

**“VICTOR BABEȘ” UNIVERSITY OF MEDICINE AND PHARMACY  
FROM TIMISOARA**

**FACULTY OF MEDICINE**

**Department XVI**

**GĂDĂU CARMEN**



# **PHD THESIS**

**THE ASSESSMENT OF EPIDEMIOLOGICAL, DIAGNOSTIC  
AND THERAPEUTIC DATA IN ARTERIAL HYPERTENSION  
WITH TYPE 2 DIABETES IN FAMILY MEDICINE**

**- A B S T R A C T -**

**Scientific Coordinator:**

**PROF. ARDELEANU ELENA, PhD**

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## 1. INTRODUCTION

According to a report from the World Health Organization, high blood pressure (HBP) is one of the most common cardiovascular diseases and is also, the most common risk factor for cardiovascular morbidity and mortality worldwide. Since the prevalence of hypertension increases after 60 years, this especially affects people with risk factors and older people. Nowadays, the prevalence of high blood pressure and diabetes, as well as the association of these two conditions are increasing, along with other significant risk factors such as hyperlipaemia, obesity, and, population ageing and chronic kidney disease. A vicious circle is created when type 2 diabetes and hypertension are combined. This combination worsens the progression of micro and macrovascular lesions, promotes the occurrence and progression of kidney disease, and increases the incidence of coronary, cerebral and peripheral arterial cardiovascular events, as well as mortality.

Romania is an eastern European country where high blood pressure, type 2 diabetes and other cardiovascular conditions are more prevalent. Despite significant advances in socioeconomic and medical fields, the number of cardiovascular events and mortality is still increasing. The situation is alarming compared to Western European countries, where the mortality rate and cardiovascular disease has fallen by 50% in recent decades. Regarding the prevalence of diabetes in Romania, it is higher than the European average. The current situation requires a better knowledge of the relationship between the two comorbidities, better control of modifiable risk factors such as sedentary lifestyle, smoking, obesity and hyperlipaemia, and more, as well as a more efficient implementation of prevention and early detection programs among the population.

There is very little research on the intervention of primary medicine in assessing the prevalence, early diagnosis, cardiovascular risk factors, and clinical characteristics of DZ (diabetes mellitus)-HBP in the population receiving primary treatment. In addition, there is little data from education studies through family medicine about adopting a healthy lifestyle, home monitoring of BP, telemedicine and increasing adherence to treatment.

## 2. AIM OF THE STUDY

This study aimed at assessing at the level of family medicine practices in Timis County the prevalence of HBP and DZ type 2, socio-economic and risk factors in the presence of the two comorbidities, including, as well as optimal therapeutic control.

The **specific objectives** were as follows:

1. Assessment of the prevalence of hypertension associated with type 2 diabetes in a group of adult hypertensive patients monitored at the level of family medicine practices in Timis County.
2. Analysis of the relationship between HBP and DZ type 2 and socio-demographic factors and lifestyle results. Salt consumption in hypertensive people in Timis County
3. Comparison of data with a control group of hypertensive patients without type 2 diabetes for the year assess cardiovascular risk factors in this group of adult hypertensive patients with type 2 diabetes and to determine their classification in the CV risk groups.
4. Framing the hypertensive population with type 2 diabetes in cardiovascular risk groups

5. Assessment of blood pressure in family medicine practices performing a 24-hour tension profile using MATA in the family medicine cabinet and comparison of the tension profiles of hypertensive patients with type 2 diabetes and hypertensive without this comorbidity.

6. Assessment of the biological and clinical characteristics of hypertension, type 2 diabetes mellitus and associated cardiovascular and renal diseases.

7. Cardiovascular risk assessment of the study population based on laboratory and paraclinical, biochemical and imaging data.

8. Rapid identification of organ effects caused by hypertension associated with type 2 diabetes using electrocardiography, Doppler transthoracic echocardiography, carotid ultrasound, IGB, estimated glomerular filtration rate and albumin/ratio/urinary creatinine.

9. Analysis of the prevalence of cardiovascular, renal, cerebral and peripheral vascular diseases in hypertensive patients with type 2 diabetes 10. Assessment of lifestyle and salt consumption of hypertensive adult population with type 2 diabetes in Timis county.

11. Evaluation of treatment and response to treatment in patients with hypertension and type 2 diabetes, assessment of the awareness of the disease in the population addressing the family doctor and treatment.

12. Evaluation of the results of HBP treatment with type 2 DM in adults treated in primary medicine in Timis county, analyzing the elements that contributed to the incapacity of the year obtain a more satisfactory BP control for the population enrolled in study.

13. Creating and implementing family medicine level programs for the year educate the population about healthy lifestyle, healthy lifestyle, to actively engage in self-health care and increase adherence to treatment. In family medicine practices, there should be mixed health teams to detect risk factors and for the year perform screenings for BP and early diagnoses.

### 3. METHODOLOGY

The research is a cross-sectional clinical study that is based on the hypertensive population from 12 family medicine practices in Timis County in urban and rural areas. Study participants were enrolled during visits to family medicine practices. The study was conducted in 2017-2023. The criteria for inclusion in the research were adults over the age of 18 with old or newly detected hypertension during the office visit. Cases with acute coronary artery injury or advanced chronic kidney disease stage 5 of BCR have been excluded.

The research was attended by 14 family doctors, 3 cardiologists, 18 family medicine residents and 23 nurses. Work teams were formed that were trained on the methodology of the deployment, the correct measurement of BP at the cabinet and at ambulatory (MATA), assisting patients in filling out questionnaires, recording data, drawing up sheets, drawing up sheets, monitoring the effectiveness of treatment and training patients to combat environmental and metabolic risk factors, increase adherence to lifestyle changes and drug therapy.

