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THE PREVALENCE OF ARTERIAL HYPERTENSION IN ROMANIAN ADULT POPULATION: RESULTS FROM THE PREDATORR STUDY

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Abstract

Background and aims*: PREDATORR is a national study designed to estimate the prevalence of diabetes mellitus, prediabetes, overweight, obesity, dyslipidemia, hyperuricemia and chronic kidney disease in Romanian adult population. The aim of present study was to estimate the prevalence, incidence, treatment and control in subjects from PREDATORR study.* ***Material and methods:*** *This study included 2727 adults aged 20 – 79 years. Subjects were examined, and three measurements were performed at a time of at least one minute and the mean of blood pressure readings was recorded. Hypertension was defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg and/or antihypertensive drug therapy.* ***Results:*** *The prevalence of hypertension in Romanian adult population aged 20 – 79 years was 47.38% and was higher in men: 48.62% than women: 46.23%. The incidence of hypertension was: 10.7% in 20 – 39 years age group, 43.1% in 40 – 59 years age group and 75.1% in subjects aged ≥ 60 years. Among subjects with hypertension, 18.7% did not receive antihypertensive drug therapy, 27.7% received antihypertensive treatment in monotherapy, 34.7% were under double antihypertensive drugs and most of them (37.6%) received three or more antihypertensive drugs.* ***Conclusions:*** *The prevalence of hypertension in Romania is high, possible explanations of this might be the unhealthy lifestyle and diet.*

key words: *hypertension, prevalence, PREDATORR*

Background and aims

Hypertension is a global public health problem and is one of the leading causes of cardiovascular morbidity and mortality, by increasing the risk of stroke, congestive heart failure, myocardial infarction, peripheral arterial disease, sudden death and chronic kidney disease [1-4].

In 2015, it was estimated that over 1.13 billion people worldwide had this condition, this number increased from 594 million in 1975, low and middle-income countries having contributed substantially to this increase [5,6]. Current estimates show that the percentage of people with hypertension will increase by 15-20% by 2025, their number reaching 1.5 billion [6,7].

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It is well known that the prevalence of hypertension increases with age, over 60% of people with this condition are over 60 years old [6,8]. Globally, the standardized age-related prevalence of hypertension in males was 24.1% and 20.1% in females [5]. In developed countries, early detection and treatment of both hypertension and other associated risk factors has led, over the last decades, to a reduction in cardiac or stroke mortality. However, countries in Central and Eastern Europe, Sub-Saharan Africa and South Asia had registered the highest blood pressure prevalence [5].

The increase in global hypertension prevalence is due to increased life expectancy, environmental factors such as unhealthy eating, excessive alcohol and salt consumption, obesity, sedentary or prolonged exposure to stress [6].

Romania is still one of the countries with high cardiovascular risk [9], where cardiovascular diseases, including hypertension, represent the main cause of death. The aim of this study was to evaluate the prevalence and incidence of hypertension in the adult Romanian population aged 20 - 79, the degree of therapeutic control, the type of antihypertensive medication, and the correlation of hypertension with other risk factors.

Material and Method

This study was part of the PREDATORR study (National Study on PREvalence of DiAbeTes mellitus, prediabetes, overweight, Obesity, dyslipidemia, hyperuricemia and chronic kidney disease in Romania), conducted by the Romanian Society of Diabetes, Nutrition and Metabolic Diseases and Romanian Society of Nephrology between December 2012 and February 2014. The PREDATORR study had a cross-sectional design and was mainly aimed to estimate the prevalence of diabetes mellitus (DM), prediabetes, overweight, obesity, dyslipidemia, hyperuricemia and chronic kidney disease in Romania. Each subject enrolled signed an informed consent before being included in the study. The PREDATORR study was approved by the National Ethics Committee. Both the design of the study and other results have already been published [10].

Depending on marital status, subjects were classified as: married, unmarried, divorced or widowed. Related to the educational level, the subjects were considered to have a high level of education if they graduated high school, college or university, and those with a low level of education were subjects without school or those who completed primary or secondary school.

