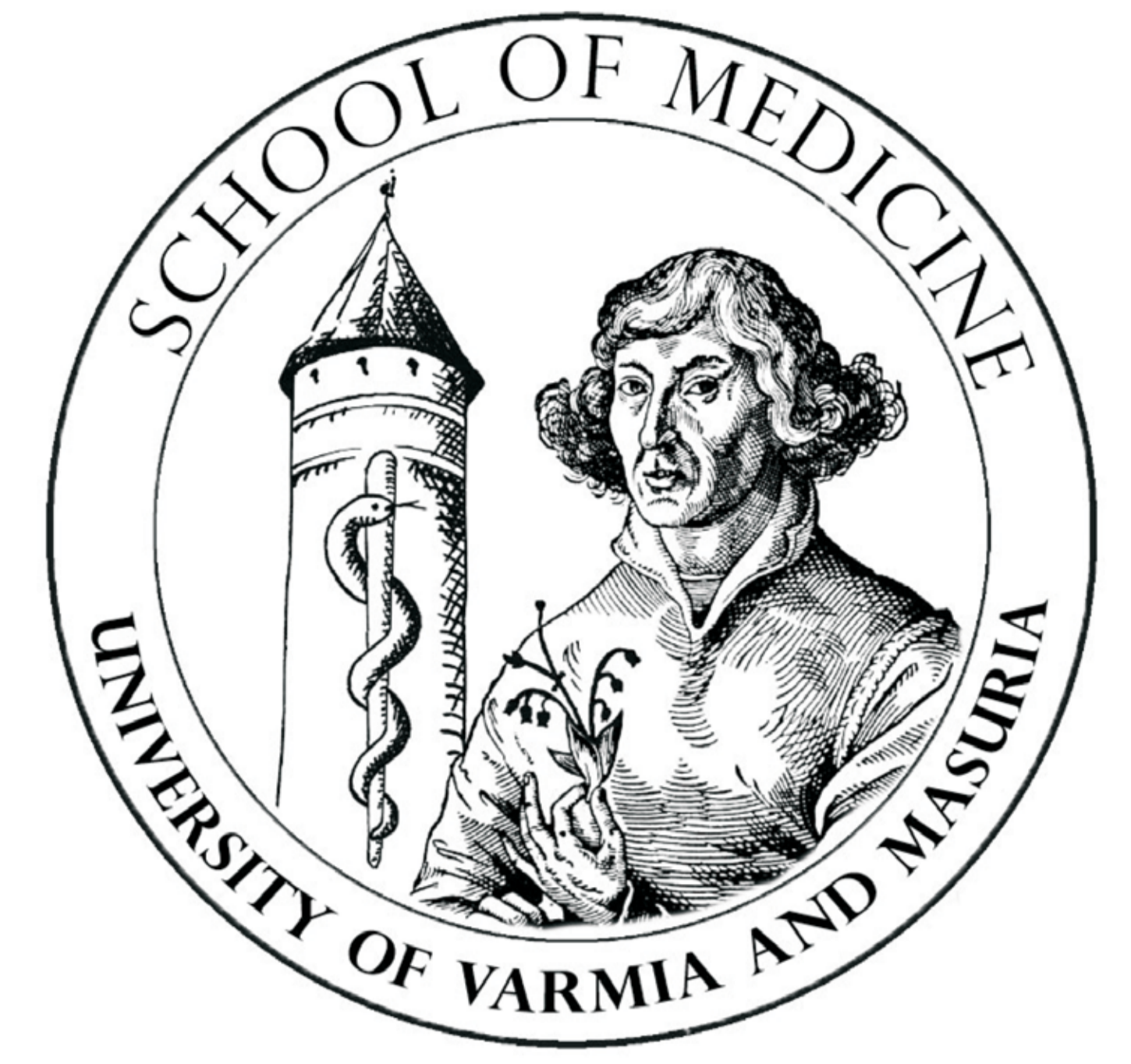


Differences in the risk factors associated with diabetic retinopathy between type 1 and type 2 diabetes mellitus

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INTRODUCTION

- An epidemic of diabetes mellitus (DM), mainly DM2 linked to changing lifestyle, obesity, and increasing age of the population is observed nowadays.
- IDF forecasts a rise from 366 million patients with diabetes worldwide in 2011 to 552 million by 2030.
- There are 3.1 million patients with DM in Poland, 5.2 million of the Polish population have the pre-diabetes status.
- Prevalence of DM in Warmia-Mazury (Poland) is 4.8%.