Consistent with the recommendations of the Helsinki Declaration and international medical ethics regulations, each patient signed a written consent upon inclusion in the

study. The research was approved by the ethical committee of the "Victor Babes" University of Medicine and Pharmacy in Timisoara. The patient acceptance rate of study participation was high at 94.7%.

Sociodemographic basic data (age, gender, urban/rural residence, educational level), lifestyle data (physical activity carried out, smoking, diet, salt intake in food, etc, exposure to stress), anamnestic data related to the cardiovascular and/or diabetic pathological family history, pathological personal history such as cardiovascular disease, personal history of diabetes mellitus, myocardial infarction, atrial fibrillation, etc, strokes, peripheral arterial disease and information on disease awareness, current treatment, adherence to treatment was collected from questionnaires completed in the medical office in the presence of the family doctor or family medicine resident by the subjects enrolled in the study.

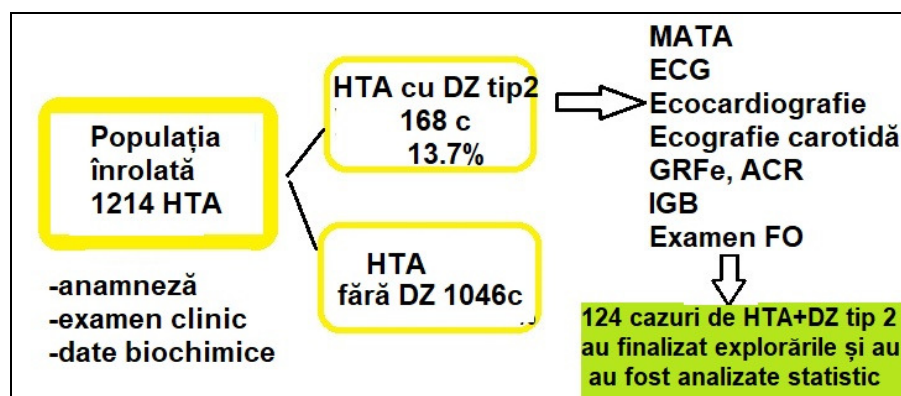


Figure 8.1. Study methodology

Of these 168 hypertensive patients with type 2 diabetes, complete data (questionnaires, biological data, complete paraclinical investigations and MATA) were obtained only from 124 patients. A total of 44 cases of hypertensive patients with type 2 DZ were excluded from the statistical analysis either because they were lost during the study or did not have complete data.

To detect the particularities of hypertension associated with DZ type 2 we compared epidemiological, paraclinical, data, clinical and therapeutic response of the HBP + DZ type 2 lot with the control group consisting of 128 hypertensives without diabetes. The study included at least 3 visits to the family medicine cabinet, which took place monthly and conducting biochemical and cardiological investigations. During the first visit, the anamnesis was carried out and the questionnaires with socio-economic data, related to lifestyle, heredo-collateral antecedents, were completed, personal pathological and clinical examination was done with evaluation of cabinet blood pressure. The therapeutic regimen was established and recommendations were made for imaging investigations, namely echocardiography-Doppler, carotid ultrasound, and, as well as other imaging investigations (related to the individual CV pathology of the patient) and specialized consultations.

Between visit 1 and 2, MATA and ECG were determined routinely in family medicine practices by the doctor or residents. During this time, biochemical blood and urine investigations were collected and performed in accredited laboratories. The 2nd visit was made 1 month after visit 1, when the BP cabinet was measured, the treatment was evaluated and the investigations were recorded. For newly diagnosed hypertensive patients, an BP check on the effectiveness of therapy was performed 14 days after treatment initiation.

Between visit 2 and 3 were performed in cardiology offices imaging investigations for the detection of cardiac and carotid AOMH. Visit 3 took place 3 months after enrolment in the study, during which the newly conducted investigations were recorded, the effectiveness of the response to therapy was controlled, adherence to treatment and final study batches were established, which had complete data and entered the statistical analysis of the results. Patients with uncontrolled DZ and HBP were followed up to find the causes of lack of control. They were again monitored with MATA to exclude the effect of white coat.

Those with uncontrolled hypertension were further clinically and paraclinically investigated to rule out factors that contributed to the lack of BP control such as: decreased adhesion therapy, and, lifestyle factors, especially high salt intake, drug interactions, psychological causes or secondary HBP.

The study was supported by a grant provided by the Foundation of Residents of Family Medicine of Banat, grant number 253/2017.

### **3.1. Blood pressure assessment**

The BP measurement by the cabinet was made according to the standard procedure, making 3 determinations, taking into account the average of the last 2 measurements, performed at distances of 2 minutes. If large differences were found between the voltage values at the 3 measurements, repeated determinations of BP were made. Cabinet BP measurements were performed on all patients by oscillometric method.

For the outpatient monitoring of BP (MATA) were used Meditech and BTL4 monitors, detection being carried out at the cabinet level of family medicine. Diurnal and nocturnal period determination was based on patient reported bedtime and wake time data.