In terms of smoking, subjects were considered smokers if they smoked more than one cigarette daily or occasionally or gave up smoking for less than a year before. Non-smokers were subjects who never smoked or smokers who have quit smoking for more than a year before [10].

An electronic machine was used for weighing subjects and a taliometer for height measurement; the body mass index (BMI) was calculated and the nutritional status was classified according to the World Health Organization (WHO) [11].

Blood pressure (BP) measurement was performed with the patient in sitting position after 5 minutes of rest with the cuff on both arms at the heart level. Three measurements were performed at a time of at least one minute and the mean of BP values was recorded.

Hypertensive subjects were defined as those with systolic blood pressure (SBP) ≥ 140mmHg and/or diastolic blood pressure (DBP) ≥ 90mmHg during the study, or if they were on antihypertensive treatment at home or subjects with a history of diagnosed hypertension.

Awareness of hypertension was defined as subjects who declared personal history of

hypertension and/or current use of antihypertensive treatment.

Hypertension detected during the study was considered when the subjects declared no personal history of hypertension, no antihypertensive treatment, but had elevated BP values (SBP ≥ 140mmHg and/or DBP ≥ 90mmHg) during the study visit. Hypertension was classified according to ESH/ESC 2013 criteria.

Hypertension treatment-controlled subjects were considered subjects who received antihypertensive treatment and who had SBP values < 140mm Hg and DBP < 90 mmHg during study visit.

Antihypertensive therapy has been classified according to the different classes of antihypertensive drug classes: angiotensin-converting enzyme inhibitors, beta blockers, diuretics, angiotensin receptors blockers, calcium channel blockers, centrally active antihypertensive drugs.

The statistical analysis was performed using the IBM SPSS Statistics 19.00 software (IBM, Armonk, New York, USA), the level of statistical significance was given by $p \leq 0.05$. All data were analyzed by age group and gender. The chi-square test was used to compare the percentages, and Student's test to compare the mean values. To determine the correlations between hypertension and other risk factors, the logistic regression was used. To determine the prevalence of hypertension in the adult population of Romania, the data were weighted according to the results of the last census in 2011.

Results

The characteristics of the study participants are shown in Table 1. 2727 subjects aged between 20 and 79 were included in the study. It can be seen that the highest percentage of subjects was in the 60-79 age group: 48.06% men and 47.31% women. Most of the subjects were married and had a high education level.

It can be noticed that for both sexes, regardless of age, the mean BMI was included in the overweight category (BMI = 25-29.9 kg/m^2) and mean of waist circumference (WC) exceeded 80 cm for women and over 94 cm - for men. Obesity (BMI > 30kg/m^2) was more common in females versus males, statistically significant differences in the 60 – 79 years old age group ($p < 0.001$) and insignificant in the other two age groups ($p = 0.902$, $p = 0.303$).

The mean SBP increased significantly statistically with age for both sexes ($p < 0.001$) and male subjects had higher values of both SBP and DBP; the highest SBP values were recorded in male subjects aged over 60 years old.

Table 1. Characteristics of the study population, stratified by sex and age group.

Age groups	Men (%, no)	Women (%, no)	p (Men vs Women)
20 – 39 years	15.46% (200)	14.51% (208)	
40 – 59 years	36.47% (472)	38.17% (547)	
60 – 79 years	48.06% (622)	47.31% (678)	
Total (men + women)	47.40% (1294)	52.60% (1433)	
Total	2727 (100%)		
Marital status			
Widowed			
20 – 39 years	0% (0)	0.50% (1)	
40 – 59 years	0.80% (4)	7.90% (43)	
60 – 79 years	9.60% (60)	34.70% (235)	