The Diabetes Atlas, 5th ed. 2011. Available from: <http://www.idf.org/diabetesatlas>. accessed 2014 June 17.

Chicocha A. Type 2 Diabetes mellitus. Choroby cywilizacyjne. 2013; 67:38-40.

- One of the most severe chronic complications is diabetic retinopathy (DR).
- There are many studies on epidemiology and analysis of risk factors of DR.
- However, not many authors compare influence of these factors on DR development between DM1 and DM2 patients.

Scanlon PH, Aldington SJ, Stratton IM. Epidemiological issues in diabetic retinopathy. Middle East Afr J Ophthalmol. 2013 Oct-Dec;20(4):293-300. Wong TY, Mwangi M, Klein R, Larsen M, Flynn H, Hernandez-Medina M, et al. Rates of progression in diabetic retinopathy during different time periods: A systematic review and meta-analysis. Diabetes Care. 2009;32:2307-13.

OBJECTIVE

To examine the risk factors associated with DR in a Warmia and Mazury (Poland) population of adult patients with DM with a particular focus on the differences between patients with DM1 and with DM2.



MATERIALS AND METHODS

This is a cross-sectional study (2011-2013).

The study group consisted of adults patients with DM1 and DM2, diagnosed according to the WHO criteria.

All patients were inhabitants of Warmia and Mazury Region.

Status of eye retina was assessed based on colour fundus imaging.

Risk factors for diabetic retinopathy were evaluated based on the demographic data, medical history, as well as clinical and biochemical parameters related to metabolic control of diabetes.

Demographics

- Age,
- Sex,
- Place of residence

Biochemical parameters

- Glycaemia
- HbA1c
- Cholesterol
- Triglycerides
- Creatinine
- Albumin/Creatinine ratio
- eGFR

CONCLUSIONS

- It was shown that common risk factors for diabetic retinopathy in DM1 and DM2 patients included: diabetes duration, percentage of glycated haemoglobin, triglycerides concentration and cigarette smoking status.
- The risk factor for diabetic retinopathy which differentiated the two studied groups of diabetic patients was the advancement of diabetic kidney disease: in DM1 patients - diabetic kidney disease in G1 chronic kidney disease; in DM2 patients - diabetic kidney disease in G2 chronic kidney disease.
- A significant identified risk factor for diabetic retinopathy in DM2 patients consisted in the level of intensification of anti-diabetic treatment caused by late implementation of insulin therapy.

RESULTS

Characteristics of the study group with DM

	Study group			p	Study group		p
	Total	DM1	DM2		Women	Men	
Number of patients n (%)	1209	315 (26)	894 (74)		639 (53)	570 (47)	
Number of eyes (n)	2418	630	1788		1278	1140	
Age (years); mean (SD)	54.9 (15.79)	37.04 (13.55)	61.2 (11.13)	0.00	56.2 (16.28)	53.5 (15.12)	0.00
Duration of DM (years); mean (SD)	11.0 (8.60)	12.3 (9.78)	10.5 (8.09)	0.03	11.3 (8.72)	10.6 (8.45)	0.09
Age at onset (years)	43.9 (16.33)	24.8 (12.00)	50.6 (11.64)	0.00	44.7 (17.22)	42.9 (15.24)	0.00
Oral drugs (%)	29	0	39		34	24	0.00
Insulin therapy (%)	43	100	25		37	49	0.00
Oral drugs and insulin therapy (%)	28	0	37		29	27	0.43
Medical care (%)	39	48	36	0.45			
GP (%)	61	51	64	0.35			
Place of living (%)	42	26	50	0.00	44	43	0.45
City (%)	28	36	27	0.09	29	30	0.35
Countryside (%)	26	38	23	0.01	27	27	0.40