Therapeutic targets in HBP vary according to different guidelines and within the same guide they change frequently within a few years, with the publication of new studies and scientific evidence on optimal blood pressure values to ensure maximum cardiovascular protection:

- 1 8-64-year-old patients the main target is the reduction of BP by cabinet <130/80 mmHg
- 65-79-year-olds target is BP <140/80 mmHg. A voltage is considered controlled if systolic blood pressure (SBP) is 130-139 and SBP <80 mm Hg. When SBP is between 130-139 and is well tolerated, a lower diastolic blood pressure (DBP), respectively <70 mmHg, can also be accepted
- In elderly patients with SBP target is the reduction of SBP <140 mmHg. BP should not fall below 120/70 mmHg, when problems with coronary and cerebral irrigation may occur
- in fragile patients, targets will be individualized, especially in the elderly
- As there are no MATA values for diabetic hypertensive patients, the therapeutic targets at MATA were the general ones, respectively the average BP /24h <130/80 mmHg, the average daily BP <135/85 MmHg and BP night average <120/70 mmHg
- Normal BP has been defined by normal cabinet measurements and at MATA

### **3.2. Paraclinical investigations**

Electrocardiograms were performed in family medicine practices and included 12 derivatives, respectively 6 peripheral standards and 6 pre-cordial derivatives. Electrocardiographs Bionet CardioTouch 3000 were used, the patient being in a position of kinostatism, the electrodes being applied in the standard position. The parameters assessed were the rhythm (sinus, atrial fibrillation), heart rate, PR interval, duration of QRS complex, heart rate, the presence of atrioventricular or intraventricular conduction disorders and pathological changes in the ST segment and T wave.

The two-dimensional Doppler transthoracic echocardiography was performed for the study of left ventricular hypertrophy (LVH) in two-dimensional ultrasound, in particular the left parasternal longitudinal section was used, short transverse parasternal axis at the submitral level and apical section 4 and 2 chambers. The echocardiographies provided information related to the dimensions and geometry of the LV, the area and volume of the left atrium, the aortic dimensions, the thickness of the LV walls, the systolic function (EF by the Simpson method) and the diastolic function LV, the diastolic function, mass LV.

Carotid ultrasound was performed in cardiology offices with an ultrasound Sonoscape SSI 8000, with a transducer of 7.5 MHz, with automatic measurement of intima-media thickness (IMT). It was measured in the distal common carotid artery, 0.5 cm before the carotid bulb. Measurements were made at both left and right carotid levels. The maximum and mean IMT was automatically measured.

### **3.3. Diagnostic criteria of diabetes**

The data from the American Diabetes Association Guides was used: fasting blood sugar  $\geq 126$  mg/dL at least 2 different determinations, at least, glucose tolerance test with 2-hour glucose  $\geq 200$  mg/dL, HbA1c  $> 6.5\%$  or the existence of a previously diagnosed DZ, the patient being treated, regardless of blood glucose or HbA1c. Normal blood glucose  $< 100$  mg/dL and HbA1c 4.8-6%. Prediabetes was diagnosed with blood glucose 101-125 mg/dL, glucose tolerance test with blood glucose 2 hours 140-199 mg/dL and HbA1c with values of 6-6.5%. Control of type 2 diabetes mellitus was considered achieved by basal glucose therapy  $< 130$  mg/dL and HbA1c  $< 7\%$ .

### **3.4 Assessment of cardiovascular risk factors in HBP with DZ Type 2**

Hypertension rarely occurs isolated, usually patients also have associated risk factors that increase the CV risk of hypertension. The 10-year risk estimate for having a fatal event was based on "Systemic Coronary Risk Assessment (SCORE) and the 2018 European Guide to Arterial Hypertension.

The main factors that influence the cardiovascular risk in hypertensive patients are: male gender, age over 55 years at B and over 65 years at F, smoking, total cholesterol and HDL cholesterol, diabetes, diabetes mellitus, overweight and obesity, family history of early cardiovascular disease under 55 years of age at B and over 65 years at F, family history of early HBP, sedentary lifestyle, etc, psychological and socio-economic factors, early menopause, uric acid, high heart rate  $> 80$  b/min.

SCORE risk categories included: reduced risk of fatal events in the next 10 years (SCORE <1%); moderate risk SCORE ( $\geq 1\%$  -  $\leq 5\%$ ); high risk SCORE ( $\geq 5\%$  -  $\leq 10\%$ ) death in the next 10 years. Very high risk ( $>10\%$ ) included hypertensive patients with DZ with cardiovascular disease or having a significant major risk factor such as hypercholesterolemia major or patients with HBP at risk SCORE  $\geq 10\%$ .

#### 4. PERSONAL CONTRIBUTIONS TO DETERMINING THE PREVALENCE OF HBP ASSOCIATED DZ TYPE 2 IN TIMIS COUNTY

##### 4.1 PREVALENCE OF HBP WITH DZ TYPE 2

From a total of 1214 hypertensive patients analyzed at the level of 12 family medicine practices in Timis County, follow up in the study and evaluate complex to obtain epidemiological, biological and clinical data studied, and, 13.8% (168 patients) had associated type 2 diabetes diagnosis.

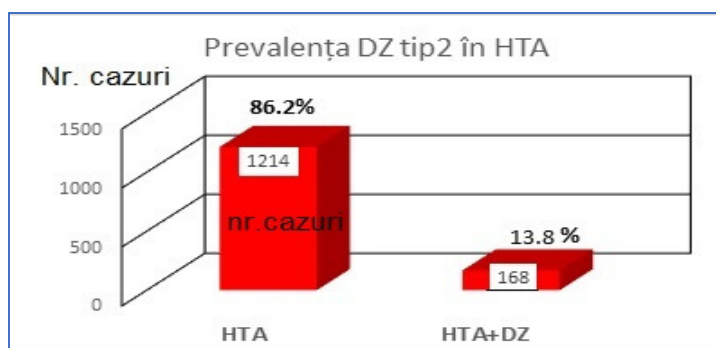


Figure 9.1. The prevalence of HBP with DZ type 2 in Timis county

Of these 168 hypertensives with type 2 DZ, 82.7% (139 cases) had known type 2 diabetes, so they were diagnosed prior to study entry with DZ and 17.3% (29 cases) were newly diagnosed patients on enrolment in the study.