Divorced			
20 – 39 years	3.00% (6)	2.90% (6)	
40 – 59 years	5.30% (25)	9.10% (50)	
60 – 79 years	4.80% (30)	6.80% (46)	
Unmarried			
20 – 39 years	37.50% (75)	25.50% (53)	
40 – 59 years	3.00% (14)	4.90% (27)	
60 – 79 years	1.10% (7)	2.80% (19)	
Married			
20 – 39 years	58.50% (117)	70.20% (146)	
40 – 59 years	90.70% (428)	77.90% (426)	
60 – 79 years	84.20% (524)	55.30% (375)	
Educational level			
Low			
20 – 39 years	4.00% (8)	5.30% (11)	
40 – 59 years	4.30% (20)	8.30% (45)	
60 – 79 years	17.30% (107)	32.40% (219)	
High			
20 – 39 years	96.00% (191)	94.70% (196)	
40 – 59 years	95.70% (449)	91.70% (500)	
60 – 79 years	82.70% (513)	67.60% (456)	
BMI (kg/m^2)	(Mean ± SD)	(Mean ± SD)	
20 – 39 years	26.73 ± 4.73	25.05 ± 6.22	
40 – 59 years	29.05 ± 4.81	28.84 ± 6.08	
60 – 79 years	28.31 ± 4.62	29.56 ± 5.30	
Obesity (BMI > 30kg/m^2)	% (nr)	% (nr)	
20 – 39 years	20.00% (40)	20.60% (43)	p=0.902
40 – 59 years	37.00% (175)	40.40% (221)	p=0.303
60 – 79 years	30.70% (191)	42.90% (291)	**p<0.001**
Waist circumference (cm)	(Mean ± SD)	(Mean ± SD)	
20 – 39 years	94.92 ± 15.66	83.11 ± 15.21	
40 – 59 years	104.01 ± 12.52	94.04 ± 14.69	
60 – 79 years	103.59 ± 12.40	97.81 ± 13.65	
Abdominal obesity (WC >80cm - women, WC >94cm - men)	% (no)	% (no)	
20 – 39 years	47.00% (94)	52.40% (109)	p=0.324
40 – 59 years	82.40% (389)	83.90% (459)	p=0.612
60 – 79 years	81.30% (506)	90.40% (613)	**p<0.001**
SBP (mmHg)	(Mean ± SD)	(Mean ± SD)	
20 – 39 years	125.88 ± 12.54	115.92 ± 13.55	**p<0.001**
40 – 59 years	136.05 ± 16.59	131.93 ± 23.65	**p=0.001**
60 – 79 years	145.30 ± 20.52	139.81 ± 20.44	**p<0.001**
p – between age groups	**p<0.001**	**p<0.001**	
DBP (mmHg)			
20 – 39 years	75.38 ± 10.03	72.77 ± 9.66	p=0.007
40 – 59 years	82.12 ± 11.53	79.51 ± 10.34	**p<0.001**
60 – 79 years	81.30 ± 12.66	79.75 ± 13.33	p=0.027
p – between age groups	**p<0.001**	**p<0.001**	

Legend: BMI- body mass index; WC – waist circumference; SBP – systolic blood pressure; SD – standard deviation; cm – centimeters; no – number.

The total prevalence of hypertension in the Romanian adult population was 47.38% (no = 7153920), higher in male subjects (48.62%), compared with female subjects (46.23%). As

expected, hypertension prevalence increases with age: 16.35% in 20 – 39 years old age group, 54.23% in those aged 40 to 59 years old and 84.43% in those over 60 years old (Table 2).

Table 2. The prevalence of hypertension in the Romanian adult population (weighted data).

Age groups	Men (%, population no)		Women (%, population no)		Total (%, population no)	
20 – 39 years	21%	614645	11.5%	322481	16.35%	937126
40 – 59 years	56.3%	1562612	52.2%	1474617	54.23%	3037229
60 – 79 years	85.3%	1383707	83.77%	1795858	84.43%	3179565
Total	48.62%	3560964	46.23%	3592956	47.38%	7153920

Legend: no – number

Table 3. Awareness of hypertension.

Previously known hypertension			
	Age groups		
	20 – 39 years (%, no)	40 – 59 years (%, no)	60 – 79 years (%, no)
Men	14% (28)	43.4% (205)	72.0% (448)
Women	7.7% (16)	42.9% (235)	78.0% (529)
Total	10.7% (44)	43.1% (440)	75.1% (977)
Previously known hypertension with high BP values during study visit			
Men	28.5% (8)	40.4% (83)	51.1% (229)
Women	25.0% (4)	42.1% (99)	46.6% (247)
Total	27.2% (12)	41.3% (182)	48.7% (476)

Legend: no – number

Table 4. The incidence of hypertension.