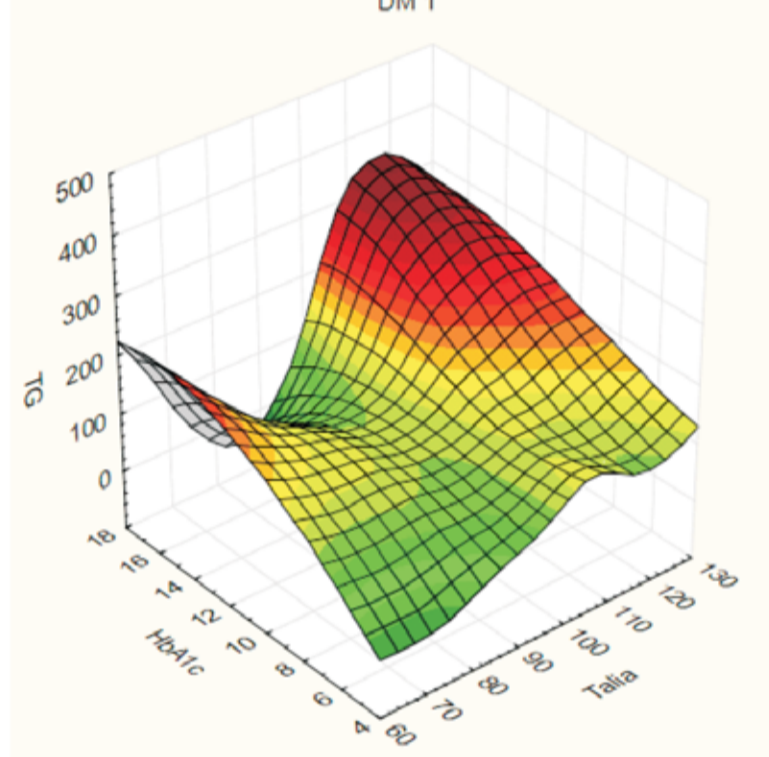
* - statistical significance. DM1 - diabetes mellitus type 1; DM2 - diabetes mellitus type 2; DM - diabetes mellitus; GP - general practitioner