From the group of 168 hypertensive people with type 2 DZ, complete anamnestic data through completed questionnaires, clinical and paraclinical data were finally obtained from 124 hypertensive people with type 2 DZ, who entered into the analysis of the characteristics of this associated pathology, being statistically analyzed.

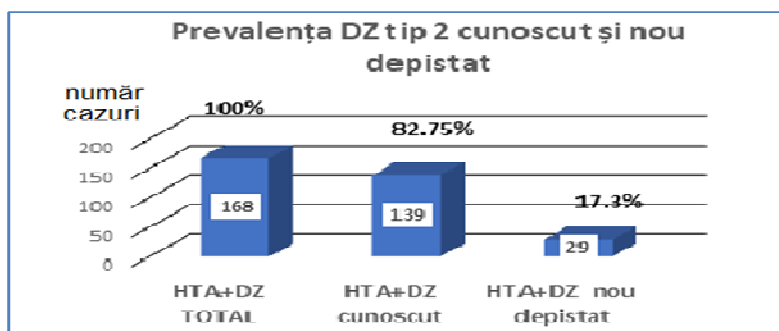


Figure 9.2. The prevalence of known and newly diagnosed DZ type 2 in the HBP group

The age group 20-30 years comprised 7 patients, representing 4%; the age group 31-40 years had 13 patients (10.4%); the age group 41-50 years had 17 patients (13.7%); the age group 51-60 years had 25 patients (20.1%); the age group 61-70 years had 30 patients (25.5%) and the age group over 70 years 34 patients (27%). Two-thirds of hypertensive patients with type 2 diabetes were over the age of 50. The prevalence of diabetes mellitus (known and unknown) increased significantly with the age of hypertensive patients, the highest prevalence is found in the age groups 61-70 and 71-80 years.

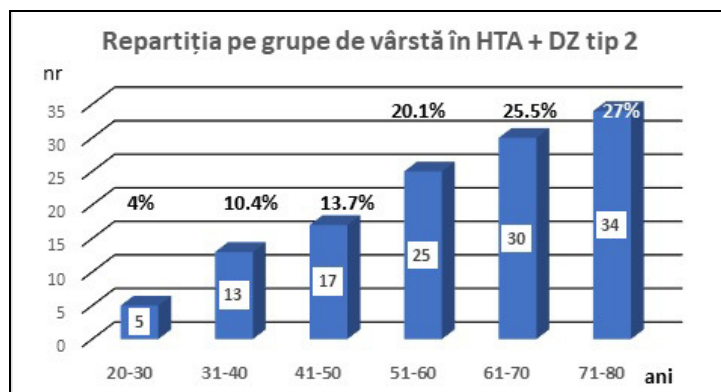


Figure 9.3. Age group distribution in HBP+DZ type 2

Table 1. Epidemiological features of study batches

Features	Study group HBP + DZ tip 2		Control HBP without DZ		p value
	n	%	n	%	
Average age	63 ± 12.3		53 ± 15.8		0.001
Number	124	100	128	100	0.721
Males	65	52.4	58	45.4	0.060
Females	59	47.5	70	54.6	0.064
Educational level					
Low	72	58.06	65	50.78	0.246
High	52	41.94	63	49.22	0.246
Urban living area	77	62.09	82	64.06	0.746
Rural living area	47	37.90	46	35.94	0.746
Reduced salt intake	81	65.32	82	64.06	0.834
Normal	43	34.68	46	35.94	0.834
Average duration HBP	6.97 ± 4.57 years		4.89 ± 2.98 years		0.041
Duration HBP <5 ani	37	29.83	58	45.30	0.011
Duration HBP >5 ani	87	70.17	70	54.70	0.011
Duration DZ >5 ani	79	63.7	-	-	-
Duration DZ <5 ani	45	36.3	-	-	-

Abbreviations: n, number; HBP, hypertension; DS, standard deviation; DZ, type 2 diabetes

#### 4.2. Tension values in HBP with DZ type 2 and HBP without DZ type 2

SBP and DBP measured at the cabinet were significantly higher in the study group with HBP + DZ type 2 compared to the group with HBP without DZ, as shown in Table 4. The difference between batches was 5.4 mm Hg for SBP and 5.1 mmHg for DBP. Outpatient measurements of BP showed higher values in the HBP+DZ type 2 group for both SBP and DBP during both daily and night monitoring periods. The largest difference was found in

night-time DBP (8.3 mmHg). Comparison of mean/24h SBP in the HBP and DZ type 2 group with that of the HBP control group without DZ found in hypertensive diabetics higher mean/24h tensions, higher, p-value being statistically significant ( $p < 0.0001$ ) as shown in Table 2.

