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Association of body composition parameters with aortic elastic properties in newly diagnosed type 2 diabetics

TURGUT KARABAG[1], IŞIL ISEL[2], SENA HEKİMOGLU USTABAS[2], ŞEBNEM JAVADOVA[1], ÖZGÜR CAN USTA[1], ONURCAN TURK[1], AHMET OZ[1], M SAİT ALTİNTAS[1]

[1] Saglik Bilimleri University, Istanbul Education and Research Hospital, Department of Cardiology
[2] Saglik Bilimleri University, Istanbul Education and Research Hospital, Department of Internal Medicine, Istanbul, Turkey

Abstract

Background: In individuals with type 2 diabetes mellitus (T2DM), impairments in aortic elastic functions due to vascular remodeling and changes in cardiac morphology and function are observed from the time of diagnosis.

Objective: This study investigated alterations in aortic elastic functions in newly diagnosed T2DM patients using transthoracic echocardiography (TTE) and explored their association with various body composition parameters.

Materials and Methods: A total of 273 newly diagnosed diabetic patients (144 females; mean age: 50.7±12.2 years) and 139 control subjects without any detected diseases (90 females; mean age: 47.1±8.5 years) were included in the study. Echocardiographic parameters and aortic elastic properties were evaluated using TTE. Body composition indices, including Body Mass Index, Waist-to-Hip Ratio, Tri-Ponderal Mass Index (TMI), Visceral Adiposity Index, Body Shape Index, Body Roundness Index, Body Adiposity Index, and Cardiometabolic Index were calculated for all participants.

Results: When aortic elastic parameters were evaluated, aortic strain and aortic distensibility were significantly lower in Group 1 compared to Group 2, while the aortic stiffness index was significantly higher in Group 1. Aortic elastic parameters were significantly correlated with most of all body composition indices except for BSI, with the highest correlation observed with TMI (AS; rho=0.490, ASI; rho=0.456, AD; 0.516; $p<0.001$).

Conclusion: In newly diagnosed T2DM patients, aortic elastic functions are impaired at the time of diagnosis compared to the normal population. Among body composition indices; the most significant association was found with TMI. TMI may be considered a potential screening tool not only for evaluating aortic elastic functions but also for identifying other atherosclerotic processes.

Keywords: Type 2 diabetes, aortic elastic properties, tri-ponderal mass index.

INTRODUCTION

Atherosclerotic cardiovascular diseases (ASCVD) remain the leading cause of mortality and morbidity among diabetic patients, particularly those with type 2 diabetes mellitus (T2DM) [1]. Reducing the burden of ASCVD in diabetic patients is a critical clinical necessity to lower mortality, prevent related morbidities, and improve quality of life [2]. Structural changes in the arterial wall caused by diabetes negatively affect the elastic properties of arteries [3,4]. Furthermore, it is known that prediabetic states similarly lead to impairments in aortic elastic properties [4,5]).

Studies have demonstrated significant associations between increased total fat mass and its distribution with insulin resistance, glucose intolerance, and heightened risks of diabetes and cardiovascular diseases [6]. Body fat distribution, even in normal-weight elderly adults, is closely linked to metabolic syndrome [7]. While anthropometric measurements such as body mass index (BMI) and waist-to-hip ratio (WHR) are commonly used to define abdominal obesity, numerous body composition indices have been developed. However, it remains unclear which parameter is most effective in predicting and defining cardiovascular risk and metabolic disorders [8].

This study investigates the aortic elastic parameters in newly diagnosed T2DM patients and explores their association with various body composition indices.

MATERIALS AND METHODS

PATIENT SELECTION

The study included 273 patients (Group 1; 129 males, 149 females; mean age: 50.7 ± 12.2 years) newly diagnosed with diabetes based on evaluations conducted after presenting to our cardiology and internal medicine outpatient clinics for various complaints. Additionally, 139 control subjects (Group 2; 49 males, 90 females; mean age: 47.1 ± 8.5 years) with no identified diseases during their assessments were included. Detailed medical histories were obtained for all participants, and current and previous medication use information was recorded. Comprehensive physical examinations were performed for each subject. Blood pressure was measured using a sphygmomanometer after 5 minutes of rest in a seated position, and pulse rates were documented.