Metabolic control in the study group with DM

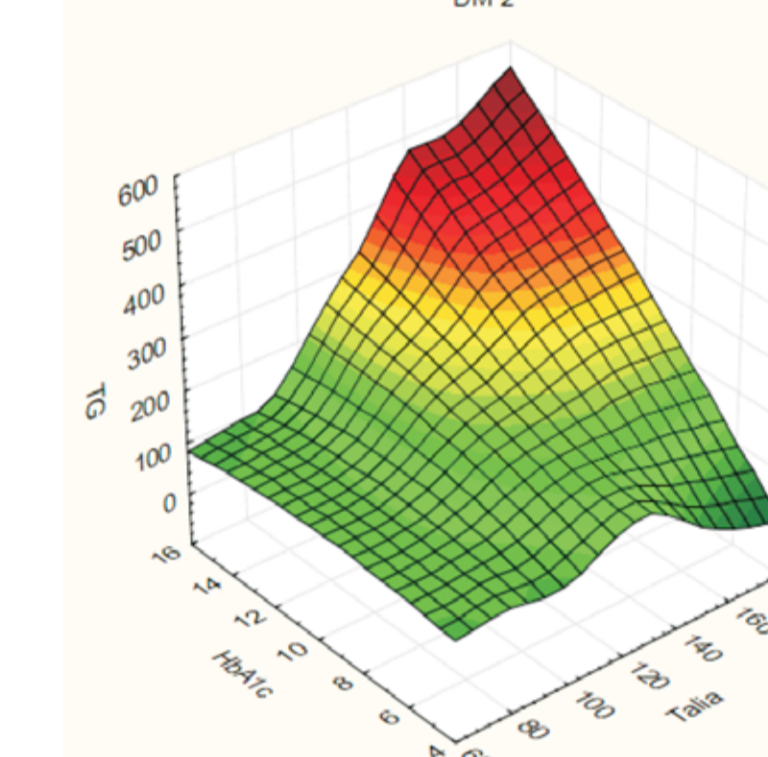
Analysed factors	Study group			p	Study group		p
	Total	DM1	DM2		Women	Men	
HbA1c (%)	8.00 (1.79)	8.44 (2.02)	7.84 (1.67)	0.00	7.9 (1.75)	8.1 (1.83)	0.01
Mean glycaemia (mg/dl)	169.54 (50.11)	181.44 (51.69)	165.10 (48.83)	0.00	166.5 (49.20)	172.8 (50.98)	0.09
Cholesterol (mg/dl)	184.64 (44.14)	182.39 (39.32)	185.42 (45.70)	0.68	184.9 (45.97)	184.3 (45.97)	0.43
TG (mg/dl)	139.84 (83.66)	106.28 (63.97)	151.64 (86.56)	0.00	135.7 (77.47)	144.2 (89.59)	0.22
Creatinine (mg/dl)	1.07 (3.51)	0.85 (0.38)	1.15 (4.12)	0.00	1.0 (3.48)	1.2 (3.54)	0.00
eGFR (ml/min/1.73)	88.81 (25.81)	101.10 (25.80)	84.04 (24.02)	0.00	88.3 (27.07)	89.3 (24.48)	0.15
Albumin/creatinine ratio in urine (mg/mmol)	1.54 (3.09)	0.53 (0.74)	2.08 (3.68)	0.01	1.6 (2.56)	1.5 (3.45)	0.15
Blood pressure (mmHg)	133.38 (17.12)	127.70 (15.15)	135.39 (17.33)	0.00	132.5 (17.94)	134.4 (16.12)	0.01
Systolic (%)	78.90 (9.44)	77.54 (8.97)	79.38 (9.56)	0.01	78.1 (17.94)	79.7 (9.55)	0.00
Diastolic (%)							
BMI (kg/m ²)	28.95 (6.09)	24.24 (4.00)	30.61 (5.82)	0.00	29.1 (17.94)	28.8 (5.82)	0.63
Waist (cm)	98.75 (15.37)	87.06 (10.88)	102.35 (14.76)	0.00	97 (16.18)	100.7 (14.22)	0.00

* - statistical significance

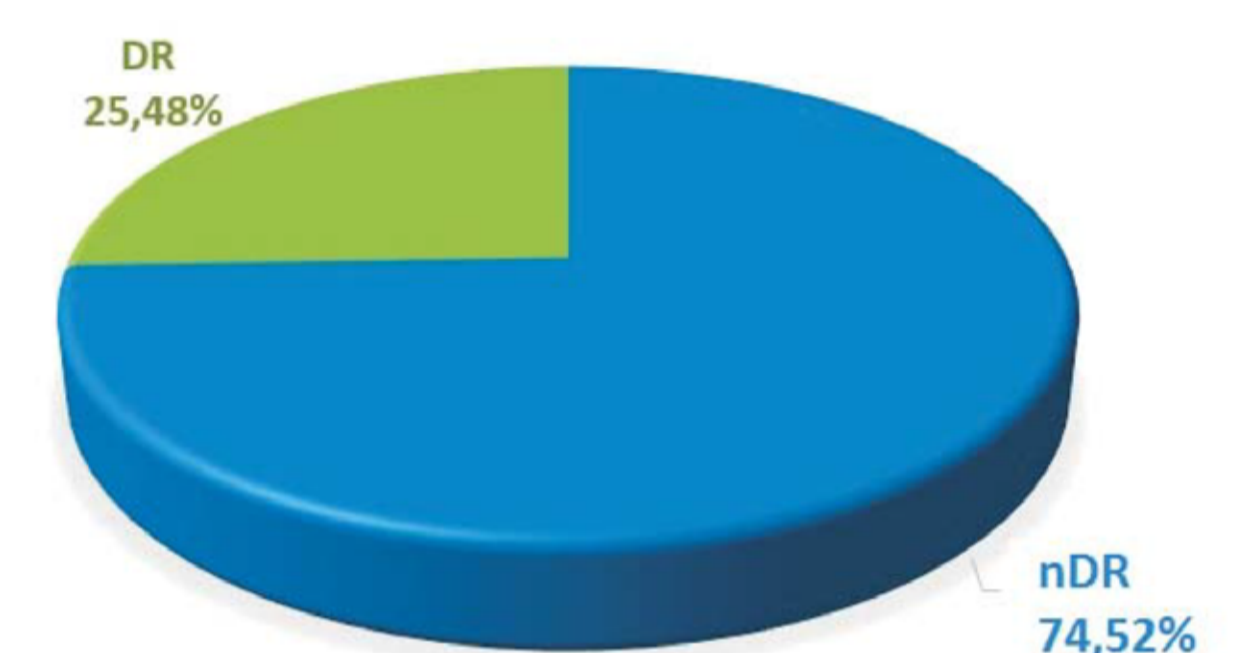
The relationship between the ratio of HbA1c, total cholesterol and BMI in the group of DM1 patients