**Table 2. BP at the cabinet and at MATA in HBP with DZ type 2 and without DZ**

Measurement method	Study group HBP+DZ tip 2		Control with HBP		p value
	Mean $\pm$ DS (mmHg)	95% CI	Mean $\pm$ SD (mmHg)	95% CI	
Cabinet BP					
Cabinet SBP	155.5 $\pm$ 12.89	(151.6-162.5)	145.1 $\pm$ 11.1	(139.1-149.0)	<0.001
Cabinet DBP	82.61 $\pm$ 9.08	(82.35-90.87)	80.50 $\pm$ 6.86	(79.11-87.50)	0.002
MATA					
Daytime SBP	142.0 $\pm$ 12.02	(137.9-142.1)	133.8 $\pm$ 8.82	(132.2-138.3)	<0.001
Daytime DBP	84.95 $\pm$ 7.02	(83.70-86.20)	82.59 $\pm$ 6.60	(81.43-83.74)	0.006
Night-time SBP	131.3 $\pm$ 11.95	(129.1-133.4)	123.0 $\pm$ 9.66	(121.3-124.7)	<0.001
Night-time DBP	79.40 $\pm$ 6.91	(77.17-82.62)	71.94 $\pm$ 8.61	(70.43-76.44)	<0.001
SBP / 24 h	135.6 $\pm$ 11.66	(133.6-137.7)	128.4 $\pm$ 8.92	(126.9-130.0)	<0.001
DBP / 24 h	82.00 $\pm$ 4.89	(81.13-82.87)	80.04 $\pm$ 6.44	(78.91- 81.17)	0.0070

Abbreviations: BP: blood pressure, SBP: systolic blood pressure; DBP: diastolic blood pressure

#### 4.3. Forms of hypertension in HBP with DZ type 2 and HBP

Regarding the forms of hypertension encountered, from the total group of hypertensives analyzed in the study (1214), a number of 133 (10.9%) have been diagnosed on the basis of repeated tensile measurements on subsequent visits and MATA as having hypertension of "halat white". In the group of hypertensive patients with diabetes mellitus, the following forms of HBP were diagnosed based on MATA: masked hypertension in 19 cases (15.32%), episodes of orthostatic hypotension in 15 cases (12%) and nocturnal hypertension in 22 cases (17.7%). Episodes of orthostatic hypotension were more common in HBP with DZ type 2, in the age group over 70 years, and in those with over 3 antihypertensive drugs.

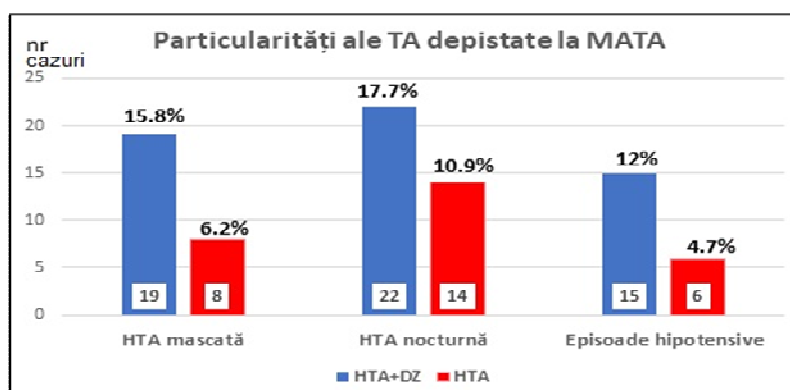


Figure 9.19. Forms of HBP detected at MATA

#### 4.4 Fitting in degrees of hypertension

Hypertensive patients with type 2 DZ experienced significantly more severe degrees of hypertension than HBP without DZ. In the HBP with DZ group, there were grade 1 HBP 22.5% (28 cases), grade 2 HBP 43.5% (54 cases) and grade III 31.4% (39 cases). HBP grade classification in the NO-DZ group showed more patients in grade 1, mild HBP, and

35.1% (45 cases), respectively, in grade 2 HBP 49.2% (63 cases) and grade 3 HBP 15.6% (20 cases), representing a lower number of cases compared to the HBP group with DZ.

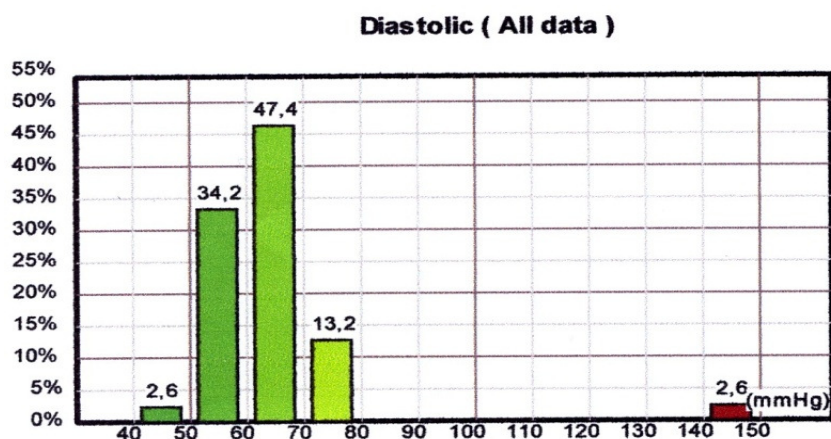


Figure 9.23. Percentage representation of TA values in white coat HBP

## 5. PERSONAL CONTRIBUTIONS TO THE ASSESSMENT OF RISK FACTORS IN HBP WITH DZ TYPE 2

Analysis of clinical, biological and imaging data showed that hypertensive patients with DZ type 2, compared with the hypertensive group without DZ type 2, had an increased prevalence of risk factors, a hypertension-mediated organ damage, cardiovascular disease. The number of risk factors present in hypertensive patients with type 2 DZ ranged from 2-6, most of which had at least 3 cardiovascular risk factors. There were no significant differences between the 2 groups on the following risk factors: family history of cardiovascular disease, sedentary lifestyle and low levels of HDL-cholesterol.

