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ORIGINAL RESEARCH

Sex Differences in Risk Factors Associated with Coronary Artery Disease: What Does Glycated Albumin Indicate?

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Abstract

Objective: To investigate gender differences in risk factors associated with coronary artery disease (CAD), and to explore the association between glycated albumin (GA) and CAD. **Method:** We recruited 350 adult patients, collected their clinical information and divided them into CAD and non-CAD groups, based on angiography results. **Results:** Patients with CAD showed significantly higher age related GA, fasting blood glucose, serum creatinine (SCr) and Gensini score. Multivariate Logistic regression analysis identified gender, age, superoxide dismutase(SOD) and GA as independent factors in CAD patients ($p < 0.05$) and the mean GA level in females was higher than in males. Univariate linear regression analysis also showed that GA was not associated with male CAD patients. In females, SOD, low-density lipoprotein cholesterol (LDL-c), and GA were associated with a significant Gensini score ($p < 0.05$). Finally, GA was capable of classifying CAD in women (AUC > 0.767; $p < 0.001$). **Conclusion:** GA is positively correlated with the severity of coronary artery obstruction in female patients presenting with CAD.

Keywords

Coronary artery disease, Angiography, Gensini score, Glycated albumin

1. Introduction

Diabetes mellitus (DM) has been demonstrated to be an independent risk factor for coronary artery disease [1]. It has been estimated that by the year 2045, there will be 693 million people living with diabetes worldwide, and many of these will develop vascular complications, including coronary artery disease (CAD) [2]. Hemoglobin A1c (HbA1c), is an important indicator of long-term glycemic control with the ability to reflect the cumulative glycemic history of the preceding 8–12 weeks. Thus, glycated HbA1c can indicate average blood glucose levels and this has been shown to be an independent risk factor for CAD. Glycated albumin (GA) however, is a glycemic product which reflects blood glucose levels from the previous 2–3 week period. And the levels of GA are more closely associated with CAD than glycated HbA1c [3]. It has further been reported that levels of serum GA are higher in female CAD patients than males, although this is yet to be confirmed [4].

In this study, 350 subjects who had undergone angiography were enrolled and their Gensini scores calculated based on their angiography results. The aim of this study was to investigate gender differences and associations between GA and stenosis severity in CAD patients.

2. Materials and methods

2.1 Subjects

We recruited 350 adult patients from the Department of Cardiology of Shandong Provincial Hospital from January 2013 to December 2019. The sample included 155 women (44.3%) and 195 men (55.7%). All subjects underwent coronary angiography and were divided into two groups. We placed patients who had $\geq$ 50% arterial obstruction into the CAD group, and the patients who had $\leq$ 50% arterial obstruction into the non-CAD group [5]. Exclusion criteria included patients with chronic heart failure, thyroid dysfunction, autoimmune disease, renal or liver dysfunction, or a malignant tumor. This study protocol was approved by the ethic committee of Shandong Provincial Hospital, Cheeloo College of Medicine, Shandong University.

TABLE 1. Stenosis score for different degree of coronary artery obstruction.

Coronary artery obstruction	Score A
≤ 25%	1
26%-50%	2
51%-75%	4
76%-90%	8
91%-99%	16
100%	32

TABLE 2. Lesion score for each site.

Lesion site	Score B
LM	5
LAD	Proximal: 2.5; Middle: 1.5; Distal: 1
LCX	Proximal: 2.5; Middle: 1; Distal: 1
RCA	1
Subbranch	0.5

LM: left main coronary artery; LAD: left anterior descending; LCX: left circumflex coronary; RCA: right coronary artery.

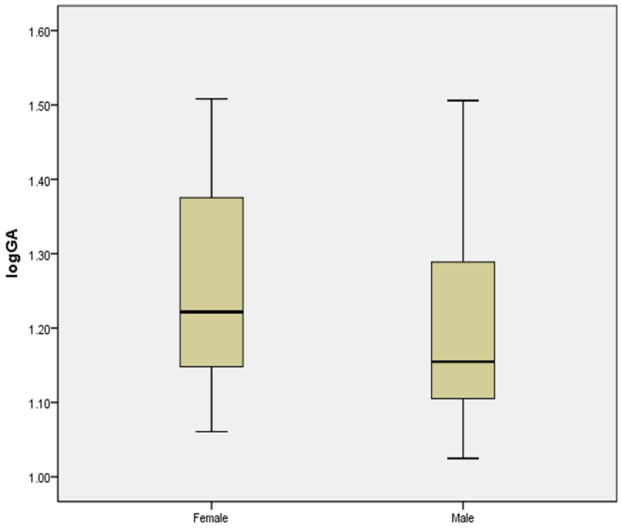

FIGURE 1. Serum GA level in female and male.

