individuals, however, the incidence rate is similar for both sexes. Notably, the likelihood of developing this disease increases significantly with age [14, 15]. Additionally, Ministry of Health programs, such as the National Health Plan, aim to develop early diagnosis methods for lipid disorders and improve cardiological care. These projects strive to eliminate healthcare disparities compared to other European Union countries [16]. This study aims to assess the prevalence of CAD and its risk factors among patients in Żywiec district population.

MATERIAL AND METHODS

The survey study was conducted between July and September 2024 in the Cardiology Department of the Żywiec County Hospital, following approval from the hospital director and the head of the department. The study tool was an anonymous proprietary questionnaire composed of the following sections:

1. Questions regarding patients' health status. This section included data on age, sex, body weight, height, blood pressure values, diagnosis of ischemic heart disease, hypertension, previous episodes of myocardial infarction, stroke, and past cardiac procedures. Additionally, participants were asked about the occurrence of cardiovascular diseases in their families.
2. Questions regarding patients' quality of life. The survey analyzed the presence and nature of chest pain, occurrences of dyspnea, fatigue (including its intensity), and dizziness. It also assessed whether the disease imposed limitations on work, household activities, or sports participation. Questions regarding social and interpersonal relationships were included, along with inquiries about complications following cardiac procedures, if applicable. This paper includes data on complications in patients following pacemaker implantation and vascular prosthesis placement and limitations in daily activities. Further data on this topic will be published in a separate paper.
3. Questions regarding the relationship between the disease and diet. Participants were asked whether they followed a specific diet and what type it was. Data on the use of diets will be published in another paper.

All participants in the study were informed in advance about its purpose and nature and gave their informed consent to participate. Consent was obtained orally during direct contact with patients staying in the cardiology ward. The data collected during the study were completely anonymous and did not contain any information that could identify the participants. Accordingly, no personal data were stored, and the participants' right to withdraw consent applied at the moment of their participation in the study and was clearly communicated to them.

Based on each patient's height and weight, the Body Mass Index (BMI) was calculated and interpreted according to the World Health Organization (WHO) classification [17] (Table 1). Additionally, each patient was assigned a classification within the New York Heart Association (NYHA) scale [18] (Table 2), considering their reported blood pressure values and symptoms. Blood pressure measurement was performed by qualified medical personnel using standard hospital equipment, in accordance with current clinical practice. Height and body weight were self-reported by the patients, which was noted in the methodology. Although these measurements were not

Table 1. Body Mass Index according to the World Health Organization classification [17]

BMI	Nutritional status
< 18.5	Underweight
18.5-24.9	Normal weight
25.0-29.9	Overweight
30.0-34.9	Obesity class I
35.0-39.9	Obesity class II
≥ 40	Obesity class III

Table 2. New York Heart Association functional classification [18]

Class	Description
I	No symptoms
II	Symptoms with ordinary activity
III	Symptoms with less than ordinary activity
IV	Symptoms at rest or with any minimal activity

calibrated as part of the study, the data obtained reflect typical procedures used in hospital ward conditions.

Characteristics of the study group

All study participants were patients of the Cardiology Department at the Żywiec County Hospital. The inclusion criterion was residency in the district of Żywiec. The questionnaire was administered during the patients' hospital stay. A total of 158 individuals participated in the study, including 98 men (62%) and 60 women (38%), aged 33-101 years (67.51 ± 12.12). The analysis included 150 patients, as 8 did not meet the inclusion criteria. The highest recorded BMI was 43.94, and 16 respondents (10.7%) were classified in class 4 according to the New York Heart Association.

Statistical analysis

The survey data were entered and processed using MS Excel and subsequently statistically analyzed in Statistica version 13.0 (TIBCO Software Inc.). Classical statistical measures such as mean and standard deviation were used for analysis. To assess dependence and correlation strength between variables, Cramér's V coefficient (Vc) and Phi coefficient (ϕ) were applied. The correlation strength interpretation followed these criteria: 0 – no correlation between variables, 1 – very strong correlation between components, indicating a functional relationship. If Vc or ϕ falls within the range (0; 0.3), the relationship between variables is very weak, within (0.3; 0.5), the correlation is weak, within (0.5; 0.7), the correlation is moderate, within (0.7; 0.9), the correlation is strong, within (0.9; 1), the correlation is very strong. The adopted confidence level was 95%.

RESULTS

Among all 150 respondents, the majority were male. A detailed gender distribution is presented below (Figure 1).

Among all respondents, the vast majority fell within the age range of 40 to 80 years. In contrast, the smallest group consisted of individuals below 40 years of age, which may indicate limited representation of the youngest participants within the study population. The detailed age distribution of the respondents is illustrated in the pie chart, allowing for a visual assessment of the demographic structure of the study group (Figure 2).