The type 2 diabetes study group showed statistically significantly increased LDL-C levels compared to the control group (54.03% vs. 36.72%,  $p=0.005$ ) and triglycerides (46.77% vs. 32.03%,  $p=0.016$ ). Obesity with BMI  $>30\text{kg/m}^2$  was present at 56.46% vs. 38.28%,  $p=0.003$ , and abdominal obesity was present at 60.48% vs. 45.31%,  $p=0.015$ . A total of 73 hypertensive patients (58.87%) had an uncontrolled DZ with glycated haemoglobin above 7%. In the group of hypertensives without DZ type 2 there were 17 cases (13.28%), which showed a decrease in glucose tolerance.

**Table 3. Mean values of metabolic parameters in HBP with and without DZ**

Average value parameters	HBP with DZ type 2	HBP	p
Glycaemia, mg/dL	136 $\pm$ 46	91.14 $\pm$ 18	$P < 0.001$
Glycated haemoglobin	6.91 $\pm$ 1.84	5.46 $\pm$ 0.82	$P < 0.001$
LDL (mg/dL)	139.50 $\pm$ 41.2	108.40 $\pm$ 32.10	$P < 0.001$
HDL-c (mg/dL)	42.20 $\pm$ 11.5	139.0 $\pm$ 71.20	$P 0.07$
Triglycerides	176.10 $\pm$ 89.4	129.0 $\pm$ 71.20	$P < 0.001$
Uric acid mg/dL	5.50 $\pm$ 1.90	5.30 $\pm$ 1.80	0.6683
Potassium	4.51 $\pm$ 0.39	4.46 $\pm$ 0.47	0.3598
Sodium	139.60 $\pm$ 3.16	138.9 $\pm$ 2.33	0.3908

## 6. PERSONAL CONTRIBUTIONS TO THE ASSESSMENT OF ORGAN DAMAGE IN HYPERTENSION WITH DZ TYPE 2

### 6.1. Cardiac damage

Cardiac damage, expressed by HVS, was detected electrocardiographically by Cornell index, which was present in 37 cases with HBP + DZ type 2 (29.8%) compared to 27 cases (21%) in case of HBP without diabetes. Echocardiography was the investigation that confirmed the existence of left ventricular hypertrophy by determining the mass of the left ventricle. Average mass VS (in grams) was  $153 \pm 89.6$  g in HBP with DZ type 2 versus  $115.2 \pm 72.3$  g in HBP without diabetes,  $p=0.01$ . Based on echocardiographic data HVS was reported in 71 cases (57.2%). The back wall thickness of the left ventricle was  $8.61 \pm 4.62$  in HBP with DZ type 2 versus  $7.99 \pm 4.1$  in HBP,  $p=0.05$ .

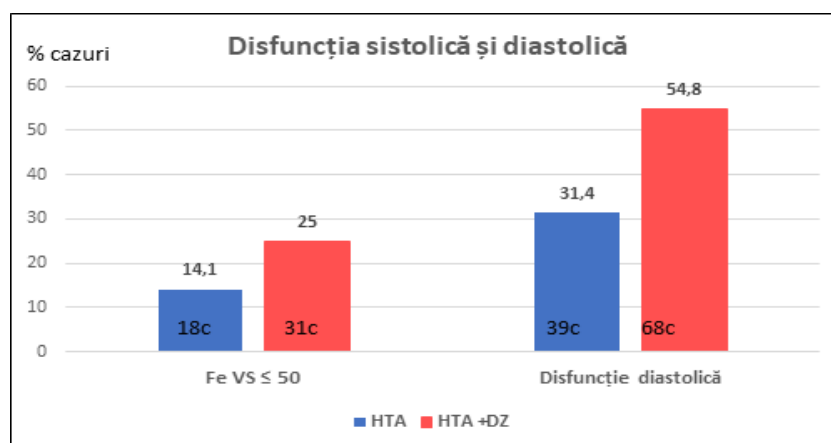


Figure 9.35. Systolic and diastolic dysfunction in HBP with and without DZ type 2

### 6.2. Renal impairment

The prevalence of chronic kidney disease in the HBP + DZ type 2 study group was 15.3% (19 patients), most cases belonging to stage III of BCR. Patients with HBP + DZ type 2 were classified in the following stages of chronic kidney disease: stage 1 with RFG  $\geq 90$  ml/min/1.73 m<sup>2</sup> + ACR  $\geq 30$  mg/g, w, comprising 3 patients (2.41%); stage 2 with eGFR 89-60 ml/min/1.73 m<sup>2</sup> + ACR  $\geq 30$  mg/g comprising 4 cases (3.22%); stage 3 with GFR 30-59 ml/min/min/1.73 m<sup>2</sup>, comprising 10 patients (8.6%) and stage 4 with GFR 29-15 ml/min/1.73 m<sup>2</sup> comprising 2 patients (1.6%).

