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Relationship the Variation of Serum Vaspin and Some Biochemical Parameters Associated with Gender and BMI of Type2 Diabetic Patients

Zahraa Abdalelah Saleem and Khalid Shaalan Sahab

Department of Chemistry - College of Science- University of Diyala

zahraaabd74@gmil.com

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Abstract

Diabetes mellitus is a chronic disorder categorized by rise blood glucose with a disturbance in the use of carbohydrates, fats and proteins resulting from a deficiency in the secretion of the insulin or the action of insulin or both. The current study aimed to estimation of Vaspin and some biochemical parameters included insulin, fasting blood glucose(FBG), HbA1c, urea, creatinine, Triglyceride(TG), Total Cholesterol(TC), High-density lipoprotein (HDL), low density lipoprotein (LDL) and Very low density lipoprotein (VLDL)in blood of type2 diabetic patients, and determining the change of the ratio in patients comparing with healthy people.The serum vaspin level in patients group was significantly lower than that of the healthy subjects ($p<0.05$). The serum insulin levels in patients were higher than of healthy subjects but without significant differences ($p>0.05$). There were a significant difference of serum FBG, HbA1c and urea levels in patients compared to controls ($p<0.05$), while creatinine level was increased non significantly ($p>0.05$). The levels of TC, TG, LDL and VLDL were elevated significantly in patients when compared with controls ($p<0.05$), while HDL was diminished non significantly in patients compared to controls. There was no significant links between serum vaspin and insulin concentrations with FBG, HbA1C, CRP, urea, creatinine, TC, TG, LDL, HDL, and VLDL levels. Vaspin had lowest area under curve (AUC .393) and sensitivity (68.3) in ROC curve.

Keywords: T2Diabetes Mellitus, Vaspin, biochemical parameters, gender, BMI.

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علاقة تباين vaspin وبعض العوامل الكيموحيوية مع الجنس ومؤشر كتلة الجسم لمرضى السكري من النوع الثاني

زهراء عبدالله سليم و خالد شعلان سحاب

قسم الكيمياء - كلية العلوم - جامعة ديالى

الخلاصة

مرض السكري هو اضطراب مزمن يتصف بارتفاع نسبة السكر في الدم مع اضطراب في استخدام الكاربوهيدرات والدهون والبروتينات الناتج عن نقص في إفراز الأنسولين أو عمل الأنسولين أو كليهما. هدفت الدراسة الحالية هي تقدير الفاسبين وبعض العوامل البيوكيميائية المتضمنة الأنسولين وكلكوز الدم الصائم (FBG) و HbA1c واليوريا والكرياتينين والدهون الثلاثية (TG) والكوليسترول الكلي (TC) والبروتين الدهني عالي الكثافة (HDL) والبروتين الدهني منخفض الكثافة (LDL)والبروتين الدهني منخفض الكثافة جدًا (VLDL) في دم مرضى السكري من النوع 2 ، وتحديد تغير النسبة في المرضى مقارنة بالأشخاص الأصحاء.تسعون شخصا (60) مريضا من داء السكري من النوع 2 و (30) اصحاء من مستشفى بعقوبة التعليمي / محافظة ديالى في العراق للفترة من 2021/10/1 إلى 2021/12/30.تم استخدام مجموعة ELISA kit لتقدير كميه vaspin في مصل الدم و تم تقييم اختبارات الدم FBG و HbA1c و TG و TC و HDL واليوريا والكرياتينين باستخدام مجموعات المختبرات المتاحة .كان مستوى الفاسبين في الأوعية الدموية في مجموعة المرضى أقل بكثير من مستوى الاصحاء ($p<0.05$)كانت مستويات الأنسولين في الدم أعلى من الأشخاص الأصحاء ولكن دون فروق ذات دلالة إحصائية ($P> 0.05$). كان هناك فرق معنوي في مستويات FBG و HbA1c في الدم واليوريا في المرضى مقارنة مع مجموعة التحكم ($P <0.05$) ، بينما زاد مستوى الكرياتينين بشكل غير معنوي ($P> 0.05$). تم رفع مستويات TC و TG و LDL و VLDL بشكل ملحوظ عند المرضى عند مقارنتها مع مجموعة التحكم ($p <0.05$) ، بينما انخفض HDL بشكل غير ملحوظ في المرضى مقارنةً بالمجموعة الضابطة. لم تكن هناك روابط ذات دلالة إحصائية بين تراكيز الأنسولين والأوعية الدموية في المصل مع مستويات FBG و HbA1C و CRP واليوريا والكرياتينين و TC و TGو LDL و HDL و VLDL. كان Vaspin أدنى منطقة تحت المنحنى (AUC) وحساسية في منحنىROC .كانت مستويات الفاسبين منخفضة بشكل ملحوظ في دم مرضى مرضى T2DM وكان لديها أدنىAUC وحساسية في منحنى ROCلذلك قد يكون الانخفاض الملحوظ في مستوى غشاء المصل مؤشرًا محتملاً لتفاقم T2DM

الكلمات المفتاحية: T2Diabetes Mellitus، Vaspin، المعلمات البيوكيميائية ، الجنس ، مؤشر كتلة الجسم.