Among all respondents, the vast majority were classified as overweight. Approximately only 1/4 of the participants had BMI values falling within the range considered normal, indicating a relatively small

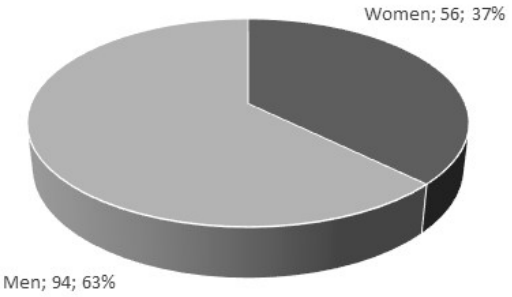

Figure 1. Participation of women and men in the study (N; %)

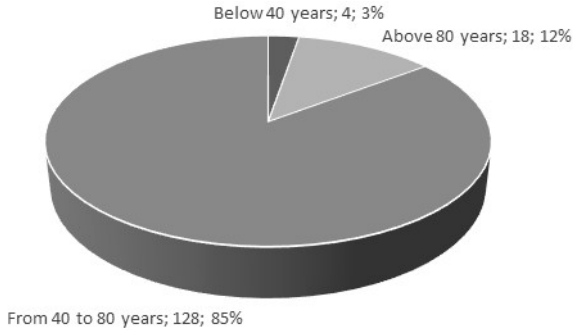

Figure 2. Age distribution of the studied patients (N; %)

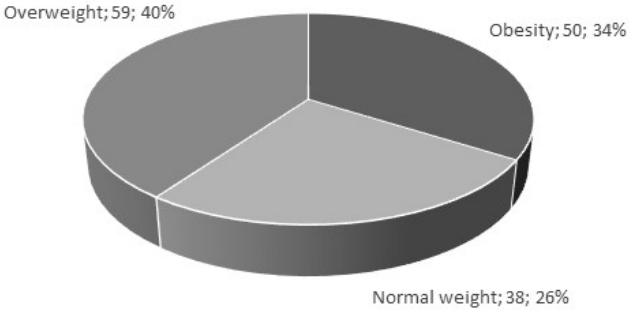

Figure 3. Distribution of Body Mass Index (BMI) among study subjects (N; %)

proportion of individuals with normative body weight in the examined sample. A detailed breakdown of body weight status is presented below, allowing for a clear assessment of body mass diversity within the study group (Figure 3).

A total of 44% (N = 66) of respondents confirmed having coronary artery disease (CAD). Among them, 22 women (14.7%) and 44 men (29.3%) reported being affected (Table 3).

Table 3. Occurence of coronary disease

Sex	Occurrence of coronary disease		
	Yes N (%)	No N (%)	I don't know N (%)
Women	22 (14.7%)	28 (18.7%)	6 (4%)
Men	44 (29.3%)	45 (30%)	5 (3.3%)
Total	66 (44%)	73 (48.7%)	11 (7.3%)

Among all surveyed participants, 36 individuals had high normal blood pressure, while 33 respondents were diagnosed with stage 1 hypertension according to European Society of Cardiology Guidelines 2021 [19]. The smallest group consisted of those with isolated systolic hypertension (N = 4) (Table 4).

Not all participants could have their BMI interpretation linked to their blood pressure category, which is why the following figure represents N = 137. Among all overweight respondents, 17 had stage 1 hypertension, while only 7 had optimal blood pressure levels. Among participants classified as obese based on BMI, 16 exhibited high normal blood pressure (Table 5).

Among all respondents without a family history of metabolic syndrome (N = 70), 41 individuals were also not diagnosed with coronary artery disease (CAD). Conversely, among those with a positive family history (N = 62) of metabolic syndrome or CAD, a majority

Table 4. Blood pressure values according to European Society of Cardiology Guidelines 2021 [19] and comparison with the results obtained in our survey for each category

Pressure value	Systolic [mm Hg]		Diastolic [mm Hg]	N	%
Optimal	< 120	and	< 80	20	14
Normal	120-129	and/or	80-84	18	13
High normal	130-139	and/or	85-89	36	23
Stage 1 hypertension	140-159	and/or	90-99	33	22
Stage 2 hypertension	160-179	and/or	100-109	16	12
Stage 3 hypertension	≥ 180	and/or	≥ 110	12	7
Isolated systolic	≥ 140	and	< 90	4	2
Lack of data				12	7

