Journal of Medical and oral biosciences
ISSN (Online): 3007-9551
ISSN (Print): 3007-9543

JMOB
Open Access DOAJ

Type: Research article
Publish online: 20/ 02/ 2025

Effect of Vimentin Protein in Female Iraqi bariatric surgery patients with diabetes mellitus

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OPEN ACCESS

ARTICLE INFO
Received: 15/ 12/2024
Revised: 11 / 01/ 2025
Accepted: 17/ 02 / 2025
Publish online: 20/ 02/ 2025

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CITATION

Lamia H.A. Al- Sultan. (2025). Effect of Vimentin Protein in Female Iraqi bariatric surgery patients with D.M. JMOB. 2;(1): 17-26.

https://doi.org/10.58564/jmob.102

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Abstract

Obesity has come to be a serious global health risk that can cause a number of chronic, frequently fatal diseases, such as type 2 diabetes and coronary artery disease. Conventional weight-loss approaches such as diet, exercise, and medication typically have relatively poor long-term results. Bariatric surgery is the greatest option for treating patients who are morbidly obese because it allows for substantial, long-term weight loss and improves or resolves obesity-related comorbidities, all of which reduce mortality rates. Vimentin indicate is assessed utilizing thorough cross-sectional research and some biochemical markers. Ninety female blood samples total, divided into three groups, were used in the study. Before BS, group A had type 2 diabetes mellitus (DM) due to obesity; group B was the same group A, however after BS; and group C was the control group. The findings showed that, in comparison to the control group, the patient D.M.'s HbA1c and BMI values increased significantly ($P \leq 0.05$) before and after the BS groups. The results also showed that, in all patient groups, the concentrations of urea, creatinine, and uric acid increased significantly. All patient groups showed a considerable rise in vimentin concentration as compared to the control group. This present study led us to the conclusion that vimentin had a noticeable impact on biochemical markers in obese people with pre-diabetes.

Keywords: DM, Obesity, bariatric surgery, Lipid profile, Vimentin.

Introduction

Diabetes mellitus is a metabolic disease characterized by elevated blood sugar levels and inadequate endogenous insulin production or activity(1).Obesity gradually develops as a result of high blood sugar in type 2 diabetes (2). With the recent rise in popularity of obesity surgery, it is now possible to have a balanced and healthy body. However, many diseases and surgical treatments are intimately related(3) including polycystic ovarian syndrome, diabetes, joint disorders, scoliosis, and other conditions; in addition, cases of hormonal imbalance (4, 5).

Bariatric surgery, or BS, is becoming a more viable choice for people who are exceedingly obese and have tried every nonsurgical weight loss method available. Beyond assisting patients with immediately losing weight, BS enhances several health indicators following surgery (5, 6). Reducing the size of the patient's stomach with

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bariatric surgery aims to lower their caloric intake. Eating decreases as a result, and weight loss occurs gradually over time. For example, an 80% reduction in stomach size after a sleeve gastrectomy (SG) result in a significant reduction in the quantity of solid food consumed and in calories burned. The filamentous protein known as vimentin (Vim) is a type of cytoskeletal element with a molecular weight of approximately 57 k Dalton (7). It is expressed in adipocytes and other mesenchymal cells, where it stabilizes TG and produces lipid droplets (8), and participation in the insulin-dependent translocation of the main insulin-responsive glucose transporter isoform, glucose transporter type 4 (GLUT4), to the plasma membrane(9). Vimentin has been proposed to take part in lipolysis through direct interactions with HSL using a proteomics approach(10), in addition its association with ERK signaling and β-adrenergic receptors (11). According to a recent study, mice deficient in vimentin (Vim−/−) accumulated less fat than mice of the wild type, indicating that vimentin is necessary for the body to normally accumulate fat(12). However, there are no animal studies that support vimentin's involvement in diet-induced obesity and type 2 diabetes. Consequently, this study aimed to evaluate levels of Vimentin and number of biochemical variables (lipid profile and kidney function) with Body mass index (BMI) and HbA1c in female patients under BS surgery.