The diagnosis of diabetes was based on the following criteria: fasting glucose ≥7.0 mmol/L (≥126 mg/dL), HbA1c ≥48 mmol/mol (≥6.5%), or 2-hour glucose during an oral glucose tolerance test (OGTT) ≥11.1 mmol/L (≥200 mg/dL). Electrocardiograms (ECGs) were obtained for all participants. In the presence of symptoms suggestive of coronary artery disease, patients were examined for the presence of coronary artery disease. Patients whose test results suggested the presence of coronary artery disease were excluded from the study.

The diagnosis of diabetes was confirmed with one laboratory test in the presence of symptoms or with two separate laboratory tests in the absence of symptoms [9].

LABORATORY PARAMETERS

Venous blood samples were collected from all participants after 8 hours of fasting. The following parameters were measured: fasting blood glucose, urea, creatinine, lipid panel (total cholesterol, triglycerides, low-density lipoprotein, high-density lipoprotein), liver enzymes (aspartate aminotransferase, alanine aminotransferase), and C-reactive protein using the Roche Diagnostics Cobas 8000 c702 analyzer. HbA1c levels were measured with the Arkray ADAMS™ A1c HA-8180V Analyzer, while insulin levels were determined using the Roche Diagnostics Cobas 8000 c602 system. Additionally, complete blood counts were measured with the Mindray BC-6800 Plus analyzer.

Insulin resistance was quantified using the Homeostatic Model Assessment (HOMA-IR) formula:

HOMA-IR= Fasting glucose (mg/dL)×Fasting insulin (mU/L)/405

Informed consent was obtained from all participants. Study was approved by the local ethics committee of our hospital (approval number: 397).

BODY COMPOSITION INDICES

All participants' height, weight, waist circumference, and hip circumference were measured. Waist circumference was measured at the level of the umbilicus while the patient stood upright with arms extended laterally, using a measuring tape to combine the midpoint of the subcostal margin on each side. Hip circumference was measured by aligning the tape around the most prominent part of the gluteal region and the symphysis pubis.

Body Mass Index (BMI) was calculated as weight in kilograms divided by the square of height in meters:

$$BMI = \text{weight (kg)} / \text{height (m}^2\text{)}$$

The waist-to-height ratio (WHtR) and waist-to-hip ratio (WHR) were calculated from the waist and hip measurements. Other body composition indices were computed using the following formulas:

Tri-Ponderal Mass Index (TMI)

$$TMI = \text{weight (kg)} / \text{height (m}^3\text{)}$$ [10]

Visceral Adiposity Index (VAI):

For men:

$$VAI = (\text{WC (cm)} / (39.68 + (1.88 \times \text{BMI}))) \times (\text{TG (mg/dL)} / 1.03) \times (1.31 / \text{HDL (mg/dL)})$$

For women:

$$VAI = (\text{WC (cm)} / (36.58 + (1.89 \times \text{BMI}))) \times (\text{TG (mg/dL)} / 0.81) \times (1.52 / \text{HDL (mg/dL)})$$ [11]

Body Shape Index (BSI):

$$BSI = \text{WC} / (\text{BMI } 2/3) \times \text{Height } 1/2)$$ [12]

Body Roundness Index (BRI):

$$BRI = 364.2 - 365.5 \times \sqrt{(1 - [(\text{waist circumference in centimeters (cm)} / 2\pi)^2 / (0.5 \times \text{Height (cm)})^2])}$$ [13]

Body Adiposity Index (BAI):

BAI = (Hip Circumference (cm) / Height (m) 1.5) – 18 [14]

Additionally, the **Cardiometabolic Index (CMI)**, a relatively novel marker for assessing cardiovascular risk, was calculated as: CMI = WtHR × TG (mmol L−1)/HDL-C (mmol L−1) [15]

TRANSTHORACIC ECHOCARDIOGRAPHY AND AORTIC ELASTIC FUNCTIONS

All transthoracic echocardiographic examinations were performed using the Philips EPIQ 7 echocardiography system (Philips Healthcare, 3000 Minuteman Road, Andover, MA, USA) with a 2.5–3.5 MHz transducer. M-mode recordings were conducted at 50 mm/s, and Doppler recordings at 100 mm/s. Evaluations were carried out in the left lateral decubitus position, and measurements included LV internal dimensions, wall thickness and EF measured with the biplane Simpson method were assessed according to recent guidelines for chamber quantification [16]. Tissue Doppler imaging parameters (S', systolic; E,' early diastolic; A,' late diastolic myocardial velocities) were measured at the lateral, septal, and tricuspid annuli. All measurements were recorded as the average of two separate measurements.