Table 5. Blood pressure values in comparison to BMI

	Optimal	Normal	High normal	Stage 1 hypertension	Stage 2 hypertension	Stage 3 hypertension	Isolated systolic
Normal weight N (%)	7 (9.6)	4 (5.5)	5 (6.9)	5 (6.9)	5 (6.9)	5 (6.9)	2 (2.7)
Overweight N (%)	7 (9.6)	8 (11)	15 (20.6)	17 (23.3)	3 (4.1)	5 (6.9)	0 (0)
Obesity N (%)	6 (8.2)	5 (6.9)	16 (21.9)	10 (13.7)	8 (11)	2 (2.7)	2 (2.7)

Table 6. Impact of family history of metabolic syndrome and/or coronary artery disease on the occurence of these conditions in the patient

Coronary heart disease	Does metabolic syndrome or coronary artery disease occur in the family?			
	No	Yes	I don't know	Total
No N (%)	41 (27.3)	20 (13.3)	12 (8)	73 (48.7)
Yes N (%)	23 (15.3)	39 (26)	4 (2.7)	66 (44)
I don't know N (%)	6 (4)	3 (2)	2 (1.3)	11 (7.3)
Total N (%)	70 (46.7)	62 (41.3)	18 (12)	150 (100)

– 39 individuals – were diagnosed with CAD. The Cramér's V correlation coefficient was 0.2310, indicating a weak correlation. The lower correlation value is significantly influenced by respondents who are unaware of whether metabolic syndrome or CAD is present in their family history (Table 6).

Among the 30 respondents (24.5%) with implanted pacemakers or vascular prostheses, 23 (83%) experienced no complications (Table 7).

Among all respondents classified as NYHA class 2 (N = 52), 25 individuals reported no limitations in daily activities. Conversely, among those classified as NYHA class 4 (N = 16), 14 individuals experienced significant limitations in performing daily tasks. The Cramér's V correlation coefficient was 0.3716, indicating a moderate correlation between NYHA classification and limitations in daily activities (Table 8).

Hypertension was diagnosed in 67% (N = 101) of all respondents. Among them, 57% (N = 58) had not experienced a myocardial infarction. In contrast, among respondents without diagnosed hypertension (N = 41), 76% (N = 31) had not suffered a myocardial infraction. The Cramér's V correlation coefficient was 0.177, indicating a weak relationship. This suggests that hypertension may be associated with myocardial infraction occurrence, but it is not a direct cause nor a guaranteed predictor of its development (Table 9).

DISCUSSION

The obtained results indicate that the majority of patients hospitalized in the cardiology ward were men. A study conducted by Suman et al. [20] explores the connection between gender and increased risk of cardiovascular diseases (CVD). The differences in CVD prevalence between men and women stem from sex, hormone levels, gene expression on X and Y chromosomes, lifestyle, diet and susceptibility to stress factors. Men are 3-4 times more likely than women to suffer ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI). Additionally, ischemic heart disease (IHD) develops earlier in men than in women. Women are largely protected against CVD due to estrogens produced during the menstrual cycle, with estradiol (E2) playing a key role. By activating the estrogen receptor alpha (ER), it accelerates endothelial healing in response to injuries. E2 also promotes vasodilation and suppresses inflammation, preventing atherosclerosis development. However, the cessation of estrogen production after menopause leads to metabolic changes, contributing to diabetes and obesity. Middle-aged women develop hypertension earlier and more rapidly than men [21]. Age is another major risk factor for CAD. As aging progresses, the severity and prevalence of coronary

Table 7. Assessment of complications in patients following pacemaker implantation and/or vascular prosthesis placement

Pacemakers or vascular prostheses	Complications after implantation of pacemakers or vascular prostheses		
	No	Yes	Total
No N (%)	92 (75.4)	0 (0)	92 (75.4)
Yes N (%)	25 (20.5)	5 (4.1)	30 (24.6)
Total N (%)	117 (95.9)	5 (4.1)	122 (100)

Table 8. Impact of specific blood pressure values vs. restriction of physical activity

Occurrence of limitations in daily activities	NYHA functional classification			
	I	II	III	IV
No N (%)	36 (26.7)	29 (21.5)	9 (6.7)	2 (1.5)
Yes N (%)	13 (9.6)	23 (17)	9 (6.7)	14 (10.4)
Total N (%)	49 (36.3)	52 (38.5)	18 (13.3)	16 (11.9)

NYHA – New York Heart Association

Table 9. Comparison of the impact of diagnosed hypertension on the incidence of myocardial infarction