2.2 Clinical data collection

At the point of hospitalization, we recorded general data, including sex, age, systolic blood pressure(SBP), diastolic blood pressure (DBP), complete disease history, personal history, any medication and results of physical examination for each subject. Patients with a current or former smoking habit for at least six months were defined as having a smoking history. Patients who had ever been diagnosed with DM were record as having a DM history. After 12 hours of fasting, we collected blood samples for biochemical measurements. The levels of SOD, hemocyanin (HCY), non-esterified fatty acid (NEFA), fasting blood glucose (FBG),

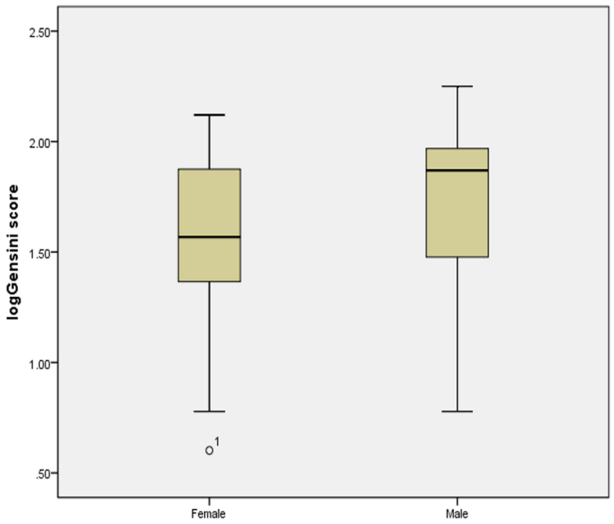

FIGURE 2. Gensini score in female and male patients with CAD.

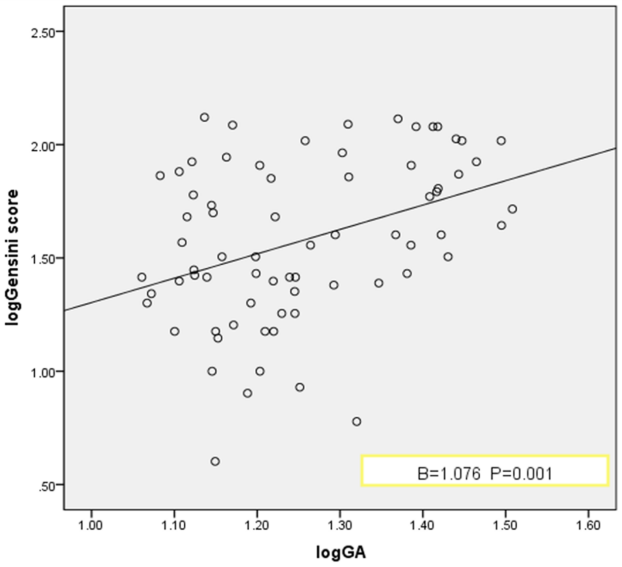

FIGURE 3. Correlation of the log gensini score with the Log GA in female CAD patients.

SCr, uric acid, total cholesterol(TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-c), LDL-c, and GA were measured using standard assays conducted by the laboratory of Shandong Provincial Hospital. The estimated glomerular filtration rate (eGFR) was calculated using the CKD-EPI$_{SCr}$ formula: GFR = 141 × min (SCr/κ, 1)$^{\alpha}$ × max(SCr/κ, 1)$^{-1.209}$ × 0.993^{Age} × 1.018 [if female] × 1.159 [if black] [6]. The degree of coronary artery stenosis was evaluated according to the Gensini scoring system of the American Heart Association [7], and a Gensini score was reached by multiplying score A and score B (Table 1, 2).

TABLE 3. Clinical characteristics of patients without and with CAD.