	Age groups		
	20 – 39 years (%, no)	40 – 59 years (%, no)	60 – 79 years (%, no)
Men	8.0% (16)	12.9% (61)	13.6% (85)
Women	3.8% (8)	9.5% (52)	6.0% (41)
Total	5.8% (24)	11.1% (113)	9.7% (126)

Legend: no – number

53.5% (no = 1461) of the total subjects included in this study, stated that they had been previously diagnosed with hypertension by a doctor and/or current use of antihypertensive treatment. 75.1% of subjects over 60 years old (three quarters) declared personal history of hypertension, of which almost half (48.7%) had increased BP values during the study visit. In the 40 - 59 age group, 43.1% of the subjects were hypertensive, 41.3% of them had BP values outside of the therapeutic targets. In young subjects, previously known hypertension was found in a lower percent: 10.7%, almost a quarter of them (27.2%) had uncontrolled BP values (Table 3).

Table 4 shows that most new cases of hypertension were in subjects aged 40 to 59 years old: 11.1%, followed by subjects over 60 years old: 9.7%. Only 5.8% of young subjects were diagnosed with hypertension during this study. It can be seen that in all age groups the incidence of hypertension was higher in male subjects (Table 4).

In Table 5 it can be seen that most subjects with newly diagnosed hypertension had SBP values between 140 and 159 mmHg (mild hypertension).

In Table 6, we can observe that previously known hypertension was statistically significantly ($p < 0.001$) more frequently in

overweight subjects (odds ratio = 2.03; 95% CI 1.59% - 2.59%) and subjects with obesity (odds ratio = 4.25; 95% CI 3.27% - 5.51%) compared to subjects with normal weight. Also, hypertension was statistically significant (p <0.001) correlated with diabetes status, its prevalence being almost three times greater in subjects with DM compared to those without diabetes (odds ratio in subjects with known DM = 2.76 CI 95%: 1.97% - 3.86% and odds ratio in subjects with unknown DM = 2.93 CI 95%: 1.59% - 5.39%). Hypertension was more common in subjects with ischemic cardiac diseases (p <0.001), smokers (p = 0.392) and those with a low educational level.

Table 5. Severity of newly diagnosed hypertension.

Severity of newly diagnosed hypertension		**Age groups**		
		20 – 39 years (%, no)	40 – 59 years (%, no)	60 – 79 years (%, no)
Men	Mild	5.5% (11)	9.5% (45)	8.0% (50)
	Moderate	1.0% (2)	2.9% (14)	4.6% (29)
	Severe	1.5% (3)	0.4% (2)	0.9% (6)
Women	Mild	3.3% (7)	8.2% (45)	4.4% (30)
	Moderate	0.48% (1)	0.9% (5)	1.4% (10)
	Severe	0% (0)	0.3% (2)	0.14% (1)
Total (Men + Women)	Mild	4.4% (18)	8.8% (90)	6.1% (80)
	Moderate	0.7% (3)	1.8% (19)	3.0% (39)
	Severe	0.7% (3)	0.4% (4)	0.5% (7)

Legend: Mild hypertension - SBP: 140-159 mmHg, Moderate hypertension - SBP: 160-179 mmHg, Severe hypertension – SBP ≥ 180 mmHg; no - number

Table 6

Previously known hypertension adjusted by Age, BMI, Diabetes status, Ischemic cardiac diseases, Marital status, educational level, smoking status			**Controlled hypertension adjusted by Age, BMI, Diabetes status, Ischemic cardiac diseases, Marital status, educational level, smoking status**	
	AOR (95% CI)	p	AOR (95% CI)	p
Sex				
Women	1		1	
Men	0.85 (0.69 - 1.05)	p=0.15	0.64 (0.49; 0.84)	**p<0.001**
Age group				
20 – 39 years	1		1	
40 - 59 years	3.48	**<0.001**	0.46 (0.21; 1.03)	p=0.059
60 - 79 years	12.13 (8.21 - 17.91)	**<0.001**	0.38 (0.17; 0.85)	p=0.018
BMI				
Normal weight	1		1	
Overweight	2.03 (1.59 - 2.59)	**<0.001**	0.70 (0.48; 1.01)	p=0.059