	Diagnosed hypertension			
Myocardial infraction	No	Yes	I don't know	Total
No N (%)	31 (20.7)	58 (38.7)	7 (38.7)	73 (48.7)
Yes N (%)	10 (6.7)	35 (23.3)	0 (0)	66 (44)
I don't know N (%)	0 (0)	8 (7.9)	1 (0.7)	11 (7.3)
Total N (%)	41 (27.3)	101 (67.3)	8 (5.3)	150 (100)

artery disease increase. Patients over 65 years old face a higher likelihood of major cardiovascular events, while those over 75 years old often suffer from multivessel CAD [22]. However, younger individuals are increasingly diagnosed with IHD [23]. Family history is also a significant independent risk factor for CHD. Research from the University of Copenhagen suggests that a first-degree relative experiencing myocardial infarction greatly increases the risk of heart attack in the patient – particularly if it occurred in the mother or sibling before age 50 [24]. According to Johns Hopkins University School of Medicine, parental CAD increases the probability of early-onset CAD in offspring, defined as a myocardial infarction before age 55. Additionally, coronary artery calcification among siblings is a stronger predictor of subclinical atherosclerosis than parental history [25]. Furthermore, individuals with early-onset CHD share poor dietary habits, low physical activity levels, and a tendency for smoking with their relatives, significantly contributing to cardiovascular disease development [26]. The majority of surveyed patients on the cardiology ward in Żywiec County Hospital suffered from hypertension. A large-scale Polish epidemiological study by Cegłowska et al. [27] describes the prevalence of hypertension in the Polish population between 2018 and 2022. In 2018, 10.8 million cases of hypertension were recorded, while in 2022, this number increased to nearly 11 million – 4.9 million men and approximately 6 million women. The highest hypertension prevalence was noted in men aged 55-59 years and women aged 50-54 years, with older age groups showing the highest recorded cases in both sexes. Hypertension is often associated with other cardiovascular diseases. According to Lewes et al. [28], 54% of strokes and 47% of ischemic heart disease cases are attributable to high blood pressure. German researchers report that hypertension predisposes individuals to myocardial infarction, angina pectoris, heart failure (systolic or diastolic), and atrial fibrillation [29]. The condition is more prevalent among individuals with overweight and obesity [30, 31]. While hypertension increases myocardial infraction risk, in this study, most hypertensive patients had not experienced an infarction. This may be due to proper medical management and patient adherence to physician recommendations. Moreover, patients are becoming increasingly aware of their health, recognizing the importance of a healthy diet, daily physical activity, a balanced lifestyle, and treatment of comorbidities [32, 33].

Limitations of the study

This study had several limitations. Firstly, it was conducted over a relatively short period (July-September 2024) with a small sample size (158 patients). Secondly, patient responses regarding specific medical conditions were subjective – some participants were unable to confirm, whether a family member had coronary artery disease or metabolic syndrome, or if they themselves had hypertension. Lastly, the analysis was carried out in a cardiology ward of a county hospital rather than a university clinic, which means fewer patients and more limited diagnostic and treatment options. Despite these limitations, this study serves as a starting point for further analyses and contributes to the epidemiological assessment of cardiovascular diseases in the Żywiec district. To reduce the incidence of coronary artery disease in the Żywiec district, it is advisable to implement comprehensive public health measures tailored to local needs. Key initiatives include offering free screening tests (blood pressure, cholesterol, glucose, and BMI), including through mobile diagnostic units that regularly visit smaller towns in the district. At the same time, it is important to carry out diverse educational activities, mainly targeting seniors, and to promote the KOS-zawał program [34, 35]. The effectiveness of these efforts can be enhanced through collaboration with local institutions such as churches, schools, and the county government.

CONCLUSIONS

Coronary artery disease remains a significant epidemiological problem in Poland. It is associated with gender, age, lifestyle, and diet, and is also inherited – especially among first-degree relatives. The analysis of the obtained results indicates consistency with previous large-scale studies, such as WOBASZ and Pol-MONICA. Ischemic heart disease affects a considerable portion of the studied population and is diagnosed more frequently in men. Early diagnosis and appropriate treatment are essential – particularly in county areas, where access to interventional cardiology units and specialized treatment options is often limited. The majority of patients were middle-aged and older adults, confirming that this group is particularly vulnerable to cardiovascular conditions. The widespread prevalence of excessive body weight among participants highlights the important role of unhealthy lifestyle factors in the development of the disease, while the frequent coexistence of arterial hypertension – even among individuals with no prior history of myocardial infarction – further confirms its strong link with the pathogenesis of coronary artery disease. The presence of multiple risk factors in individuals without previous cardiac events may reflect the effectiveness of early diagnostic efforts, but also points to the need for further strengthening of preventive strategies, especially at the local level.

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Conflict of interest

The authors report there are no competing interests to declare.

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