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Introduction

Diabetes mellitus is a chronic disease categorized by elevation blood glucose with a disruption in the metabolism of fats and proteins in addition to carbohydrates, resulting from a deficiency in the excretion of insulin or the action of insulin or both, which causes an imbalance in the use of glucose in tissues and the release of glucose by the liver [1]. Vaspin is an adipokine, mostly expressed in visceral white adipose tissue but also found in serum. Vaspin mean visceral adipose tissue-derived serine protease inhibitor also known as Serpin A12. So,Vaspin is a protein belongs to the serpin family of serine protease inhibitors [2, 3].Obesity and insulin resistance increases visceral adipose vessel expression and serum serpins levels [3]. This increase in vascular production could be a compensatory response to the influence of unknown proteases found in fat and other tissues that inhibit insulin action. As a result, up-regulation of vascular expression may be used as a defense mechanism against insulin resistance[4].It have been discovered that adults have vascularized visceral and subcutaneous adipose tissue, with depot-specific regulation supposed to be controlled by body fat level or insulin sensitivity[5]. Vaspin is anti-atherosclerotic and anti-inflammatory, in addition to improving insulin sensitivity. Circulating vascular levels of adipokines are low when compared to other adipokines[6].Responds of adipose tissue to nutritional, neuronal, and hormonal signals, is by release of adipokines, to regulate energy balance, nutrition, thermogenesis, immunity, and neuroendocrine function[7]. Adipose tissue is recognized as a metabolically active endocrine organ plus being a fat-storage organ[8]. Expression of vaspin in humans was found in adiposes, both subcutaneous and visceral of adults, and this expression is thoughtlinked with parameters of obesity (fat content) and insulin resistance. Vaspin in human blood ranging of 0.18 to 1.55 ng/ml[9]. Ealier studies showed that the circulating plasma levels of vaspin, are significantly higher in women[9,10]. Namely Vaspin and glucose metabolism are linked, and vaspin could be viewed as a new link between obesity and related metabolic illnesses, including diabetes[11]. The evidence on serum vaspin levels in type 2 diabetes is mixed. According toYe, Y et al., people with type 2 diabetes have greater vaspin levels and a favorable association between vaspin and postprandial blood glucose levels[12]. FurthermoreLi, K et al.,in type 2 diabetes, it

was shown that continuous subcutaneous insulin infusion reduced serum vaspin concentrations while enhancing beta-cell activity.[13].Other studies observed lower vaspin levels in type 2 diabetes or found no difference in vaspin levels between persons with and without abnormal glucose levels, suggesting that decreased serum vaspin levels may be a risk factor for type 2 diabetes development. [14,15,16]. Founded on the aboveindications, can concluded that levels of blood vaspin are alterd with the etiology of type 2 diabetes.As shown by numerous studies, the compensatory capacity of vaspin secretion gradually declines with the duration of diabetes or the onset of cardiovascular diseases and aggravation of atherosclerosis, resulting in a slow decrease in vaspin levels. These changes are also influenced by gender or obesity.[17]. The aims of this study to estimation of Vaspin and some biochemical parameters included insulin, fasting blood glucose(FBG), HbA1c, urea, creatinine, Triglyceride(TG), Total Cholesterol(TC), High-density lipoprotein (HDL), low density lipoprotein (LDL) and Very low density lipoprotein (VLDL)in blood of type2 diabetic patients, and determining the change of the ratio in patients comparing with healthy people.

Materials and Methods

Collection of Samples

The study has been carried out at Baquba Teaching Hospital / Diyala Governorate in Iraq for the period from 1/10/2021 to 30/12/2021. (5ml) Samples were collected, as (60) blood samples were collected from type2 diabetic patients after diagnosis by the specialist consultant doctor. The number of males was (29) and the number of females was (31) within age range between (40-70) years. Thirty (30) blood samples of apparently healthy people of both sexes were collected and used as a control group, where the number of males was (17) and a number of females (13) were within an age range between (19-81) years and did not suffer from any chronic or acute disease at the time of collecting samples. The samples were collected by drawing 5 ml of venous blood, using plastic medical syringes and drawn blood was placed in gel tubes and let to clot for 15-30mins, then the sera were separated by the centrifuge device for (5) minutes at a rate of (3000 rpm) The serum for each sample was subjected to the following

examinations: Insulin, Vaspin, Urea, Creatinine, Triglyceride(TG), Cholesterol, High-density lipoprotein (HDL), low density lipoprotein (LDL), Very low density lipoprotein (VLDL). Anthropometric measurements including age weight and height were listed for each participant in study. The BMI is determined using a formula that contains the basic equation of weight divided by the square of height.

Clinical laboratory analysis of groups

An ELISA kits of Shanghai company (China) were used to estimation the quantities of Vaspin and Insulin. These kits use enzyme-linked immune sorbent assay (ELISA) based on biotin double antibody sandwich technology. The FBG, TG, TC,HDL, Urea, Creatininetests were mesured by use comercial available laboratory kits of Mindray Company(China)Ureais calculated according to the equation:Urea (mg/dl) =ΔA sample X concentration of standard/ΔA standard and Creatinineis calculated according to the equation:Creatinine (mg/dl) =ΔA sample X concentration of standard ΔA/standard. HbA1c was mesured by use comercial available laboratory kit of Human company (Germany). LDL-C is calculated according to the equation: LDL-C = [Cholesterol] - [HDL-C]-{[TG]/5}. Whereas VLDL-C was valued by using formula: VLDL-C ={[TG]/5}.

Ethical approval

Ethical Committees of Baquba Teaching Hospital, and College of Science/ University of Diyala gave their permission for this study. All (90) volunteers in the study gave informed written agreement before being included in the study, and the study was done according to the Helsinki Declaration.