Materials and Methods

This study has been compiled based on the national center for educational laboratories at the Medical City Hospital, Baghdad – Iraq (ID: CSEC/0423/0035)for the period 20 February to 22 August / 2023.

Sample collection and study design

This study was conducted on 90 blood samples (female). Thirty of samples were type 2 diabetes patients before BS, 30 sample for the same patients after BS and 30 a sample of healthy individuals acts as a control group. The age group of patients was (30-50) years. Serum samples were obtained from the blood collected after centrifugation and used to determine the biochemical parameters under investigation. 2 ml of blood was taken into anticoagulant tubes to make HbA1c.

Methods

The current study includes identifying: Body mass index (BMI) was measured by measuring the body height and weight of sick and healthy people using a height scale in units of centimeters (cm) and weight using a sensitive person scale in units of kilograms (kg). BMI was calculated according to the following formula: ((kg) weight) / (m^2) height (13).

Serum vimentin test kit by ELISA method supplied by (BT-Lab), China. And the measurement of glycemic hemoglobin in the blood from Stan Bio America - Lipid profile and measurement of urea, uric acid and creatinine in the blood serum using a colorimetric method according to the procedure kit provided by the biosystem.

Statistics examination

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Analysis of variance (ANOVA) was used to compare the groups before and after BS and the healthy group as a control group.
Prism 9.5.0 was used to execute all analyses and create the necessary graphics for the data analysis using means ±SD independent one-way anova.
to compare parameter means between groups; we performed the more general descriptive statistic to give a high-level summary of our results. Significant statistics were defined to mean with a p-value < 0.001. Pearson's correlation coefficients (r) and their significant were used for analyzing results between all biochemical parameters. The cut-off value of anthropometric markers for insulin resistance was set using receiver operating characteristic (ROC) cure analysis to assess the relative contribution of obesity to insulin resistance in the obese participants compared to the study subjects overall.

Results

The statistical analysis of 30 samples comparison was done between the studied groups (before surgery, after 6-month surgery and healthy group)
The comparison in Tables (1), show a significant difference (P<0.05) for all properties of the studied BMI, Hb1Ac and vimentin protein, a highly significant increase in this parameter (p<0.001) when a comparison between groups. Group A= control
Group B= Patients before BS
Group C = Patients after BS

Table1 the concentration of BMI in three groups

parameters	groups	Mean ±SD
BMI (Kg/Cm^3)	Group A	25.57 ± 1.55
	Group B	40.03 ± 2. 92
	Group C	34.45± 2.19
P-value	Group A vs. Group B, P <0.001***	
	Group A vs. Group C, P <0.001***	
	Group B vs. Group C, P <0.001***	

*** refer to highly significant.

Table2 the concentration of HbA1c in three groups

parameters	groups	Mean ±SD
HbA1c %	Group A	4.60± 0.45
	Group B	6.74 ± 0.78
	Group C	5.85 ± 0.59
P-value	Group A vs. Group B, P <0.001***	
	Group A vs. Group C, P <0.001***	
	Group B vs. Group C, P <0.001***	

*** refer to highly significant.

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Table3: the comparison of lipid profile in three groups

Parameters	Groups	Mean ±SD	P-value
TC (mg)	Group A	132.6±20.82	Group A vs. Group B, P <0.001***
	Group B	240.2±15.50	Group A vs. Group C, P <0.001***
	Group C	158±10. 59	Group B vs. Group C, P <0.001***
TG	Group A	94.42±9.80	Group A vs. Group B, P <0.001***
	Group B	210.5±30.6	Group A vs. Group C, P <0.001***
	Group C	162±11. 19	Group B vs. Group C, P <0.001***
HDL	Group A	50.2±3.22	Group A vs. Group B, P <0.001***
	Group B	35.63±2.12	Group A vs. Group C, P <0.001***
	Group C	33.60±2.16	Group B vs. Group C, P= 0.79
LDL	Group A	63.98±10.49	Group A vs. Group B, P <0.001***
	Group B	162.47±17.67	Group A vs. Group C, P <0.001**
	Group C	92.98±12.99	Group B vs. Group C, P <0.001***
VLDL	Group A	18.42±1.66	Group A vs. Group B, P <0.001***
	Group B	42.1±8.25	Group A vs. Group C, P <0.001***
	Group C	32.4±6.86	Group B vs. Group C, P <0.001***