Obesity	4.25 (3.27 - 5.51)	**<0.001**	0.57 (0.39; 0.84)	**p=0.004**
Diabetes status				
No diabetes	1		1	
Prediabetes	1.32 (1.04 - 1.67)	**p=0.021**	1.21 (0.90; 1.62)	p=0.202
Known DM	2.76 (1.97 - 3.86)	**<0.001**	1.26 (0.91; 1.73)	p=0.165
Unknown DM	2.93 (1.59 - 5.39)	**p=0.001**	0.86 (0.47; 1.56)	p=0.617
Ischemic cardiovascular diseases				
Without ischemic cardiovascular diseases	1		1	
With ischemic cardiovascular diseases	2.45 (1.97 - 3.04)	**<0.001**	1.25 (0.98; 1.61)	p=0.068
Marital status				
Widowed	1		1	
Divorced	0.79 (0.50 - 1.29)	p=0.358	1.03 (0.59; 1.82)	p=0.907
Unmarried	0.65 (0.38 - 1.12)	p=0.123	1.03 (0.49; 2.17)	p=0.930
Married	0.71 (0.51 - 0.99)	**p=0.041**	1.29 (0.92; 1.79)	p=0.138
Smoking status				
Non-smokers	1		1	
Ex-smokers	0.93 (0.71 - 1.22)	p=0.599	0.81 (0.56; 1.20)	p=0.302
Smokers	1.10 (0.88 - 1.38)	p=0.392	0.99 (0.75; 1.32)	p=0.979
Educational level				
Low	1		1	
High	0.90 (0.67 - 1.20)	p=0.467	1.29 (0.94; 1.79)	p=0.115

Legend: AOR – adjusted odds ratio; CI – confidence interval; BMI – body mass index; DM – diabetes mellitus

The logistic regression analysis showed that hypertensive men were less controlled than hypertensive women (p <0.001); also, a weak control of BP values was registered with the aging (p = 0.018), in subjects with overweight and obesity (p = 0.004), in those with DM detected during the study, in former and current smokers and those with a low educational level (table 8).

Regarding antihypertensive treatment, 18.7% of subjects with known hypertension did not receive drug therapy, 27.7% received antihypertensive treatment in monotherapy, 34.7% were under double antihypertensive drugs and most of them (37.6%) received three or more antihypertensive drugs.

The most common antihypertensive drugs used in monotherapy were beta blockers (37.68%), angiotensin-converting enzyme inhibitors (29.78%), diuretics (18.54%), angiotensin receptor blockers (7.90%) and calcium channels blockers (6.07%).

When dual therapy was chosen for the treatment of hypertensive patients, the most commonly used combinations were: diuretic + angiotensin-converting enzyme inhibitor (36.89%), angiotensin-converting enzyme inhibitor + beta blocker (17.71%), diuretic +

beta-blocker (13.83%), angiotensin receptor blocker + diuretic (8.73%), beta blocker + angiotensin receptor blocker (7.52%), diuretic + calcium channels blocker (3.88%) and beta-blocker + calcium channels blocker (2.66%).

Overall, the most commonly used classes of antihypertensive medication were: diuretics (60.23%), beta blockers (54.92%), angiotensin-converting enzyme inhibitors (54.50%), calcium channels blockers (24.51%), angiotensin receptor blocker (19.03%) and centrally active antihypertensive drugs (2.52%).

Discussion

The results of this study show information on hypertension analysis in the Romanian adult population, as the protocol of the PREDATORR study was performed so that the group of subjects included in this study is representative of our country.