Statistical analysis

The statistical package SPSS version 25.0 and Graph pad prism version 6 were employed to carry out these analyses. The numerical parameters (scale) were first tested for normality (Kolmogorov-Smirnov and Shapiro-Wilk test). Parameters that fit both tests (no significant difference) were given as mean ± standard deviation (M±SD), where student t test used to

comparative between two groups and F test used to comparative more than two groups. The median and range of the parameters that did not fit the normality tests (significant difference) were provided.The remaining parameters (nominal and ordinal) were expressed as percentage frequencies, and Pearson-Chi-square test or two-tailed Fisher exact probability were used to determine whether there were any significant differences in the frequencies (p). The person correlation was used to determine how certain metrics correlated with one another. Additionally, the outcome of a response variable for a number of explanatory variables was predicted using multiple linear regression.

Results

Elementary Descriptions (anthropometries) of Study Groups

The basic characteristics of the current study groups included gender, age and body mass index (BMI) .The percentages of gender (males and females) for patients and healthy were (48.3% and 51.7%) , (56.7% and 43.3%) and (38.3% and 61.7%) respectively. Statistical analysis show there is no significant difference in gender ($p>0.05$). Respectively, the statistical analysis showed presence a significant difference between age groups ($P<0.001$). For BMI groups, the percentages of normal weight and obese in patients and healthy were 38.3% ,61.7% and 73.3%, 26.7% respectively, the statistical analysis shows there is a significant difference between BMI groups ($P<0.001$).

Table 1: Comparative anthropometric characteristics of participants in study groups Calculated by chi-square test.

FEATURES			GROUPS		TOTAL	P VALUE
			Patients (60)	Healthy (30)		
Gender	Males	N	29	17	46	p>0.05
		%	48.3%	56.7%	51.1%	
	Females	N	31	13	44	
		%	51.7%	43.3%	48.9%	
Age groups	≤20	N	0	1	1	P<0.001***
		%	0.0%	3.3%	1.1%	
	21-40	N	3	22	25	
		%	5.0%	73.3%	27.8%	

	41-60	N	33	6	39	
		%	55.0%	20.0%	43.3%	
	61-80	N	24	0	24	
		%	40.0%	0.0%	26.7%	
	>80	N	0	1	1	
		%	0.0%	3.3%	1.1%	
BMI groups	Normal weight	N	23	22	45	P<0.001***
		%	38.3%	73.3%	50.0%	
	Obese	N	37	8	45	
		%	61.7%	26.7%	50.0%	

Calculated by chi-square test

Comparative biochemical parameter between study groups

The existing study showed significant differences (p<0.05) between urea, glucose, and HbA1C parameters between study groups. The mean value of urea, glucose, and HbA1C were higher in patients (34.55± 9.07, 187.90±69.29 and 9.48±2.24) respectively than healthy (29.37± 5.65, 86.93±10.00 and 4.97±0.47). The creatinine parameter not scored significant different between study groups (p >0.05). The results of study showed significant differences (p<0.05) between TC, TG, LDL, VLDL parameters of study groups. The mean value of TC, TG, LDL and VLDL were higher in patients (201.93±48.63, 193.17±73.48, 121.43±44.97 and 38.63±14.70) respectively than healthy (140.07±27.03, 141.60±25.92, 69.05±23.96, and 28.32±5.18). The HDL parameter not scored significant different between study groups (p>0.05). The present study appeared significant differences (p<0.05) between vaspin in study groups. The mean value of Vaspinwas lower in patients (0.46± 0.22) than healthy (0.70±0.33). The insulin parameter not scored significant different between study groups (p>0.05). Table (3) below showed the above results.

Table 3: Comparative parameters between study groups Calculated by student t test

GROUPS		N	MEAN ±SD		P VALUE
Urea (mg/dl)	Patients	60	34.55±9.07		P<0.02*
	Healthy	30	29.37±5.65		
Creatinine (mg/dl)	Patients	60	0.89±0.32		p>0.05
	Healthy	30	0.82±0.16		
Glucose (mg/dl)	Patients	60	187.90±69.29		P<0.001***
	Healthy	30	86.93±10.00		
HbA1C%	Patients	60	9.48±2.24		P<0.008**

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	Healthy	30	4.97±0.47		
TC (mg/dl)	Patients	60	201.93±48.63		P<0.001***
	Healthy	30	140.07±27.03		
TG (mg/dl)	Patients	60	193.17±73.48		P<0.001***
	Healthy	30	141.60±25.92		
HDL (mg/dl)	Patients	60	41.87±11.29		p>0.05
	Healthy	30	42.70±6.94		
LDL (mg/dl)	Patients	60	121.43±44.97		P<0.001***
	Healthy	30	69.05±23.96		
VLDL (mg/dl)	Patients	60	38.63±14.70		P<0.009**
	Healthy	30	28.32±5.18		
Vaspin (ng/ml)	Patients	60	0.46±0.22		P<0.05*
	Healthy	30	0.70±0.33		
Insulin (ng/ml)	Patients	60	2.09±0.98		P>0.05
	Healthy	30	1.72±0.80		

Calculated by student t test

Comparison of age, BMI, and waist Parameters according to Gender of Study Groups

The existent results of study showed significant differences (p<0.05) between personal characters age, BMI and waist of patients controls when compared according to gender. The mean values (for males and females) of age, BMI and waist were higher in patients (56.38± 9.33 and 57.48±8.33), (28.74±5.10 and 29.46±5.91) and (96.12±4.74 and 88.58±2.98) than healthy controls, as shown in table(4)

Table 4: comparative age, BMI, and waist parameters according to gender of study groups were calculated by t test.