The relationship between the ratio of HbA1c, total cholesterol and BMI in the group of DM2 patients



Prevalence of diabetic retinopathy in study group



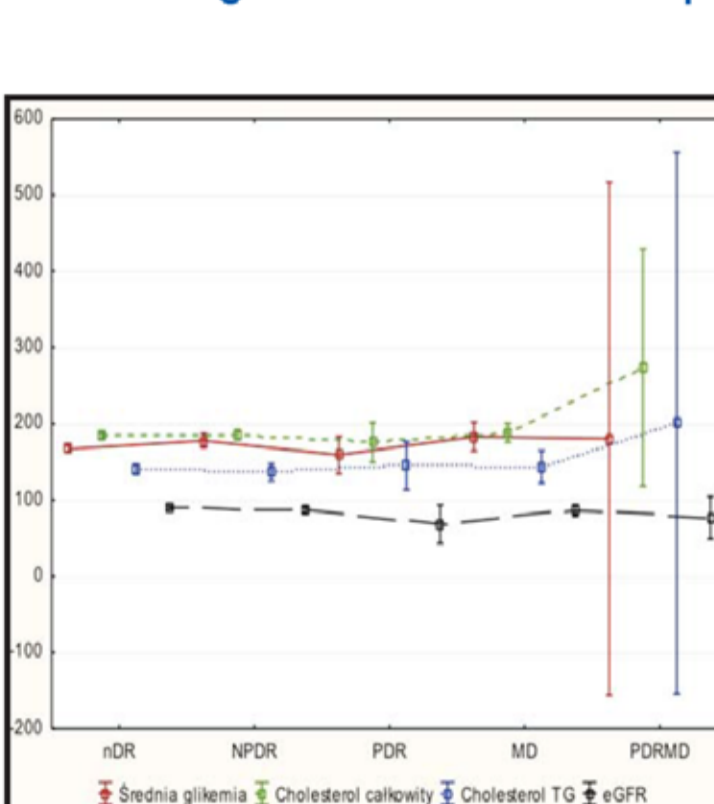
In the group of patients with DM1 has not been shown a close correlation between risk factors of DR. In the group of patients with DM2 has been shown positive correlation between HbA1c, triglycerides and waist circumference.