As mentioned, hypertension prevalence in our study was 47.38%, the percentage of hypertensive men (48.62%) was higher than the prevalence of women with this condition. Our data were similar to those obtained in the SEPHAR I, II and III studies (the Study for the Evaluation of Prevalence of Hypertension and Cardiovascular Risk in Adult Population in Romania) published in the last 13 years by Dorobantu M et al. Thus, in the SEPHAR I (2005) study, total prevalence of hypertension was 44.92%, and hypertension was more common in males (men - 50.17% vs. women - 41.11%) [12,13]. In SEPHAR II (2012), hypertension prevalence was 40.4%, this time hypertension was more common in females (men - 38.42% vs. females - 42.20%) [14,15]. Data from SEPHAR III (2016) shows a hypertension prevalence of 45.1%, higher for men this time too (men: 48.4%, women - 42.2%) [16]. In Spain, the Di@bet.es study, a study similar to PREDATORR study, the prevalence of age-related hypertension prevalence was 42.6% (95% CI: 41.2% - 44.0%) of the total population, and in this case, men had a higher hypertension prevalence: 49.9% (95% CI 47.8% - 52.0%), compared with women: 37.1% (95% CI 35.3% - 38.9%) [2]. In Portugal, the PAP study conducted in 2003 showed a prevalence of hypertension in the population aged 18 to 90 of 42.1%, the percentage of hypertensive males was higher (49.5% - men and 38.9% - women) [4]. In the Czech Republic, in a study published by Cífková et al in 2010, hypertension prevalence was 43.6% [17]. A much lower prevalence of hypertension: 29% was described in Poland in 2002 [18]. In 2003, Katharina Wolf-Maier described a prevalence of hypertension of 38% in Italy, 42% in England, 47% in Spain, 49% in Finland and 55% in Germany [19]. In another study published in 2017, the prevalence of hypertension in Italy was 25.4%, higher in females [20].

In our study, the proportion of subjects previously diagnosed with hypertension was 53.5% of the total subjects included in the PREDATORR study compared to SEPHAR studies, where this percentage ranged from 44.26% (SEPHAR I) to 69.55% (SEPHAR II) and 80.9% (SEPHAR III) [12,15,16]; in Spain, the percentage of those with personal history of hypertension was 63.7% [2], while in Portugal this percentage was 45.7% [4].

Regarding the antihypertensive treatment, 81.3% of all subjects with hypertension included in the PREDATORR study were receiving antihypertensive treatment. We can say that this percentage has increased over the last few years, if we relate to SEPHAR data: only 38.9% of hypertensive subjects were treated in 2005 [12], in 2012 - this percentage increased to 85% [15] and in 2016, SEPHAR III shows that 89.3% of hypertensive subjects were treated [16]. In Spain, 88.3% of previously known hypertensive

subjects were receiving antihypertensive drugs, according to Di@bet.es study [2]. In the PREDATORR study, 27.7% of the hypertensive subjects were treated with a single antihypertensive drug, 34.7% had dual therapy, while 37.6% of subjects had three or more antihypertensive drugs in the treatment regimen, very similar to those in the SEPHAR II study: 27.3% - monotherapy, 39.6% - dual therapy and 33.1% - ≥ 3 antihypertensive [15], and in SEPHAR III, 48.1% of hypertensive subjects were treated with a single antihypertensive treatment and 51.9% had two or more of the recommended antihypertensive [16]. In the present study, the most commonly used classes of antihypertensive medication were: diuretics (60.23%), beta blockers (54.92%) and angiotensin-converting enzyme inhibitors: 54.50%, compared to SEPHAR studies, where angiotensin-converting enzyme inhibitors occupied the first place: 79.1% followed by diuretics: 58.9% and beta-blockers: 53.2%, and in SEPHAR III: 43% - angiotensin-converting enzyme inhibitors, 40.2% - diuretics, 24.1% - beta blockers [15,16].

Conclusions

The results of this study show once again that our country has a very high prevalence of hypertension, with a very high percentage of people still undiagnosed, but also a very high percentage of those diagnosed who do not reach the therapeutic targets. In our opinion, it is necessary to develop campaigns for the prevention, detection and treatment of hypertension and other cardiovascular risk factors. Prevention measures should be initiated from the first years of life by adopting a healthy lifestyle (diet, exercise) that should be maintained throughout life.

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