GROUPS		N	MEAN±SD	P VALUE
Age (years)	Patients	60	56.95±8.77	P<0.01**
	Healthy	30	35.13±11.87	
BMI (Kg/m2)	Patients	60	29.12±5.50	P<0.02*
	Healthy	30	25.70±3.69	
Waist (cm)	Patients	60	92.23±5.44	P>0.05
	Healthy	30	94.47±4.16	

Calculated by t test

Comparison of biochemical parameters according to Gender of Study Groups

The study's findings indicate that the urea, glucose, and HbA1C characteristics varied signific antly (p< 0.05) depending on the study groups' gender. The mean value of urea was highest for

males and females patients (34.98±7.12 and 34.81±10.68), glucose (195.76±72.61 and 180.55±66.38), and HbA1C (9.69±1.90 and 9.65±2.54) respectively than healthy. Finally, the creatinine was not significant between gender of study groups the current study's findings were the genderspecific differences in the study groups' TC, TG, LDL, and VLDL parameters (p< 0 .05). The mean value of TC was highest for females and males patients (215.16±37.14 and 187.79±55.71)TG (209.03±79.31 and 176.21±63.72), LDL (129.65±33.24 and 112.66±54.07), and VLDL (41.81±15.86 and 35.24 ±12.74) respectively than healthy. Finally, the HDL was not significant between genders of study groups table (5).

Table 5: Comparative biochemical parameters according to gender of study groups calculated by F test

GENDER		PATIENTS	HEALTHY	P VALUE
		Mean±SD	Mean±SD	
Urea	male	34.98±7.12	30.00±5.45	P<0.05*
	females	34.81±10.68	28.54±6.01	
Creatinine	male	0.91±0.28	0.92±0.12	p>0.05
	females	0.86±0.36	0.68±0.10	
Glucose	male	195.76±72.61	88.29±9.50	P<0.001***
	females	180.55±66.38	85.15±10.73	
HbA1C	male	9.69±1.90	5.08±0.45	P<0.001
	females	9.65±2.54	4.83±0.47	
Cholesterol Mg/dL	male	187.79±55.71	147.29±27.48	P<0.001***
	females	215.16±37.14	130.62±24.26	
Triglycerides Mg/dL	male	176.21±63.72	141.71±28.96	P<0.001***
	females	209.03±79.31	141.46±22.48	
HDL Mg/dL	male	39.90±8.69	44.00±7.27	P>0.05
	females	43.71±13.15	41.00±6.35	
LDL Mg/dL	male	112.66±54.07	74.95±21.45	P<0.001***
	females	129.65±33.24	61.32±25.68	
VLDL Mg/dL	male	35.24±12.74	28.34±5.79	P<0.001***
	females	41.81±15.86	28.29±4.50	
Vaspin (ng/ml)	male	0.49±0.22	0.91±0.40	p<0.05
	females	0.43±0.21	0.42±0.20	
Insulin (ng/ml)	male	2.41±1.20	1.45±0.72	p>0.05
	females	1.78±0.80	2.07±0.88	

Calculated by F test

Comparison biochemical parameters according to BMI of study groups

The findings of the current study demonstrate that there are significant variations (p0.05) betw een study group BMI levels and urea, glucose, and HbA1C parameters.The mean value of urea was highest for normal and obese patients (37.09±11.11 and 32.97±7.25), glucose (193.52±59.39 and 184.41±75.37), and HbA1C (9.58±2.46 and 9.42±2.13) respectively than healthy. The creatinine has not significant different between BMI levels of study groups. The results of study shows there is significant differences ($p<0.05$) between cholesterol, triglyceride, LDL, and VLDL parameter and BMI levels of study groups. The mean values of cholesterol was highest for normal and obese patients (191.26±42.10 and 208.57±51.71), TG (193.70±76.84 and 194.84±72.39), LDL (108.74±33.65 and 129.32±49.56), and VLDL (38.74±15.37 and 38.88±14.48) than healthy. The HDL parameter show non-significant ($p>0.05$) between BMI levels of study groups. Table (6) below shows the above results.

Table 6: Comparative biochemical parameters according to BMI of study groups were calculated by F test

GROUP		PATIENTS	HEALTHY	P VALUE
		Mean±SD	Mean±SD	
Urea	Normal	37.09±11.11	29.23±5.24	P<0.01**
	Obese	32.97±7.25	29.75±7.05	
Creatinine	Normal	0.93±0.37	0.82±0.18	p>0.05
	Obese	0.86±0.29	0.81±0.14	
Glucose	Normal	193.52±59.39	87.59±10.66	P<0.001***
	Obese	184.41±75.37	85.13±8.24	
HbA1C	Normal	9.58±2.46	4.90±0.49	P<0.001***
	Obese	9.42±2.13	5.15±0.37	
TC Mg/dL	Normal	191.26±42.10	137.45±27.22	P<0.001***
	Obese	208.57±51.71	147.25±26.92	
TG Mg/dL	Normal	193.70±76.84	138.55±27.55	P<0.001***
	Obese	194.84±72.39	150.00±19.91	
HDL Mg/dL	Normal	43.78±9.77	43.32±7.40	P>0.05
	Obese	40.68±12.12	41.00±5.53	
LDL Mg/dL	Normal	108.74±33.65	66.43±24.00	P<0.001*** LSD=19.40
	Obese	129.32±49.56	76.25±23.85	