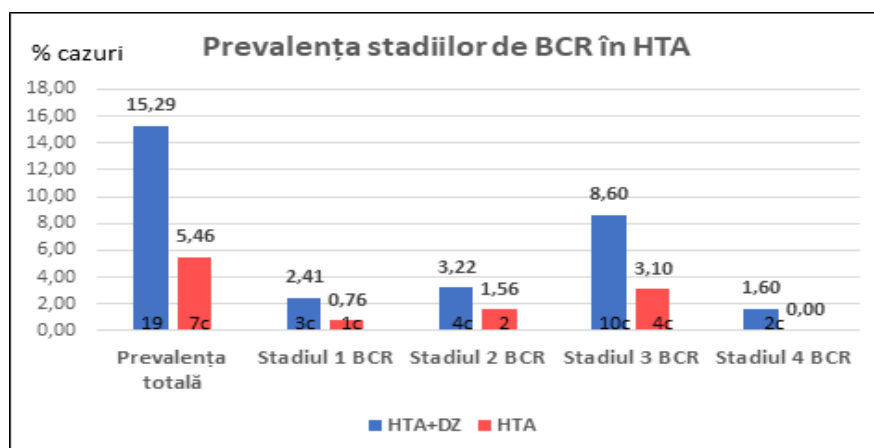


Figure 9.40. The prevalence of chronic kidney disease stages in HBP+DZ

### 6.3. Vascular damage: carotid and peripheral arteries in HBP with DZ type 2

We found that carotid atherosclerosis was more expressed in diabetic patients, So GIM  $\geq 0.9$  mm was present in 41.9% (52 cases), compared to 32.8% (42 cases) in hypertensive patients without DZ. The association between HBP and DZ resulted in an increased prevalence of carotid atherosclerosis, contributing to other associated metabolic and haemodynamic factors. Carotid atheroma plaques were present in 55.6% (62 cases) of diabetic hypertensive patients, being statistically significantly less common (35.1%, 45 cases) in hypertensive patients without diabetes,  $p < 0.05$ ). The ankle arm index was  $< 0.9$  in 14 patients (11.2%) with HBP and DZ type 2.

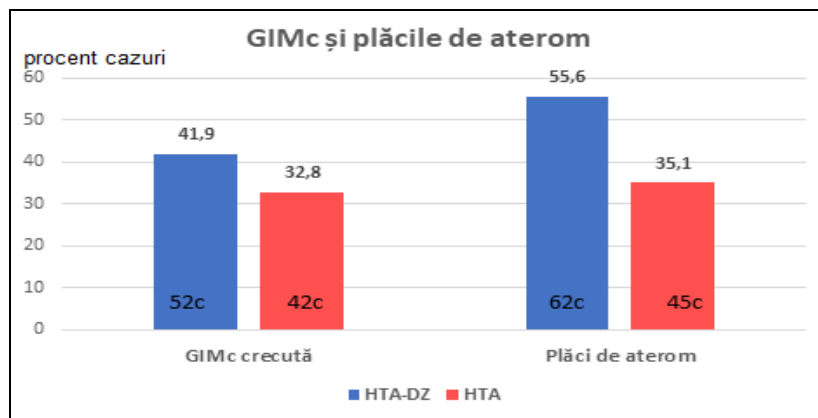


Figure 9.44. Intimate mean carotid thickness and atheroma plates

## 7. CONTRIBUTIONS TO THE ASSESSMENT OF CARDIOVASCULAR AND RENAL ASSOCIATED DISEASES IN HYPERTENSIVE PATIENTS WITH TYPE 2 DZ

A significant proportion of patients with HBP and DZ type 2 had an increased prevalence of cardiovascular, cerebrovascular and chronic kidney disease as shown in Table 4.

Table 4. Comorbidities associated with HBP+DZ type 2 and HTA without DZ

Associated cardiovascular diseases	HBP+DZ		HBP fără DZ		p
	nr	%	nr	%	
Chronic kidney disease	19	15.32	7	5.46	0.01
Coronary heart disease	38	30.64	24	18.75	0.02
Heart failure	27	21.7	7	5.46	0.001
Cerebrovascular diseases	9	7.25	7	5.46	0.08
Atrial fibrillation	19	15.3	6	4.6	0.01
Myocardial infarction	8	6.45	4	3.12	0.06
Peripheral arteriopathy	9	7.25		5.76	0.06
Carotid atherosclerotic plaques	62	55.6	45	35.5	0.05

## 8. PERSONAL CONTRIBUTIONS ON THE IMPLEMENTATION OF HBP THERAPY WITH DZ TYPE 2 AT THE LEVEL OF FAMILY MEDICINE

The patients included in the study followed with all lifestyle change educational programs, in order to promote physical activity at least 30 minutes daily, quitting smoking, excessive alcohol consumption, and, home monitoring of blood pressure and blood glucose. They were trained on healthy nutritional behavior for both hypertension and diabetes,

including weight loss in overweight and obese, dietary counseling, and, reduction of the intake of sodium to 2 grams/day.

Patients were included in care programs and combating risk factors for increasing adherence to treatment, achieving and maintaining therapeutic targets for both HBP and DZ type 2. In order to achieve these objectives, at the medical office level, educational promotion and health control teams made up of health professionals and residents of family medicine, were formed, who have collaborated with specialists cardiologists and nutrition and metabolic diseases.

Hypertensive patients with type 2 DZ typically had a combination of a BSRA associated with a long-acting calcium channel blocker. In triple combination, a thiazide-like diuretic such as indapamide was also given. Conversion enzyme inhibitors were administered most frequently, respectively at 58.6%, followed by diuretics at 43.5%, calcium channel blockers at 33%, beta blockers at 32.2%, respectively, central-acting hypotensors at 7.25% and aldosterone antagonists at 5.6%. They also received 48.3% lipid-lowering treatment and 30.6% anti-aggregate treatment%. All patients received guidance on diet and antidiabetic therapy through nutrition specialists and metabolic diseases. Type 2 DZ therapy benefited from biguanides, sulphonylureas, dipeptidyl peptidase 4 (DPP4) inhibitors, sodium-glucose co-transporter (SGLT2) inhibitors and insulin in uncontrolled cases with ADO. Regarding antidiabetic medication 2 sodium glucose co-transporter inhibitors have a mild diuretic effect, reducing SBP by 3-6 mmHg and DBP by 1-2 mmHg, also providing cardiovascular protection proven by studies.