To obtain aortic elastic parameters, ascending aortic M-mode echocardiographic recordings were acquired from the parasternal long-axis view, approximately 3 cm above the aortic valve. The systolic aortic diameter (AoS) was measured when the aortic valve was fully open. At the same time, the diastolic aortic diameter (AoD) was measured at the end of the diastole, at the peak of the QRS complex on the ECG, using the distances between the inner edges of the anterior and posterior walls of the vessel. Aortic elastic parameters were calculated using aortic diameters and systolic (SBP) and diastolic blood pressure (DBP) values with the following formulas:

Aortic strain (%)

$$\text{Aortic strain} = 100 \times (\text{AoS} - \text{AoD}) / \text{AoD}$$

Aortic stiffness index

$$\text{Aortic stiffness index} = \ln(\text{SBP} / \text{DBP}) / \text{Aortic strain}$$

Aortic distensibility ($cm^2/dyn/10^3$)

$$\text{Aortic distensibility} = (2 \times \text{Aortic strain}) / \text{Pulse pressure}$$ [17]

STATISTICAL ANALYSIS

All data were recorded in the "IBM SPSS (Statistical Package 27 Social Sciences) Statistics 25" program. The suitability of the variables to normal distribution was examined using histogram graphics and the Kolmogorov-Smirnov test. Mean, standard deviation and median values were used when presenting descriptive analyses. An independent T-test was used to compare continuous variables between groups if the distribution was expected, and the Mann-Whitney U test (MU) was used if the distribution was abnormal. Spearman correlation tests were used in the comparative analysis of the measurement data. In order to eliminate the lack of balance between the groups, demographic characteristics, body composition parameters and aortic elastic properties, which are among the variables predicting new diabetes mellitus diagnosis in binary regression analysis, were evaluated with univariate analysis. Those with significant p values were evaluated with multivariate analysis. Odds ratio (OR) and 95% confidence interval (CI) were calculated In order to identify independent determinants of aortic elasticity parameters, multivariate linear regression analyses were performed. Results with a P-value below 0.05 were considered statistically significant.

RESULTS

Table 1 compares demographic data between groups. In Group 1, age, systolic and diastolic blood pressure, and heart rate were significantly higher compared to Group 2. All body composition indices, except for BSI, were significantly higher in Group 1 (Table 1). Additionally, the rates of female sex, hypertension, hyperlipidemia, and obesity were significantly higher in Group 1 (Table 1). Among diabetic patients, 153 were classified as obese and 78 as overweight.

When laboratory parameters were evaluated, glycemic parameters were predictably worse in the diabetic group (Table 1). Total cholesterol (TC), triglycerides (TG), and LDL-C levels were significantly higher in Group 1, while HDL-C levels were significantly lower (Table 1). AST and ALT levels were also significantly higher in Group 1 compared to Group 2. While urea and creatinine levels were similar between groups, CRP was significantly higher in Group 1 (Table 1).

Table 1

Comparison of demographic, laboratory and body composition parameters between the groups