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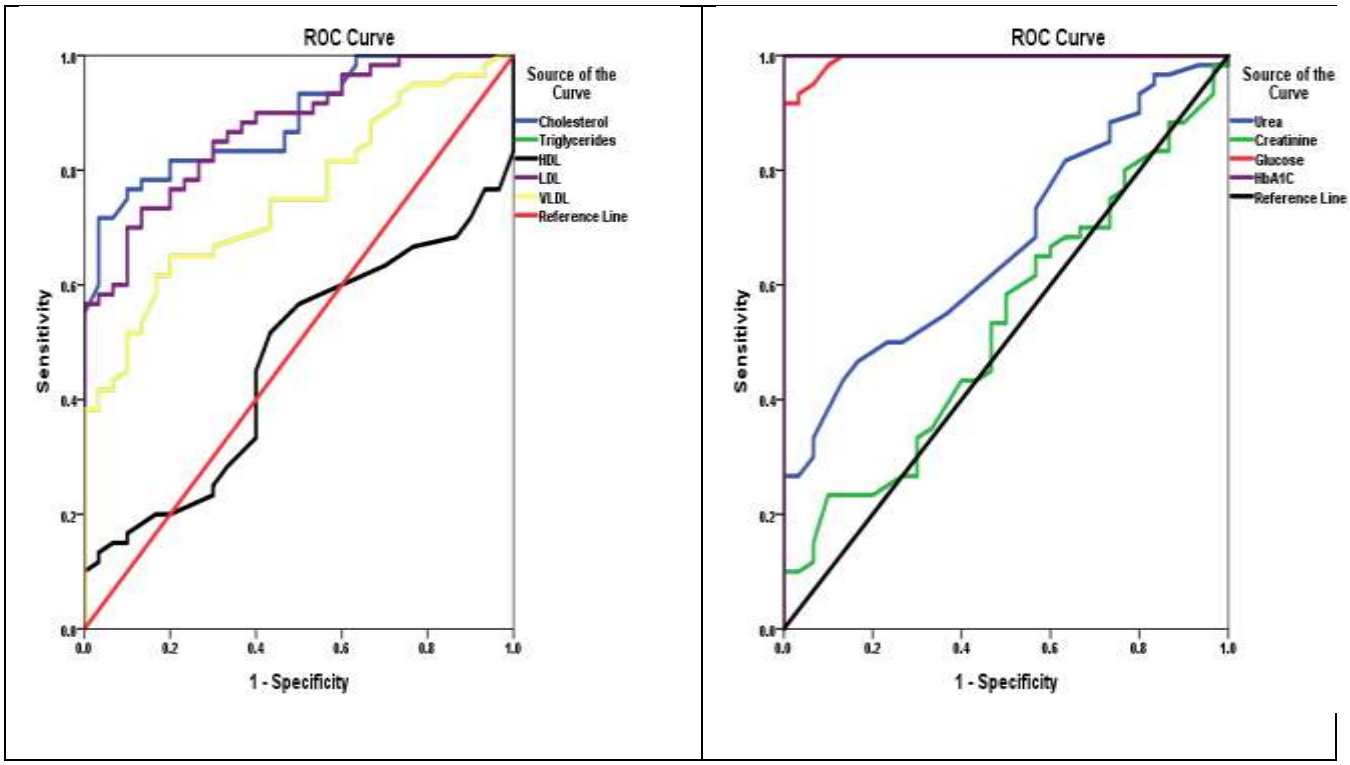
VLDL Mg/dL	Normal	38.74±15.37	27.71±5.51	P<0.001***
	Obese	38.88±14.48	30.00±3.98	
Vaspin (ng/ml)	Normal	0.59±0.29	0.85±0.22	P<0.05
	Obese	0.38±0.17	0.26±0.12	
Insulin (ng/ml)	Normal	1.80±0.95	1.42±0.75	p>0.05
	Obese	2.27±1.02	2.53±0.85	

Calculated by F test

LSD= least significant different



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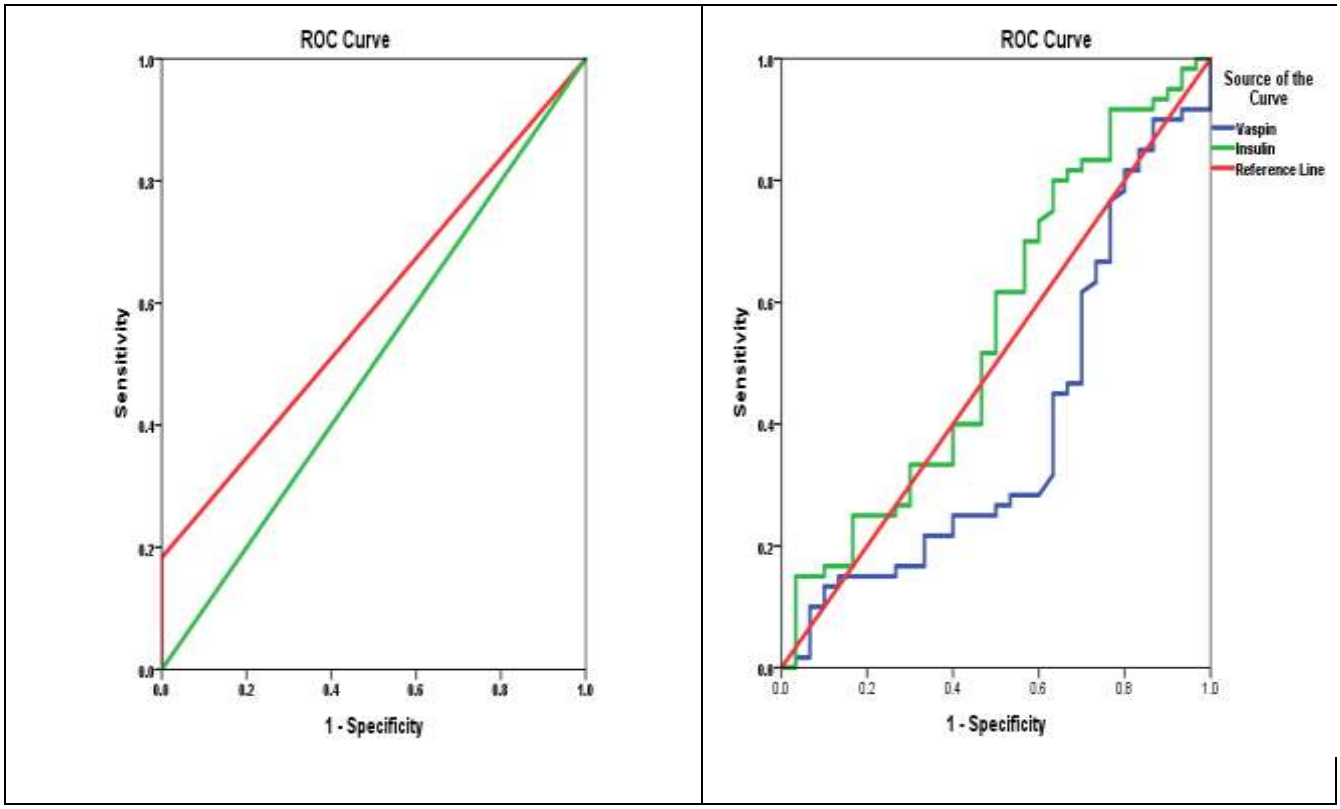