In patients with BCR and GFR below 45 ml/min/m<sup>2</sup> there is a risk of developing hyperkalaemia, which increases by 8 times if a BSRA or spironolactone is administered. Thiazide diuretics play a role in maintaining volume and reduce the risk of hyperkalemia. When GFR is low <30 ml/min/m<sup>2</sup>, loop diuretics such as furosemide or torasemide are recommended.

## 9. CONCLUSIONS

Research proves the importance of primary care in prophylaxis, early diagnosis and treatment, and, the need for urgent strategies for education and public awareness on risk factors and hypertension and the organization of public health promotion campaigns.

The high, increasing prevalence of HBP associated with DZ type 2, as well as the more severe evolution require those who activate in primary medicine, including primarily family doctors, to be actively involved in the detection, evaluation, treatment and monitoring of these patients. The research presented is the first carried out at the level of family medicine practices in Timis County, aiming to assess the prevalence of HBP association with DZ type 2, CV risk factors, and, socio-economic, biological, clinical and therapeutic characteristics of the enrolled hypertensives from Timis County.

The present study has reached its objective regarding the establishment of the prevalence of HBP with DZ type 2, the elaboration of diagnostic and therapeutic algorithms, as well as the implementation of public educational programs for disease awareness, and, monitoring BP, combating risk factors and increasing adherence to measures on the well-being of the lifestyle of the population. The prevalence of hypertension associated with type 2 diabetes mellitus, assessed at the level of primary medicine in Timis county, was 13.8%. The

increased prevalence of this association can be explained by the characteristics of the population in the study, which frequently showed an unhealthy lifestyle, including increased salt intake (34%), and, sedentary lifestyle (74%), obesity (65%), dyslipidemia (67%) and lack of adherence to drug therapy (37%).

In the group with HBP and DZ type 2 the blood pressure was more severe. Thus the average SBP cabinet was  $155.5 \pm 12.89$  mmHg and DBP  $82.61 \pm 9.08$  mmHg, and at MATA SBP/24h it was  $135.6 \pm 11.66$  mmHg and DBP average was  $82.00 \pm 4.89$  mmHg.

In the HBP group with type 2 DZ, compared to HBP without DZ, statistically significant many risk factors prevailed: abdominal obesity in 82.48%, hypertriglyceridemia in 59.68% and LDLc hyper in 54.03%.

Comorbidities were more commonly found in HBP with DZ type 2: coronary heart disease at 30.64%, chronic kidney disease at 15.32%, heart failure at 21.7%, cerebrovascular disease at 7.25%, and%, atrial fibrillation at 13.3% and peripheral arteriopathy at 7.25%.

Considering that most of the patients with BCR belonged to early stages, when detecting, early treatment measures are simple and cost effective, a rapid diagnosis of BCR in primary care is required

Organ damage was more common in HBP with DZ type 2. Cardiac damage was expressed in ECG by Cornell index, present at 29.8%, HVS by ultrasound in 58%, with altered geometry by concentric remodeling, eccentric hypertrophy and concentric hypertrophy. Diastolic dysfunction was present at 54.8% and systolic dysfunction with FE < 50% to 25%. The prevalence of renal impairment in DZ HBP was 15.3% (compared to 5.46% in HBP), of which the majority (8.6%) belonged to BCR grade 3. The prevalence of BCRs increased with the age of the hypertensive population. The average intimal carotid thickness was increased >0.9 mm to 41.9% of HBP with DZ 2 versus 32.8% in non-diabetics, In HBP with DZ type 2, atheroma plates were present at 55.6% versus 35.1% in HBP.

Another important objective of the study, which was fulfilled, was the development of diagnostic and therapy algorithms to guide and improve the prophylactic, diagnostic and therapeutic activity of family medicine.

Moreover, therapeutic recommendations of the HBP Guide on non-pharmacological recommendations have been implemented. These were transmitted by the medical staff during the sick visits to the medical office or during the visits to the patients' home. Recommendations on lifestyle changes mainly referred to a healthy, hyposodized diet, high in vitamins and low in saturated fatty acids, combating sedentary, alcohol consumption, and, quitting smoking and losing weight in obese We have implemented therapeutic schemes using drugs indicated in HBP and DZ, recommending mandatory BSRA, BCC, diuretics, etc, administered in a dual or triple scheme.

The glycemic control was carried out in collaboration with the diabetes specialist, the patients also benefiting from SGLT2 and DPP4 inhibitors for their cardio-reno-protective effect. A only partial target was poor control of both HBP (39.7%) and DZ (17.3%) among the study population. High non-compliance with therapy, an unsatisfactory result, was due to the side effects of drugs, a large number of tablets, and, co-medication or causes related to improper collaboration between medical professionals and the patient. A good family doctor and patient relationship strengthens their confidence and increases adherence to treatment.

The study demonstrates the need to develop cardiovascular prevention strategies to educate the public about these two common diseases and the serious health implications. Public awareness campaigns on risk factors at the level of schools, universities and industrial units are needed.

The study must be continued in the long term by including a larger number of participants, introducing new diagnostic methods and close collaboration with cardiologists and diabetologists.