	Group 1 (n=273)	Group 2 (n=139)	p
Age (year)	50.6 ± 10.2	44.1 ± 8.6	<0.001
Gender (F, n-%)	144 - 52.7	90 - 64.7	0.020
Obesity (n-%)	153 - 56	2 – 1.4	<0.001
Smoking (n-%)	99 - 36.3	62 – 44.6	0.101
BMI (kg/ m^2)	30.9 ±5.6	235.6 ± 2.9	<0.001
WC (cm)	107.2 ±11.5	89.1 ±11.3	<0.001
HC (cm)	109.9 ±11.0	99.7 ± 7.2	<0.001
Waist to Height ratio	0.65±0.08	0.53±0.06	<0.001
Waist to Hip ratio	0.97±0.06	0.89±0.08	<0.001
TPI	18.8±3.9	14.2±2.0	<0.001
VAI	4.14±8.35	1.43±0.85	<0.001
BSI	0.08±0.05	0.08±0.02	0.368
BRI	6.74±2.01	4.12±1.35	<0.001
BAI (%)	40.3±9.3	28.5±4.5	<0.001
CMI	3.86±8.90	1.01±0.64	<0.001
SBP (mm/Hg)	138.7 ±19.5	120.8 ±15.3	<0.001
DBP (mm/Hg)	84.2 ±12.5	73.8 ±12.1	<0.001
Heart Rate (/dk)	84.9 ±12.8	78.5±8.5	<0.001
Glucose (mg/dL)	184.9 ± 79.3	90.8 ± 7.1	<0.001
Urea (mg/dL)	27.7 ±8.1	26.9 ± 8.2	0.427
Creatinine (mg/dL)	0.72 ±0.16	0.72 ±0.14	0.837
AST (U/L)	21.8 ±13.1	18.5 ±8.3	0.025
ALT (U/L)	30.2 ±26.8	17.2 ±11.5	<0.001
Total Cholesterol (mg/dL)	211.7 ± 58.7	194.3 ±37.6	0.090
HDL (mg/dL)	45.2 ±13.9	56.8 ±13.5	<0.001
LDL (mg/dL)	127.9 ±40.5	117.8 ±33.2	0.0360
Triglyceride (mg/dL)	201.3 ±149.0	97.5±41.1	<0.001
HbA1c (%)	8.78 ±2.35	5.39 ±0.29	<0.001
Insulin (mU/L)	12.9 ± 8.3	8.1 ± 4.4	0.004
Homa-IR	5.37 ± 3.72	1.85 ±1.06	<0.001
CRP (mg/L)	6.84±6.95	2.10±2.57	<0.001
WBC (10^9 /L)	8.05 ±2.32	6.80 ±1.97	0.011

Abbrevations: BMI: Body mass index, WC: Waist circumference, HC: Hip circumference, TPI: Tri ponderal index, VAI: Visceral adiposity index, BSI: Body shape index, BRI: Body roundness index, BAI: Body adiposity index, CMI: Cardiometabolic index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, AST: Aspartate Transaminase, ALT: Alanine Transaminase, LDL: Low Density Lipoprotein, HDL: High Density Lipoprotein, HbA1c: Glycated Hemoglobin, CRP: C-Reactive Protein, Homa-IR: Homeostatic Model Assessment-Insulin Resistance, WBC: White Blood Cell

Echocardiographic parameters revealed that left ventricular wall thickness and left atrial diameter were significantly higher in Group 1 compared to Group 2 (Table 2). Among parameters reflecting diastolic function, the E/A ratio was significantly lower in Group 1, while lateral and septal E/E ratios were significantly higher (Table 2). The ejection fraction was also significantly lower in Group 1 compared to Group 2.

When aortic elastic parameters were evaluated, aortic strain and aortic distensibility were significantly lower in Group 1 than in Group 2, whereas the aortic stiffness index was significantly higher in Group 1 (Table 2).

Spearman correlation analysis demonstrated that aortic elastic parameters were significantly correlated with almost all body composition indices except for BSI. The highest correlation was observed with TPI (Table 3). Additionally, aortic elastic parameters were significantly correlated with glycemic parameters (Table 3).

Parameters that can predict diabetes were included in the univariate analysis as age, gender, SBP, DBP, body composition parameters, aortic elastic properties (ASI, AS, AD). Significant results are given in Table 4. Multivariate analysis was performed on the parameters that were significant in univariate. In the multivariate logistic regression analysis, ASI (Odds ratio (OR): 1.884, 95% confidence interval (CI): 1.295–2.741, p = 0.001)) and BMI (Odds ratio (OR): 1.752, 95% confidence interval (CI): 1.215–2.526, p = 0.003)) were found to be independent predictors of newly diagnosed diabetes (Table 4).

The multivariate linear regression analysis identified TPI, WC, and HC as independent risk factors for all aortic elasticity parameters. Moreover, waist-to-hip ratio and BRI were independent risk factors for aortic stiffness, BRI and BAI for aortic distensibility, and BAI for aortic strain (Table 5).

Table 2

Comparison of conventional echo parameters, diastolic and systolic functions, aortic elastic properties in newly diagnosed type 2 DM patients and control groups