	Patients without CAD (n = 150)	Patients with CAD (n = 200)	p
Age (years)	59.03 ± 9.11	63.07 ± 9.71	< 0.001
sex			< 0.001
Female [n (%)]	84(56%)	71(35.5)	
Male [n (%)]	66(44%)	129(64.5)	
DM [n (%)]	22(14.7%)	72(36%)	< 0.001
HBP [n (%)]	77(51.3%)	131(65.5%)	0.008
Smoking [n (%)]	45(30%)	85(42.5%)	0.017
Heart rate (beats/min)	70.00(65.00,80.00)	69.00(63.00,78.00)	0.202
SBP (mmHg)	131.79 ± 19.30	132.62 ± 18.96	0.687
DBP (mmHg)	75.53 ± 12.04	75.38 ± 10.79	0.905
SOD(U/mL)	166.65(154.45,176.93)	166.20(156.00,180.625)	0.517
HCY(μmol/L)	12.00(10.35,14.73)	12.75(11.20,15.95)	0.013
NEFA (mmol/L)	0.50(0.38.0.74)	0.51(0.38,0.71)	0.954
FBG (mmol/L)	5.40(4.98,6.12)	5.96(5.12,7.69)	< 0.001
SCr (μmol/L)	62.43(55.00,71.25)	67(57.25,77.75)	0.003
eGFR	96.50(89.75,102.25)	95.00(86.00,104.00)	0.558
Uric acid(μmol/L)	327.93 ± 82.56	331.60 ± 96.78	0.71
TG (mmol/L)	1.42(1.10,1.96)	1.47(1.10,1.96)	0.599
TC (mmol/L)	4.46(3.83,5.23)	4.07(3.55,5.06)	0.006
HDL-c (mmol/L)	1.20(1.00,1.42)	1.16(0.99,1.36)	0.134
LDL-c (mmol/L)	2.70(2.17,3.22)	2.49(1.99,3.18)	0.083
GA (%)	14.11(13.09,15.53)	14.88(13.15,20.23)	0.004
Gensini score	2.00(0.00,5.00)	56.00(25.00,89.13)	< 0.001
Medications			
Anti-platelet drugs [n (%)]	143(95.3%)	200(100%)	0.002
Statins [n (%)]	137(91.3%)	195(97.5%)	0.01
Beta-blockers [n (%)]	102(68%)	158(79%)	0.02
ACEIs or ARBs [n (%)]	41(27.3%)	97(48.5%)	< 0.001
CCBs [n (%)]	34(22.7%)	54(27%)	0.355
Diuretics [n (%)]	13(8.7%)	30(15%)	0.074
OADs [n (%)]	19(12.7%)	72(36.0%)	< 0.001

2.3 Statistical analyses

The non-parametric Kolmogorov-Smirnov test was conducted to assess the normality of the distribution among continuous variables. Normally distributed variables were expressed as mean ± standard deviation and analyzed by an independent-sample *t*-test. Variables not satisfying a normal distribution were presented as median values and analyzed by the Mann-Whitney U-test. Categorical variables were presented as numbers (percentages) and underwent a Chi-Square test. Parameters which were not normally distributed were log transformed before regression analysis. Box plots were performed to examine GA and Gensini score by sex. The relationship between Gensini score, gender and CAD was examined using univariate linear regression analysis, followed by multivariate liner regression analysis for independent risk factors derived from the univariate liner regression analysis. A partial correlation was carried out between GA, Gensini score, and DM. Simple linear regression analysis was performed between GA and Gensini score in females, and a receiver operating characteristic (ROC) curve was drawn to evaluate the predicted cutoff value for GA. A probability (p) value < 0.05 was considered to have a significant statistical difference. All data analyses were performed with SPSS (version 21.0).

TABLE 4. Clinical characteristics of female and male patients with CAD.