Figure 1: ROC curve of parameter

Discussion

The current investigation found significant differences (P0.05) between age groups for sick an d healthy people, where the age group 41- 60 and 61 - 80 year scored highest percent for patients (55.0% and 40.00%), while 21- 40 age groups scored least percent for patients (5.0%). The patients' age group of 41- 60 scored the highest percentage (60.0%) with significant

differences (p0.05) in the study by [18], which also found significant differences (p0.05) amo ng age groups. Other study showed significantly different in age between patients and healthy, When compared to the mean age of diabetic participants, which ranged from 19 to 86 years, the average age of controls, spanning a range of 18 to 73 years, was significantly different (P 0.001) [19]. Also, in another study that showed there was significantly more frequent in women than in men [20] the study population was characterized by an age ranging between 18 and 85 year, with an average of 47.45±16.85 year.T2DM prevalence increased with age, was higher in men

than in women [21].One of nine deaths among adults between the ages of 20 and 79 is thought to be caused by diabetes and its complications [22].

For gender, the current findings showed that there were no appreciable differences (P>0.05) between the study groups. The current results agree with a study done by [23] when showed there are no gender-related differences between study groups' male and female participants, healthy and patient genders, or between the two (p>0.05). Our results disagree with [24] when pointed women were more likely than men to be overweight or obese, also our results disagree the results presented by [25] when stated, the prevalence of T2DM was 19.4% for men and 15.5%for women although there are some differences between regions and countries, the prevalence of obesity is largely consistent worldwide. Our results agree with the study [26] when showed no significant differences between genders in control and diabetic subjects.

Obesity have been controversial topics in recent years. Several earlier studies focused on obesity as a key risk factor for type 2 diabetes mellitus [27]. The Body Mass Index (BMI), which is calculated by dividing weight by height squared, is the most widely used parameter for categorizing body weight; BMI values greater than 30 kg/m2 are considered obese [28,29]. BMI is indicator used to best represent the relationship between obesity and T2D [30]. Age and body mass index of patients were strongly linked with diabetes [31]. Based on BMI levels current results showed significant differences (P≤0.05) between BMI levels among patients and healthy groups, where is found the patients scored highest percentage within obese weight BMI (61.7%) compared to healthy that scored highest percentage within normal weight BMI (73.3%). Our results disagree with the study by M.N. Al-Muammar,1 M. El-Shafie1 and S. Feroze1,when showed the body mass index showed a non-significant difference between the two groups (patients and healthy) [32] but disagree with the study when showed Between patients and controls, there was no statistically significant difference in BMI (28.45.1 against 28.06.0, % difference=1.4, t =0.283 and P=0.778) [33].

The high prevalence of overweight BMI in DM patients are consistent with our findings [34]. Strong and reliable evidence suggests that managing obesity can help treat type 2 diabetes and stop the progression of pre-diabetes into the disease. Modest and sustained weight loss has been

shown to improve glycemic control and decrease the need for glucose-lowering medications in patients with type 2 diabetes who are also overweight or obese [35]. According to the findings of a different studies, people who are overweight and obese are more likely to develop pre-diabetes and diabetes than people who are not overweight [36]. For lipid profile the present results shown in table (3) agree with several previous studies, Yadav et al., showed statistically significant increase in the levels of serum total cholesterol, triglycerides, LDL-c ($p<0.001$), while serum HDL-c levels did not showed statistical significant difference between the two group($p>0.05$) when obese type-2 diabetic patients compared with obese control subjects [37]. Tahir et al., [38] show high levels of Cholestrols, TG, LDL and low levels of HDL in patients than controls and these results compatible to our results. High levels of TG, TC, and LDL showed significant associations with DMT2.All lipid profile investigations show a consistent association between these variables and DMT2.[39,40]. Type 2 diabetes is associated with dyslipidemia, characterized by increased plasma TG, reduced HDL and an increased number of small dense low-density lipoprotein (LDL) particles [41]. The changes in TG were significantly correlated with changes in VLDL ($r = 0.99$, $P < 0.001$), therefore previous studies strongly suggest that VLDL is the leading actor in lipid abnormality in patients with diabetes and/or obesity [42].