	Group 1 (n=273)	Group 2 (n=139)	p
EF (%)	62.7 ±2.5	68.6 ± 1.8	<0.001
LVESD (cm)	2.58 ±0.43	2.42 ±0.32	<0.001
LVEDD (cm)	4.59 ±0.42	4.51 ±0.38	0,068
IVS (cm)	1.11 ±0.19	0.85 ±0.14	<0.001
PW (cm)	1.10 ±0.47	0.86 ±0.13	<0.001
Aortic root diameter (cm)	2.70 ±0.33	2.45 ±0.30	<0.001
Left atrium diameter (cm)	3.51 ±0.38	3.12 ±0.38	<0.001
Mitral E (m/sec)	0.65 ±0.15	0.72 ±0.17	<0.001
Mitral A (m/sec)	0.78 ±0.15	0.668 ±0.16	<0.001
Mitral EDT (ms)	234.7 ±59.6	186.9 ±37.7	<0.001
E/A	0.87 ±0.29	1.38 ±0.20	<0.001
E/E' lateral	7.63 ±2.54	6.47 ±1.74	<0.001
E/E' septal	10.40 ±2.83	8.33 ±1.82	<0.001
Aortic strain (%)	6.53±3.98	14.8±6.02	<0.001
Aortic stiffness index	1.15±0.93	0.39±0.19	<0.001
Aortic distensibility ($cm^2/dyn^1/10^3$)	2.61±1.87	6.56±3.24	<0.001

EF: Ejection Fraction, LVESD: Left Ventricular End Systolic Diameter, LVEDD: Left Ventricular End Diastolic Diameter, IVS: Interventicular Septum, PW: Posterior Wall, EDT: E Wave Deceleration Time, E': Early Diastolic Forward Flow Velocity

Table 3

Spearman correlation of aortic elastic properties with body composition and glycemic parameters

AS	Rho	P	ASI	Rho	P	AD	Rho	P
BMI (kg/ m^2)	-0.365	<0.001		0.317	<0.001		-0.383	<0.001
WC	-0.375	<0.001		0.320	<0.001		-0.390	<0.001
HC	-0.265	<0.001		0.214	<0.001		-0.269	<0.001
WtHeightR	-0.366	<0.001		0.316	<0.001		-0.384	<0.001
WtHipR	-0.352	<0.001		0.316	<0.001		-0.366	<0.001
TPI	-0.490	<0.001		0.456	<0.001		-0.516	<0.001
VAI	-0.383	<0.001		0.334	<0.001		-0.366	<0.001
BSI	-0.010	0.978		-0.110	<0.001		-0.005	<0.001
BRI	-0.366	<0.001		0.318	<0.001		-0.385	<0.001
BAI	-0.361	<0.001		0.317	<0.001		-0.345	<0.001
CMI	-0.441	<0.001		0.392	<0.001		-0.432	<0.001
HbA1c (%)	-0.471	<0.001		0.442	<0.001		-0.481	<0.001
Glucose	-0.474	<0.001		0.437	<0.001		-0.476	<0.001

Abbrevations: BMI: Body mass index, WC: Waist circumference, HC: Hip circumference, TPI: Tri ponderal index, VAI: Visceral adiposity index, BSI: Body shape index, BRI: Body roundness index, BAI: Body adiposity index, CMI: Cardiometabolic index

Table 4

Binary regression analysis in order to eliminate potential bias in regard to demographic characteristics between the groups

	Univariate			Multivariate		
	OR	95% CI	P value	OR	95% CI	P value
Age	1.039	1.016 - 1.062	0.001	0.818	0.640 - 1.046	0.109
Gender, female	0.608	0.399 - 0.926	0.021			
Aortic stiffness index	1.729	1.501 - 1.979	<0.001	1.884	1.295 - 2.741	0.001
Aortic strain	0.966	0.959 - 0.972	<0.001			
Aortic distensibility	0.931	0.917 - 0.945	<0.001			
SBP	1.064	1.048 - 1.081	<0.001			
DBP	1.072	1.051 - 1.093	<0.001			
WC	1.158	1.125 - 1.192	<0.001			
HC	1.136	1.101 - 1.172	<0.001			
BMI	1.478	1.363 - 1.601	<0.001	1.752	1.215 - 2.526	0.003
Waist to Height ratio	8.905	5.695 - 13.923	<0.001			
Waist to Hip ratio	5.005	3.434 - 7.293	<0.001			
VAI	3.248	2.411 - 4.376	<0.001			
BRI	2.648	2.162 - 3.244	<0.001			
BAI	1.303	1.191 - 1.425	<0.001			

Abbrevations: SBP: Systolic blood pressure, DBP: Diastolic blood pressure, BMI: Body mass index, WC: Waist circumference, HC: Hip circumference, TPI: Tri ponderal index, VAI: Visceral adiposity index, BSI: Body shape index, BRI: Body roundness index, BAI: Body adiposity index, CMI: Cardiometabolic index