*** refer to highly significant

Table4: the comparison of kidney function in three groups

Parameters	Groups	Mean ±SD	P-value
Uric acid (µmol/l)	Group A	252.8±1.44	Group A vs. Group B, P <0.001***
	Group B	386.3±5.03	Group A vs. Group C, P <0.001***
	Group C	314.7±15. 59	Group B vs. Group C, P <0.001***
Urea (nmol/l)	Group A	14.12±0.62	Group A vs. Group B, P <0.001***
	Group B	44.5±0.80	Group A vs. Group C, P <0.001***
	Group C	26.7±0.72	Group B vs. Group C, P <0.001***
Creatinine (µmol/l)	Group A	51.33±0.32	Group A vs. Group B, P <0.001***
	Group B	85.63±0.36	Group A vs. Group C, P <0.001***
	Group C	63.60±0.30	Group B vs. Group C, P= 0.79

*** refer to highly significant

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Table5 the concentration of vimentin in three groups

parameters	groups	Mean ±SD
vimentin (ng/ ml)	Group A	18.40 ± 5.21
	Group B	36.53 ± 4.39
	Group C	25.62 ± 5.80
P-value	Group A vs. Group B, P <0.001***	
	Group A vs. Group C, P <0.001***	
	Group B vs. Group C, P <0.001***	

*** refer to highly significant

Discussion

The mean of BMI and HbA1c in the patient's group was determined and the results are described in the Tables 1 and 2. This tables show a statistical comparison of BMI and HbA1c between all groups indicates a significant increase (P>0.05).The BMI and HbA1c was marginally increased in obesity and hypothyroidism with obese , the results of this study support the concept that the environment we live in, which promotes excessive consumption of foods high in energy, is one of the key causes of the condition's rapid development in incidence cases obesity (14, 15). In particular, excessive consumption of foods high in saturated fats and processed sources of carbohydrates, which is frequently accompanied by a low intake of plant-derived foods rich in fiber, vitamins, and minerals, promotes these conditions (16-18). Furthermore, obese persons find food odors more appealing than people of normal weight even if they are less sensitive to odors (19). Finally, found that those with obese had increased odor sensitivity than those with lower BMI (20-23). The stomach's capacity is reduced by reducing its size through bariatric surgery(24). Consequently, the anatomical exclusion of the foregut after BS is the cause of loss of weight (25, 26). Also, this study determines the mean of lipid profile in the patient's group and the results are described in the Table3 showed a statistical comparison of total cholesterol, triglyceride, HDL, LDL and VLDL between groups indicates a significant increase (P >0.05). Many studies have explored the association between obesity and various types of dyslipidemia concurrently (27, 28). This study proven to comprehensively examine the positive associations of obesity and TC, TG and LDL levels, as well as the negative associations of obesity with HDL levels.

Losing weight will reduce the lipid profile after BS surgery (29).This is shown in the table 3.The results of the current studies are in line with this study, which reported a higher prevalence of obese subjects than in normal-weight subjects furthermore of obese patients after BS surgery.