	Female Patients (n = 71)	Male Patients (n = 129)	p
Age (years)	65.45 ± 8.16	61.76 ± 10.26	0.01
DM [n (%)]	33(46.5%)	39(30.2%)	0.022
HBP [n (%)]	48(67.6%)	83(64.3%)	0.642
Smoking [n (%)]	5(7.0%)	80(62.0%)	< 0.001
Heart rate(beats/min)	68.00(60.00,70.00)	70.00(64.00,79.00)	0.238
SBP (mmHg)	134.48 ± 18.45	131.6 ± 19.23	0.305
DBP (mmHg)	73.70 ± 11.56	76.30 ± 10.28	0.103
SOD(U/mL)	164.60(155.30,179.00)	166.70(157.05,181.50)	0.385
HCY(μmol/L)	11.90(9.80,13.80)	13.9(11.55,16.90)	< 0.001
NEFA (mmol/L)	0.53(0.41,0.78)	0.50(0.37,0.65)	0.066
FBG (mmol/L)	6.52(5.24,7.87)	5.68(5.06,7.23)	0.053
SCr (μmol/L)	56.36(51.00,64.00)	73.00(65.00,83.00)	< 0.001
eGFR	93.00(85.00,99.00)	98.00(87.00,107.50)	0.01
Uric acid (μmol/L)	293.30 ± 86.07	352.67 ± 96.17	< 0.001
TG (mmol/L)	1.48(1.14,1.96)	1.45(1.08,1.95)	0.617
TC (mmol/L)	4.25(3.66,5.11)	3.96(3.44,4.86)	0.062
HDL-c (mmol/L)	1.21(1.04,1.47)	1.10(0.97,1.32)	0.002
LDL-c (mmol/L)	2.53(1.97,3.24)	2.47(2.05,3.08)	0.538
GA (%)	16.66(14.02,24.04)	14.28(12.73,19.44)	0.001
Gensini score	37.00(22.50,76.00)	74.00(29.50,93.50)	0.006
Medications			
Anti-platelet drugs [n (%)]	71(100%)	129(100%)	a*
Statins [n (%)]	70(98.6%)	129(100%)	0.463
Beta receptor blockers [n (%)]	54(76.1%)	104(80.6%)	0.448
ACEIs/ARBs [n (%)]	37(52.1%)	60(46.5%)	0.448
CCBs [n (%)]	20(28.2%)	34(26.4%)	0.782
Diuretics [n (%)]	11(15.5%)	20(15.5%)	0.885
OADs [n (%)]	35(49.3%)	37(28.7%)	0.004

a, the variable is a constant.*

3. Results

3.1 Characteristics of all subjects

Table 3 indicates the characteristics of all included patients. In the CAD group, there were more subjects with a history of DM ($p < 0.001$), high blood pressure (HBP) ($p = 0.008$), smoking ($p = 0.017$), increased administration of anti-platelet drugs ($p = 0.002$), statins ($p = 0.010$), beta-blockers ($p = 0.020$), angiotensin-converting enzyme inhibitors (ACEIs), angiotensin II receptor blocker (ARBs) ($p < 0.001$), and oral antidiabetic agents (OADs) ($p = 0.001$) when compared to the non-CAD group. Male patients were in the majority among the CAD group, whereas female subjects made up the majority within the non-CAD group. Patients in the CAD group displayed increased age levels ($p < 0.001$), HCY ($p = 0.013$), FBG ($p < 0.001$), SCr ($p = 0.003$), GA ($p = 0.004$), Gensini score ($p < 0.001$) but lower levels of total cholesterol ($p = 0.006$). There were no significant differences seen between the two groups in heart rate, systolic blood pressure, DBP, superoxide dismutase, NEFA, eGFR, uric acid, triglyceride, LDL-c, HDL-c, ratio of administration of calcium channel blockers (CCBs) or diuretics.

3.2 Clinical characteristics of male and female patients in the CAD and non-CAD groups

Data provided in Table 4 indicates that female patients were of higher age than the males. The males also had higher HCY, SCr, eGFR, uric acid, and Gensini score ($p = 0.006$), when compared to the females, but had lower levels of

TABLE 5. Clinical characteristics of female and male patients without CAD.