Table 5

Linear regression analysis to determine the relation between aortic elastic properties with body composition parameters

Table Multivariate Linear Regression Analysis for Aortic Elasticity Parameters					
	B	**Standard Error**	**Beta**		
Variables	**Dependent variable**		**Aortic stiffness**	***t***	***P***
TPI	0.073	0.011	0.745	6.802	<0.001
Waist to Hip ratio	-24.854	9.764	-1.882	-2.545	0.012
BRI	-0.174	0.083	-0.432	-2.105	0.037
WC (cm)	0.281	0.099	4.151	2.831	0.005
HC (cm)	-0.255	0.089	-3.177	-2.874	0.005
	Dependent variable		**Aortic strain**		
TPI	-0.458	0.83	-0.649	-5.537	<0.001
VAI	-0.799	0.418	-0.152	-1.911	0.058
BRI	3.141	1.672	1.075	1.878	0.062
BAI	-0.725	0.355	-0.796	-2.042	0.043
WC (cm)	-0.507	0.232	-1.034	-2.183	0.031
HC (cm)	-0.507	0.172	0.873	2.945	0.004
	Dependent variable		**Aortic distensibility**		
TPI	-0.243	0.042	-0.666	-5.743	<0.001
Waist to Hip ratio	74.469	40.498	1.507	1.839	0.068
BRI	2.256	0.965	1.495	2.337	0.021
BAI	-0.499	0.201	-1.061	-2.487	0.014
WC (cm)	-1.062	0.462	-4.191	-2.297	0.023
HC (cm)	0.968	0.403	3.222	2.402	0.018

Abbrevations: BMI: Body mass index, WC: Waist circumference, HC: Hip circumference, TPI: Tri ponderal index, VAI: Visceral adiposity index, BSI: Body shape index, BRI: Body roundness index, BAI: Body adiposity index, CMI: Cardiometabolic index

DISCUSSION

The main findings of our study indicate that aortic elastic functions are impaired in newly diagnosed type 2 diabetic (T2DM) patients compared to the normal population. These impaired functions are associated with glycemic parameters and are significantly related to body composition indices, with the strongest correlation observed for the Tri-Ponderal Mass Index (TPI).

The factors determining the elastic functions of the aorta are primarily the balance between elastin and collagen content in the arterial wall. A shift in this balance toward collagen leads to increased arterial stiffness, one of the earliest indicators of atherosclerosis in the vascular wall [18,19]. Several mechanisms contribute to the deterioration of arterial elasticity, including endothelial dysfunction and impaired nitric oxide-mediated vasodilation originating from the endothelium. In T2DM, insulin resistance, and hyperglycemia activate the renin-angiotensin-aldosterone system, increasing the expression of type 1 angiotensin receptors in vascular tissues, which promotes arterial wall hypertrophy and fibrosis [20–23]. Furthermore, the non-enzymatic glycation of proteins in the arterial wall during chronic hyperglycemia leads to structural and functional changes in the vascular wall [24].

Several studies have investigated elastic functions in diabetic patients. Toutouzas *et al.* demonstrated that aortic elastic functions were impaired in diabetic patients and that this impairment was associated with the duration of diabetes and fasting blood glucose levels [25]. Similarly, Badran *et al.* reported that increased aortic stiffness in patients with type 2 diabetes is an early event that may explain cardiovascular complications in patients with diabetes. Poor glycemic control and duration of diabetes have negative effects on aortic elastic properties [26]. Chen Y *et al.* found a weak correlation between aortic elastic parameters and HbA1c levels [27]. In another study, Fang *et al.* concluded that variability in HbA1c levels was

associated with the progression of aortic stiffness [28]. Dang *et al.* also demonstrated that longer diabetes duration was associated with higher arterial stiffness and lower aortic strain [4]. Similarly, another study showed that aortic elastic functions were more impaired in patients with diabetes for more than seven years compared to those with a shorter diabetes duration [29]. In another study by Song *et al*., they showed that aortic elastic functions were impaired in type 2 diabetics and that this impairment was associated with epicardial adipose tissue, independent of glucose levels [30].

In our study, we focused on newly diagnosed diabetic patients and showed that aortic elastic functions were already impaired at the time of diagnosis compared to the normal population. Additionally, aortic elastic properties were moderately correlated with fasting glucose and HbA1c levels.