Characteristics of the study group with and without DR

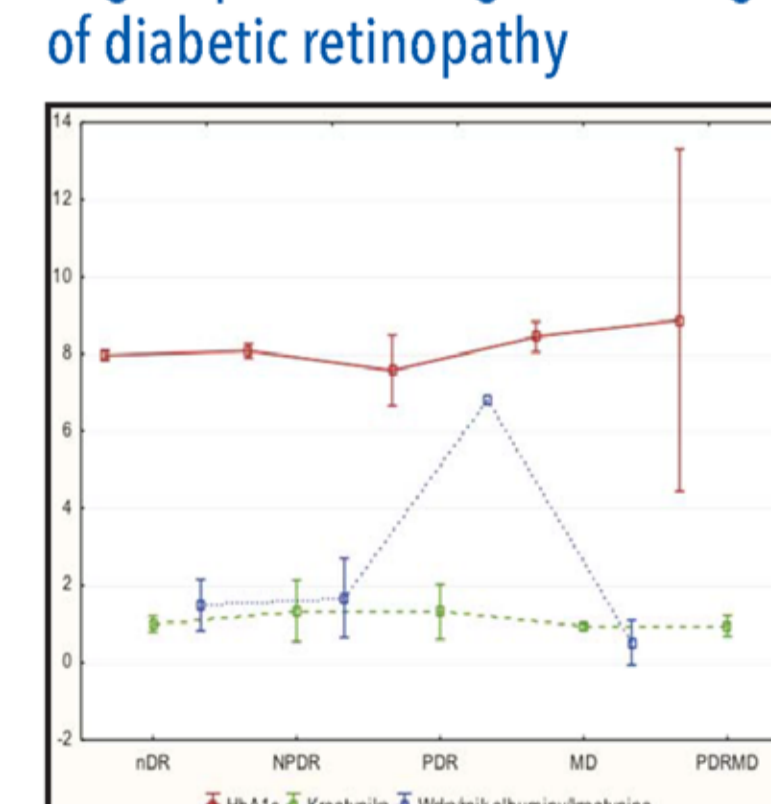
	Study group			p
	Total	With DR	Without DR	
Number of patients n (w %)	1209 (100)	308 (25.48)	901 (74.52)	
Number of eyes (n)	2418	616	1802	
Age	54.9 (15.79)	56.1 (14.18)	54.5 (16.30)	0.45
Duration of DM (years)	11 (8.60)	17.4 (8.72)	8.8 (7.39)	0.00
Age at onset (years)	43.9 (16.33)	38.5 (16.32)	45.7 (15.94)	0.00
Oral drugs (%)	29	13	35	
Insulin therapy (%)	43	53	40	
Oral drugs and insulin therapy (%)	28	34	25	
Medical care (%)	39	39	40	0.45
GP (%)	61	61	60	0.35
Place of living (%)	42	37	44	0.45
City (%)	31	35	29	0.33
Countryside (%)	27	28	27	0.35

* - statistical significance DR - diabetic retinopathy

Mean (SD) of mean blood glucose, total cholesterol, TG, eGFR in groups according to the stage of diabetic retinopathy



Mean (SD) HbA1c, creatinine, albumin/creatinine in urine in groups according to the stage of diabetic retinopathy



Metabolic control in patients with and without DR

Analysed factors	Study group			p
	Total	With DR	Without DR	
HbA1c (%)	8.0±1.79	8.1±1.42	8.0±1.90	0.00
Mean glycaemia (mg/dl)	169.5±50.11	177.4±48.33	166.8±50.49	0.00
Cholesterol (mg/dl)	184.6±44.14	186.6±45.1	183.9±43.79	0.49
TG (mg/dl)	139.8±83.66	138.8±75.74	140.2±86.42	0.57
Creatinine (mg/dl)	1.1±3.51	1.2±4.84	1.0±2.89	0.11
eGFR (ml/min/1.73)	88.8±25.81	85.7±26.39	90.0±25.52	0.02
Albumin/creatinine in urine (mg/mmol)	1.5±3.09	1.7±2.78	1.5±3.22	0.35
Blood pressure (mmHg)	133.4±17.12	135.6±19.51	132.6±16.17	0.04
Systolic (%)	78.9±9.44	78.3±9.47	79.1±9.43	0.12
Diastolic (%)				
BMI (kg/m ²)	28.9±6.09	28.4±5.69	29.1±6.21	0.11
Waist (cm)	98.7±15.37	98.1±15.47	99.0±15.35	0.55