	Female Patients (n = 84)	Male Patients (n = 66)	p
Age (years)	61.06 ± 7.59	56.44 ± 10.22	0.003
DM [n (%)]	15(17.9%)	7(10.6%)	0.251
HBP [n (%)]	42(50.0%)	35(53.0%)	0.744
Smoking [n (%)]	4(4.8%)	41(62.1%)	< 0.001
Heart rate(beats/min)	69.50(64.25,78.00)	72.00(65.75,80.00)	0.296
SBP (mmHg)	131.94 ± 19.04	131.59 ± 19.78	0.913
DBP (mmHg)	73.44 ± 12.14	78.18 ± 11.45	0.016
SOD(U/mL)	164.95(150.48,175.78)	168.10(157.53,181.55))	0.092
HCY(μmol/L)	11.30(9.25,14.15)	13.00(11.40,15.85)	0.001
NEFA (mmol/L)	0.55(0.41,0.80)	0.48(0.31,0.61)	0.01
FBG (mmol/L)	5.46(5.02,6.36)	5.36(4.97,5.90)	0.528
SCr (μmol/L)	56.00(49.00,62.00)	72.00(66.00,79.00)	< 0.001
eGFR	97.50(91.00,102.00)	95.50(88.00,104.00)	0.42
Uric acid (μmol/L)	303.67 ± 78.45	358.82 ± 77.76	< 0.001
TG (mmol/L)	1.37(1.11,1.90)	1.47(1.08,2.00)	0.531
TC (mmol/L)	4.39(3.84,5.17)	3.82(4.43,5.01)	0.278
HDL-c (mmol/L)	1.24(1.09,1.44)	1.13(0.95,1.35)	0.003
LDL-c (mmol/L)	2.73(2.21,3.17)	2.58(2.15,3.22)	0.617
GA (%)	13.30(12.65,15.12)	13.89(12.69,14.99)	0.034
Gensini score	2.00(0.00,4.88)	2.00(0.00,5.00)	0.665
Medications			
Anti-platelet drugs [n (%)]	80(95.2%)	63(95.5%)	1
Statins [n (%)]	79(94.0%)	58(87.9%)	0.244
Beta receptor blockers [n (%)]	59(70.2%)	43(65.2%)	0.597
ACEIs/ARBs [n (%)]	21(25.0%)	20(30.3%)	0.58
CCBs [n (%)]	19(22.6%)	15(22.7%)	1
Diuretics [n (%)]	7(8.3%)	6(9.1%)	1
OADs [n (%)]	12(14.3%)	7(10.6%)	0.623

HDL-c and GA (p = 0.001). There were more smokers and less DM patients in the male group. The female subjects in the CAD group taking OADs accounted for more than those in the male group. The mean GA levels in females was found to be higher than in the males, whereas the Gensini score levels were higher in males than in females (Fig. 1,2). Clinical characteristics was also presented for the non-CAD group, comparing male and female characteristics and, as Table 5 shows, the female subjects were of higher age (p = 0.003) and had higher NEFA (p = 0.01) and HDL-c (p = 0.003) levels when compared to the males. In contrast, females had lower DBP (p = 0.016), HCY (p = 0.001), SCr (p < 0.001), Uric acid (p < 0.001) and GA (p = 0.034) levels when compared to the male patients. Finally, there were more smokers present in the in male group (p < 0.001).

3.3 The effect of gender on clinical factors in the CAD groups

Univariate logistical regression analysis revealed that there were significant differences between male and female CAD subjects in terms of smoking (p < 0.001), the level of HCY (p = 0.009), NEFA (p = 0.011), SCr (p < 0.001), eGFR (p = 0.002), uric acid (p = 0.045), TG (p = 0.003), GA (p = 0.018) and Gensini score (p = 0.009). (Table 6)

3.4 Correlation between clinical risk factors and Gensini score among male patients with CAD

Univariate linear regression analysis detailed the relevant risk factors for CAD in male patients, including age, heart rate, GA, and administration of statins or Beta-blockers (Table 7). Multivariate linear regression analysis further

TABLE 6. Univariate logistic analyses for sex (male) in CAD patients.

Variable	Univariate Analysis	
	B	p
Age (years)	NS	0.061
DM	4.408	0.045
HBP	NS	0.164
Smoking	4.707	< 0.001
Log HR	NS	0.282
SBP (mmHg)	NS	0.17
DBP (mmHg)	NS	0.069
Log SOD	NS	0.62
Log HCY	10.87	0.009
Log NEFA	-4.481	0.011
Log FBG	NS	0.418
Log SCr	18.11	< 0.001
Log eGFR	23.744	0.002
Uric acid (μmol/L)	0.013	0.045
Log TG	-8.719	0.003
Log TC	NS	0.774
Log HDL	NS	0.073
Log LDL	NS	0.886
Log GA	-13.735	0.018
Log Gensini score	3.326	0.009
Medications		
Anti-platelet drugs	a*	b*
Statins	NS	0.462
Beta-blockers	NS	0.232
ACEIs or ARBs	NS	0.535
CCBs	NS	0.727
Diuretics	NS	0.459
OADs	NS	0.128

a, b*, the variable is a constant; NS, not significant.*

identified that age and high heart rates were independent risk factors for coronary obstruction, and administration of statins may alleviate arterial stenosis, while GA was not related to coronary obstruction.