Obesity and type 2 diabetes mellitus are associated with increased deposition of triglycerides in adipose tissue, such as adipose tissue of the heart, liver, pancreas, and skeletal muscle [43].Increased fractional clearance of HDL as a result of its cholesterol being depleted has been linked to obesity's low plasma HDL-C levels [44]. Obese individuals with insulin resistance have changed levels of many essential enzymes involved in HDL metabolism. In addition to insulin resistance and absolute or relative insulin shortage, some of these alterations are further established in type 2 diabetes [45]. The increased synthesis of VLDL, at least partially as a result of increased fatty acid flow to the liver, is a significant metabolic factor contributing to lower HDL-C levels in individuals with obesity and insulin resistance [46].

The results of urea, creatinine, glucose, and HbA1C shown above agree with several studies, such as a study of AL-karkhi, [47] who showed that urea , glucose, and HbA1C parameters

were increased in DM2T patients compared to controls with high significant difference ($p<0.05$). While creatinine showed non-significant difference between study groups ($p>0.05$) these results agree with our results. Nedyalkova et al., showed high percentage in HbA1C and creatinine of DM2T patients than control [48]. Blood urea and creatinine are the best strategies for estimating progression, prognosis, instituting dietary restrictions in the kidney diseasein type 2 DM [49]. Variance of urea and creatinine level due to hyperglycemia level indicates fall in renal function in diabetic patients. In Diabetic nephropathy, bio-markers such as and serum creatinine blood urea has been elevated with increased blood glucose in uncontrolled diabetics, commonly linked with kidney damage severity [50]. Urea and creatinine levels in the blood can help detect and prevent diabetic renal disease earlier and can restrict the development of end-stage kidney failure [51].

Chao et al., [52] show high levels of HbA1c in patients than controls and these results compatible to our results. HbA1c and the red blood cell life cycle are proven to be related. Lifestyle factors including intense exercise and carbohydrate restriction have an impact on HbA1c [53].
The American Diabetes Association (ADA) advises using the HbA1c level as a diagnostic ma rker for diabetes, and it can provide insight into blood glucose levels from two to three month s prior. [54].

The prevalence of HbA1c among primary care physicians is rising because to its many practic al benefits, which include simple sampling, suitability as a marker of persistently abnormal bl ood glucose levels, low individual variation, and acceptable laboratory standards [55].ADAIt has been suggested that a HbA1c score of 5.7% to 6.4% can indicate pre-diabetes, and a value of 6.5% can indicate diabetes. Recent research suggests that the degree of anemia and the HbA1c readings are related to iron deficiency anemia.[56].

Patients with diabetes have aberrant glucose metabolism in a number of organs, reduced skele tal muscle glucose disposal, increased hepatic glucose synthesis, and increased insulin-independent glucose uptake into the lens and brain tissue [57].

Diabetes mellitus is characterized by hyperglycemia together with biochemical alterations of glucose [58]. The term hyperglycemia describe the increase glucose concentrations in blood.It might be an indication that the beta- cell, which is the root cause of the formation of

DMT2, is unable to produce enough insulin to sustain normoglycemia. By increasing insulin r esistance and gluconeogenesis, visceral adiposity may have a deleterious impact on glycemic control. [59]. In order to effectively treat DMT2, it is crucial to maintain normal body weight and establish appropriate eating habits [60].

The present results showed decrease levels of vaspin and increase levels of Insulin in DM2T patients, these results are agree with results of Czech study [61] in the case of Insulin, who showed increase percentage of Insulin in obese DM2T patients and also agree in the case of vaspin the mean levels of vaspin was higher in non- obese patients compared to non- obese controls. Sathyaseelan et al., study showed that the concentration of fasting serum vaspin was lower in the obese Type 2 DM patients (0.43±0.22 ng/mL) than in the controls (0.83±0.29 ng/mL) and the difference was statistically highly significant ($p = 0.0001$), this result agree with our result [62]. The present results disagree with Blüher et al [63] who indicated the circulating level of vaspin significantly increased in obese adults.

Vaspin isprevent the proteases that cause carotid plaque growth, carotid plaque rupture, and insulin resistance [64]. Vaspinvia blocking Nuclear Factor-kappa B (NF-kB), which in turn prevents the generation of cytokines and adhesion molecules, has insulin sensing, anti-atherogenic, and anti-inflammatory properties[65].As these are beneficial effects of vaspin, its level is found to be high in obese and T2DM patients as a compensatory factor to abrogate the chain of events leading to insulin resistance and atherosclerosis. But various studies showed that serum vaspin levels were low in patients with T2DM microvascular complications than in patients without T2DM microvascular complications [66].Additionally, T2DM patients with carotid plaque as compared to those without carotid plaque had lower vaspin levels.

Vaspinis related to type 2 diabetes and obesity [9]. Obesity and diabetes research A. Otsuka Long-Evans Vaspin is said to enhance glucose tolerance and insulin action in Tokushima rats. With diabetes getting worse, its levels drastically dropped [3].

While vaspin mRNA cannot be found in slim people with normal glucose tolerance, its expression is correlated with the mass of adipose tissue in obese adults. These findings suggest that vaspin mRNA expression in adipose tissue is controlled in a fat depot-specific manner and may signify a compensatory mechanism linked to obesity, insulin resistance, and type 2 diabetes mellitus [67]. Vaspin may serve as a new link between obesity and associated metabolic illnesses, including diabetes, because of its relationship to glucose metabolism [68].

The circulating vaspin levels have been found significantly lower, and insulin sensitivity and glycemic control have been significantly improved in subjects with newly diagnosed type 2 diabetes. Based on the above data, it might be asserted that vaspin plays an important role in the pathogenesis of type 2 diabetes [11].