Socioeconomic status, smoking, hypertension, sedentary lifestyle, and obesity during adolescence are known to be associated with diabetes [31]. Obesity is considered one of the most critical indicators [31]. While body mass index (BMI) is the most commonly used measurement to define overweight and obesity, its value in reflecting metabolically detrimental body fat is limited [32]. This limitation has led to the development of new body composition indices.

In a study conducted on Brazilian children and adolescents, Ueda *et al.* demonstrated that TPI better predicted excessive body fat accumulation compared to BMI [30], which is consistent with the findings of Wang *et al.* Similarly, De Lorenzo *et al.* showed that TPI not only better reflects body fat percentage but also more effectively defines adiposity compared to BMI [33].

Since T2DM patients are often overweight or obese, a clear body composition parameter to define adiposity in this group has yet to be established [34]. Alfaraidi *et al.* found that TPI correlated better with adiposity and metabolic parameters [34]. In a study conducted in Taiwan, adolescents with persistent increases in TPI were found to have a higher risk of developing diabetes, independent of initial obesity status. The importance of TPI in monitoring growth trajectories in both obese and non-obese young children was also highlighted [35].

CONCLUSION

Our study demonstrated that aortic elastic functions are impaired in newly diagnosed T2DM patients compared to the normal population, even at the time of diagnosis. These elastic functions may represent an early marker of atherosclerosis in diabetic individuals. In the screening of aortic elastic functions in diabetic patients, monitoring body composition indices in addition to glycemic parameters is essential. Among these indices, TPI appears to be the most reliable parameter. TPI could serve as a screening tool not only for aortic elastic functions but also for the development of other atherosclerotic processes. Further large-scale studies are needed on this topic.

Introducere: La persoanele cu diabet zaharat de tip 2 (DZ2), încă de la momentul diagnosticului, se observă afectări ale funcțiilor elastice aortice, determinate de remodelarea vasculară și de modificări ale morfologiei și funcției cardiace. Acest studiu a investigat modificările funcțiilor elastice aortice la pacienții recent diagnosticați cu DZ2, utilizând ecocardiografia transtoracică (TTE), și a analizat asocierea acestora cu diverși parametri ai compoziției corporale.

Metode: În studiu au fost incluși 273 de pacienți recent diagnosticați cu DZ2 (144 femei; vârsta medie: 50,7±12,2 ani) și 139 de martori fără boli diagnosticate (90 femei; vârsta medie: 47,1±8,5 ani). Parametrii ecocardiografici și proprietățile elastice aortice au fost evaluați prin TTE. Pentru toți participanții au fost calculați următorii indici ai compoziției corporale: indicele de masă corporală (IMC), raportul talie-șold (WHR), indicele triponderal de masă (TMI), indicele de adipozitate viscerală (VAI), indicele de formă corporală (ABSI), indicele de rotunjime corporală (BRI), indicele de adipozitate corporală (BAI) și indicele cardiometabolic (CMI).

Rezultate: La evaluarea parametrilor elastici aortici, tensiunea aortică și distensibilitatea aortică au fost semnificativ mai reduse în Grupul 1 comparativ cu Grupul 2, în timp ce indicele de rigiditate aortică a fost semnificativ mai mare în Grupul 1. Parametrii elastici aortici au prezentat o corelație semnificativă cu majoritatea indicilor de compoziție corporală, cu excepția ABSI, cea mai puternică asociere fiind observată cu TMI (tensiunea aortică: rho=0,490; indicele de rigiditate aortică: rho=0,456; distensibilitatea aortică: rho=0,516; p<0,001).

Concluzie: La pacienții recent diagnosticați cu DZ2, funcțiile elastice aortice sunt deja afectate în momentul diagnosticului, în comparație cu populația sănătoasă. Dintre toți indicii de compoziție corporală, TMI a prezentat cea mai strânsă asociere cu aceste modificări. TMI ar putea fi considerat un potențial instrument de screening nu doar pentru evaluarea funcțiilor elastice aortice, ci și pentru identificarea altor procese aterosclerotice.

Correspondence to: Turgut Karabag, MD, Istanbul Egitim Arastırma Hastanesi,
Kardiyoloji Bölümü, Kat:6, Fatih, Istanbul, Turkey
Phone:+90 542 3233425
E-mail: turgutkarabag@yahoo.com

Financial support: None

Conflict of interest: authors declare no conflicts of interest.

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Received 3rd February 2025