3.5 Correlation between clinical risk factors and Gensini score among female patients with CAD

Univariate linear regression analysis revealed a positive correlation between a history of DM, fasting blood glucose, GA, and coronary stenosis in the female CAD group (Table 8). Multivariate linear regression analysis identified that high levels of GA were an independent risk factor for coronary obstruction (p = 0.002). Partial correlation analysis verified a positive correlation between GA and Gensini score in relation to a previous history of DM (Table 9). Fig. 3 shows the simple linear regression analysis results for the correlation between GA and Gensini score in females (B = 1.076, p = 0.001). The ROC curve shows that GA had a significant ability to discriminate between the non-CAD and CAD groups (Fig. 4, AUC = 0.767, p < 0.001). We calculated that the optimal predictive value is GA > 15.77 (Youden's index = 1.465).

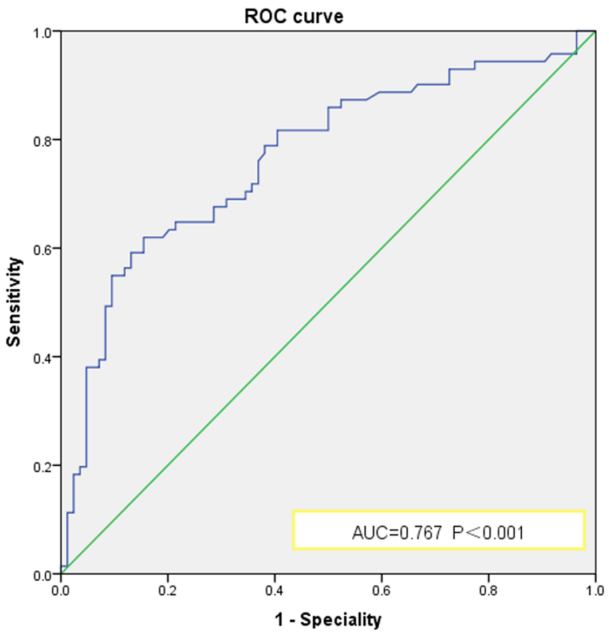

FIGURE 4. A receiver operating characteristic (ROC) curve of GA in CAD patients.
The area under ROC (receiver operating characteristic) curve > 0.767; p < 0.001.

4. Discussion

Currently, the gold standard for monitoring blood glucose levels is blood HbA1c concentration and this has been proved to be an independent marker for cardiovascular disease risk [8]. However, HbA1c can be influenced by the presence of drugs, ethnicity, and other factors. Recently, GA has been demonstrated to be a novel marker for glucose levels within a previous 2-3 week period, and studies have also found that GA is associated with carotid arterial atherosclerosis, and serum albumin can function as an antioxidant [9]. Furthermore, exposure to hyperglycemia leads to a decrease in antioxidant activity and the progression of atherosclerosis. It has also been shown that the level of serum GA may predict an increased progression in the thickness of the arterial intima-media and therefore, may represent a pro-atherosclerotic protein. CAD is also a common complication of diabetes, history of DM is an independent risk factor for CAD, and studies have found that GA is closely related to its development. It has also reported that the level of GA is significantly higher in women than in men among patients with CAD [9]. However, whether

TABLE 7. Univariate and multivariate linear regression analyses for the gensini score in male patients with CAD.

Variable	Univariate Analysis		Multivariate Analysis	
			Model 1, r = 0.399	
	B	p	B	p
Age (years)	0.007	0.021	0.007	0.02
DM	NS	0.69	Not Selected	
HBP	NS	0.225	Not Selected	
Smoking	NS	0.653	Not Selected	
Log HR	0.992	0.032	0.893	0.047
SBP (mmHg)	NS	0.956	Not Selected	
DBP (mmHg)	NS	0.646	Not Selected	
Log SOD	NS	0.318	Not Selected	
Log HCY	NS	0.236	Not Selected	
Log NEFA	NS	0.616	Not Selected	
Log FBG	NS	0.286	Not Selected	
Log SCr	NS	0.247	Not Selected	
Log eGFR	NS	0.657	Not Selected	
Uric acid (μmol/L)	NS	0.842	Not Selected	
Log TG	NS	0.059	Not Selected	
Log TC	NS	0.353	Not Selected	
Log HDL	NS	0.054	Not Selected	
Log LDL	NS	0.194	Not Selected	
Log GA	0.586	0.02	b*	
Medications				
Anti-platelet drugs	a*		Not Selected	
Statins	-0.425	0.015	-0.375	0.027
Beta-blockers	0.156	0.041	b*	
ACEIs or ARBs	NS	0.217	Not Selected	
CCBs	NS	0.756	Not Selected	
Diuretics	0.173	0.043	b*	
OADs	NS	0.651	Not Selected	

a, the variable is a constant; b*, the variables didn't enter the multivariate liner regression, NS, not significant.*

GA can be interpreted as an independent risk factor and a predictive marker remains unclear; however, in this study, we confirmed that GA is positively correlated with the severity of coronary artery stenosis in female patients.