The progression from obesity-related insulin resistance to T2DM remains poorly understood but implicates a failure of pancreatic β-cells to compensate for insulin resistance leading to chronic hyperglycemia. Regardless of the initial degree of insulin resistance and obesity, high levels of several inflammatory markers at baseline are associated with incident T2DM across a range of human populations [69].Insulin resistance is highly prevalent in obese and overweight adolescents as compared to that in non–obese adolescents [70].

The sex difference in protein turnover increases with age. Despite the fact that women have less muscle mass than men do, several research found that older females demonstrated a faster rate of protein synthesis [71].According to these results, urea levels in serum may fluctuate dynamically as people age. Males and females have different serum urea values, despite being in the same age group. There aren't many research that have been done to define reference ranges for serum urea that take gender and age into account [72]. Data findings show that the serum urea reference value is highly influenced by age and gender, hence its interpretation is based on both of these factors [73].

Authors discovered proof of a potential role for RBC as an extra-hepatic mechanism for regulating serum levels of nitrogen-related metabolites, which vary by gender in healthy persons. Increased blood levels of ammonia, citrulline, and malondialdehyde (MDA) are encouraged by type 2 diabetes, and as a result, healthy men and women no longer control nitrogen-related metabolites differently [74].

In fact, the HbA1c readings of men and women are almost same, indicating that postprandial glucose excursions in ordinary life are comparable in both sexes and that the 2-hour plasma glucose following an OGTT (2-hour PG) may be a result of the set glucose load of the oral glucose tolerance test (OGTT). The difference in glucose homeostasis between the sexes has alternatively been attributed to gonadal hormones. It is true that menopausal estrogen therapy lowers fasting blood sugar while lowering glucose tolerance [75].

Insulin sensitivity varies by gender as well. Healthy women of the same age have lower skeletal muscle mass and higher adipose tissue mass, as well as higher levels of circulating free fatty acids (FFA) and intramyocellular lipids, all of which may contribute to women developing insulin resistance more frequently than males do [76].

Since women with T2D had higher LDL-c and HDL-c levels and lower triglyceride (TG) levels than men with T2D, gender variations in the lipid profile are probably a factor in this[77] .However, it is unclear if these disparities exist across all age groups and whether menopausal state has an impact on them. Given that postmenopausal diabetes women have an atherogenic lipid and pro-inflammatory profile that is higher than that of premenopausal non-diabetic or diabetic women, this is most likely the case [78]. It is thought that sex hormones contribute to premenopausal women's relative immunity to metabolic processes.

Another study [79] showed that, when compared to men, female diabetic patients had a higher prevalence of low serum HDL levels. These findings were consistent with our own. Women with T2DM have the worse LDL-C management because they are less regularly assessed and meet their goals than males with T2DM. Despite having high LDL-C, they do not take

medication, just like males. Due to these gender disparities, older women are at an increased risk of developing diabetic mellitus (DM) [80].

The body mass index (BMI, expressed in kilograms per square meter) is a weight measurement that takes into account a person's height. Clinical definitions of overweight and obesity use BMI ranges of 25 to 29 kg/m2 and 30 or higher, respectively. These thresholds are comparable to those employed by the World Health Organization [81].

The metabolic syndrome's primary characteristic is the lipid profile seen in patients with visceral obesity. In a healthy group, there was a strong association between BMI and lipid profile.[82]. Data Results showed that compared to women, men had greater levels of blood triglycerides, insulin, and blood glucose, as well as visceral fat, plasma high-density lipoprotein (HDL) cholesterol, and triglycerides [83].

Although the levels of low-density lipoprotein (LDL) cholesterol are generally normal in visceral obesity, there are more abnormally tiny and dense LDL particles than usual (measured by apolipoprote in B levels). Given the evidence demonstrating a relationship between visceral adiposity and an atherogenic lipid profile, it is not surprising that abdominal obesity as measured by the waist-to-hip ratio or by the more accurate quantification of visceral fat accumulation by computed tomography is linked to cardiovascular events [84].

While BMI and LDL-C showed no significant link, there was a substantial negative correlation between BMI and HDL-C. In patients with normal BMI, HDL-C levels were found to be considerably higher. These findings are significant because they show that the lipid profile is only slightly impacted by BMI. Thus, a patient's body weight or BMI should not be used in the assessment or therapy of changed blood lipids in patients with diabetes [85]. In obese children there is a positive correlation between BMI and TC and LDL-C levels. In these children, proatherogenic lipid profiles begin early in life [86].

Zulfania et al., [87] showed positive correlation existed between BMI and HbA1c in type 2 a diabetic subject which was statistically significant and that compatible to our results.

Sheth et al. conducted a study on the Western Indian population, [88] demonstrated a significant linear connection between HbA1c and obese patients with dyslipidemia in those with type 2 diabetes. Type 2 diabetes and its macro vascular complications both include obesity as a major contributing factor in their pathophysiology [89].In those with or without diabetes, elevated HbA1c has also been identified as a stand-alone risk factor for coronary heart disease and stroke.The useful data from a single HbA1c test has made it a trustworthy biomarker for the diagnosis and prognosis of diabetes [90].

Conclusion

Data findings implicated decrease of plasma vaspin levels in T2DM patients. Vaspin levels were lowest significantly in patients of T2DM and had the lowest AUC and sensitivity in ROC curve. Vaspin is not correlated with any studied parameter. Therefore, the decreasing significantly in serum vaspin level may be a probable indicator of the worsening of T2DM.

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