* - statistical significance DR - diabetic retinopathy

The correlation coefficients for the variables in DM1 patients with DR

	Duration of DM	BMI	Waist	Mean glycaemia	HbA1c	Cholesterol	TG	Creatinine	eGFR	Alb/creat ratio	Systolic BP
BMI	0.089	1.000									
Waist (cm)	-0.058	0.677*	1.000								
Mean glycaemia	0.051	-0.458*	-0.509*	1.000							
HbA1c	-0.164	-0.475*	-0.360*	0.772*	1.000						
Cholesterol	0.132	-0.262	-0.477	0.390	0.193	1.000					
TG	-0.381	-0.084	-0.176	0.452	0.530*	0.588*	1.000				
Creatinine	-0.065	-0.034	-0.185	-0.158	-0.164	-0.293	-0.268	1.000			
eGFR	-0.002	-0.087	-0.390	0.509*	0.231	0.468	0.489	-0.625*	1.000		
Alb/creat ratio	0.145	-0.075	-0.270	-0.228	-0.159	0.120	-0.179	0.045	-0.149	1.000	
Systolic BP	-0.079	-0.010	0.197	-0.176	-0.353	-0.200	-0.396	0.654*	-0.171	0.136	1.000
Diastolic BP	0.460	-0.197	0.039	0.222	0.338	-0.213	-0.240	0.472	-0.387	-0.017	0.236

* - statistical significance

Analysis of mean and standard deviations of studied parameters depending on the severity of DR showed the difference only for HbA1c (p<0.05).

The correlation coefficients for the variables in DM2 patients with DR

	Duration of DM	BMI	Waist	Mean glycaemia	HbA1c	Cholesterol	TG	Creatinine	eGFR	Alb/creat ratio	Systolic BP
BMI	0.001	1.000									
Waist (cm)	0.036	0.903*	1.000								
Mean glycaemia	-0.182	0.347*	0.417*	1.000							
HbA1c	-0.237	0.222	0.263	0.758*	1.000						
Cholesterol	-0.154	-0.196	-0.204	-0.068	0.025	1.000					
TG	-0.108	0.370*	0.398*	0.461*	0.439*	0.340	1.000				
Creatinine	0.046	0.158	0.283	-0.110	0.021	-0.160	-0.090	1.000			
eGFR	-0.031	-0.201	-0.253	0.063	-0.022	0.244	-0.037	-0.837*	1.000		
Alb/creat ratio	0.014	0.281	0.357*	0.362*	0.106	0.035	0.351*	0.051	-0.106	1.000	
Systolic BP	-0.402*	0.042	0.065	0.116	0.048	0.050	0.168	0.127	-0.074	0.183	1.000
Diastolic BP	-0.584*	-0.269	-0.229	0.026	0.044	0.063	0.177	-0.079	0.044	0.035	0.469*

* - statistical significance

Risk factors of DR base on logit models in the group of DM1 and DM2

Model	Intercept (SE)	Duration of DM (SE)	Albumin/creatinine ratio (SE)	eGFR (SE)	HbA1c (SE)	Smoking (SE)	Therapy (SE)
DM1							
1	-9.50*	0.17*	1.06*	0.04			
	(2.75)	(0.06)	(0.61)	(0.02)			
2	-58.77*	0.25*	0.82	0.07*			
	(6.38)	(0.09)	(0.73)	(0.02)			
3	4.55	0.16*	1.05*	0.04			
	(3.99)	(0.06)	(0.31)	(0.02)			
4	-4.57*	0.09*	0.01*	0.26*			
	(1.13)	(0.02)	(0.008)	(0.09)			
DM2							
1	-1.76	0.11*	0.05	-0.02			
	(1.57)	(0.04)	(0.09)	(0.02)			
2	-38.73*	0.10*	0.04	-0.02			18.55*
	(1.21)	(0.04)	(0.09)	(0.02)			(0.55)
3	-3.77*	0.14*	0.02	-0.03			-1.12*
	(1.54)	(0.06)	(0.11)	(0.02)			(0.55)
4	-4.74*	0.09*	-0.02*	0.26*			
	(1.07)	(0.02)	(0.01)	(0.09)			

* - Indicates that the explanatory variable significantly affects the dependent variable of the model.