We observed that serum GA levels in the CAD group were significantly higher than those in the non-CAD group, which are consistent with results of previous studies. Compared to male patients, GA levels in females were higher. It is noted that multiple linear regression analysis was performed for male and female CAD patients, but only female patients had a positive correlation between GA and Gensini score. Considering the potential enhancement of diabetes, we further carried out partial correlation analysis and found that GA was positively correlated with Gensini score among female CAD patients. In conclusion, we found that GA is an independent risk factor for coronary stenosis in female patients with CAD.

We constructed a ROC curve to determine the discriminative ability of GA in women. According to the area under the ROC curve, an increase in GA levels had a prognostic role on CAD. When serum GA is higher than 15.7, it is indicative of an increased probability of developing CAD.

We recognize that there are some limitations to this study. First, the effect of age and hormone balance on GA was not included in our data analysis. Estrogen has a role in the stabilization of plaques, increasing insulin sensitivity, and regulating blood lipid and blood glucose metabolism, thereby exerting cardiovascular protection [10]. Studies also have shown that serum estrogen levels in postmenopausal women decrease significantly [11].

TABLE 8. Univariate and stepwise multivariate linear regression analyses for the gensini score in female patients with CAD.

Variable	Univariate Analysis		Multivariate Analysis	
			Model 1, r = 0.525	
	B	p	B	p
Age (years)	NS	0.558	Not Selected	
DM	0.174	0.04	b*	
HBP	NS	0.235	Not Selected	
Smoking	NS	0.337	Not Selected	
Log HR	NS	0.467	Not Selected	
SBP (mmHg)	NS	0.842	Not Selected	
DBP (mmHg)	NS	0.77	Not Selected	
Log SOD	-2.377	0.008	-2.037	0.016
Log HCY	NS	0.079	Not Selected	
Log NEFA	NS	0.241	Not Selected	
Log FBG	0.72	0.041	b*	
Log SCr	NS	0.915	Not Selected	
Log eGFR	NS	0.773	Not Selected	
Uric acid (μmol/L)	NS	0.656	Not Selected	
Log TG	NS	0.834	Not Selected	
Log TC	NS	0.521	Not Selected	
Log HDL	NS	0.169	Not Selected	
Log LDL	NS	0.191	Not Selected	
Log GA	1.076	0.001	0.975	0.002
Medications				
Anti-platelet drugs	a*		Not Selected	
Statins	NS	0.954	Not Selected	
Beta-blockers	NS	0.102	Not Selected	
ACEIs or ARBs	NS	0.058	Not Selected	
CCBs	NS	0.056	Not Selected	
Diuretics	NS	0.206	Not Selected	
OADs	0.21	0.012	b*	

a, the variable is a constant, b*, the variables didn't enter the multivariate liner regression; NS, not significant.*

TABLE 9. Partial correlation between GA and gensini score by DM.

Control			Log GA	Log Gensini score
DM	Log GA	Correlation	1	0.318
		p.		0.007
		df	0	68
	Log Gensini score	Correlation	0.318	1
		p.	0.007	
		df	68	0

Consequently, β cell apoptosis and insulin resistance are more marked in women than in men of the same age [10, 11]. Thus, GA levels may be affected by women's age. We did not record the menstrual status of female CAD patients, but the average age of the females in the CAD patient group was 65 years of age, therefore, most

women in this group were likely postmenopausal. Thus, this study may stengthen the correlation between GA and Gensini score. Second, this study is a cross-sectional study and cannot determine the causal relationship between GA and atherosclerosis - a topic that is clearly worthy of future study.

In conclusion, our findings show there are differences between CAD patients based on gender. In women, the increase in serum GA level is positively correlated with obstruction of CAD. Furthermore, diabetes and serum GA are independent risk factors for coronary atherosclerosis. Finally, our findings suggest that there is a predictive potential for differences in GA levels to identify CAD in women.

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CONFLICT OF INTEREST

We declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the work submitted.

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