A cross-sectional study of obesity patients with T2DM showed that the course of diabetes is a risk factor for kidney disease(30).So, creatinine , urea and uric acid increased in patients before BS surgery (31). This showed in the table4

Vimentin's biological function within living things has not been completely clarified, research indicating that human adipocyte lipid droplets contain vimentin (32), indicating that vimentin is connected to insulin-sensitive GLUT4 translocation in adipocytes as well as lipid metabolism, particularly TG stability(33). Vimentin may be involved in metabolic irregularities, according to this research; however, studies on its potential effects on diet-induced obesity and type 2 diabetes mellitus have not been conducted. Vimentin deficiency's impact on Iraqi patients' obesity following bariatric surgery and

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type 2 diabetes mellitus is being examined in our research to identify new roles for vimentin in metabolic processes

correlation

As per the r-person statistical approach, there appears to be evidence of a connection between the parameters based on the statistical data. When r approaches 1, there is a linear correlation between the two parameters; when r approaches -1, there is an inverse correlation. There is no link between the parameters when r gets closer to zero.

Figure 1 shows correlation parameters with each other before BS surgery, BMI negatively correlation with lipid profile and HbA1c in obese patient with D.M (34).Also, BMI shows negatively correlation with creatinine and uric acid (35), but this parameter showing positively correlation with HbA1c (36).

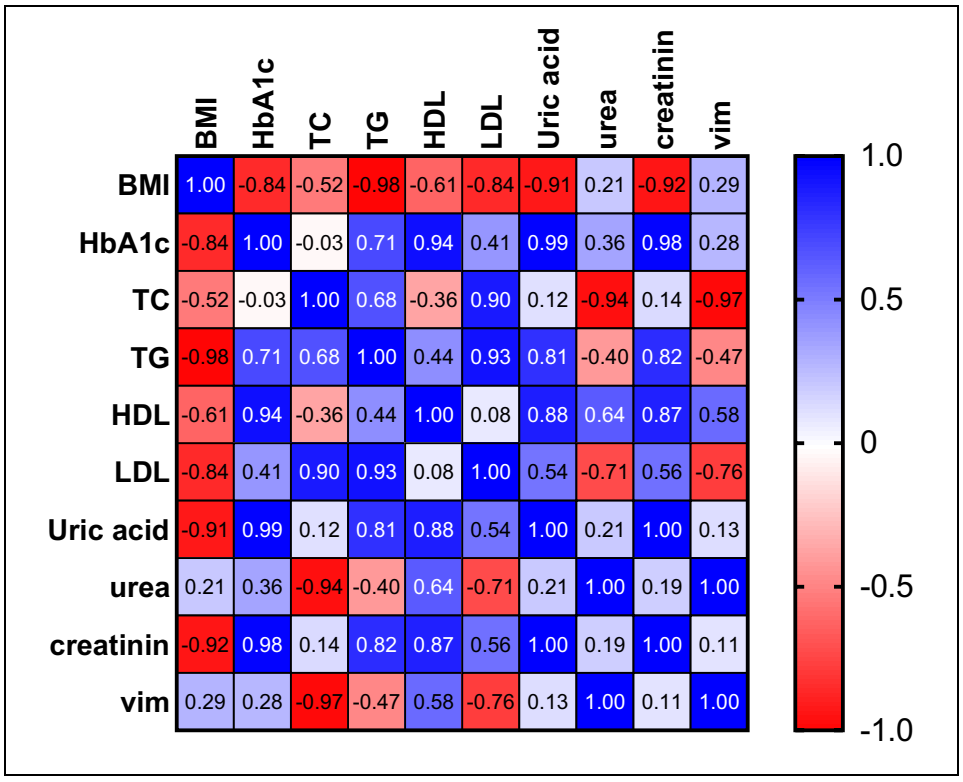

Figure 1: Shows the correlation parameters with each other before BS surgery

Vimentin shown negatively strong correlation with TC and LDL, but positively correlation with HDL and urea and no correlation with BMI and HbA1c.

Area under and the curve ROC for vimentin

The ROC curves were analyzed for vimentin to investigate its predictive value. The optimal cutoff value for circulating vimentin to predict obesity before BS in patients with healthy group was found to be < 2.600 ng/ml, < 33.00 ng/ ml (sensitivity: 85%,

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specificity: 97.83%, and AUC: 0.959) at a 95% confidence interval of (0.995 ~ 0.999) and P <0.001 shows in Figure (2). So can be use vimentin as indicter to predict obesity.

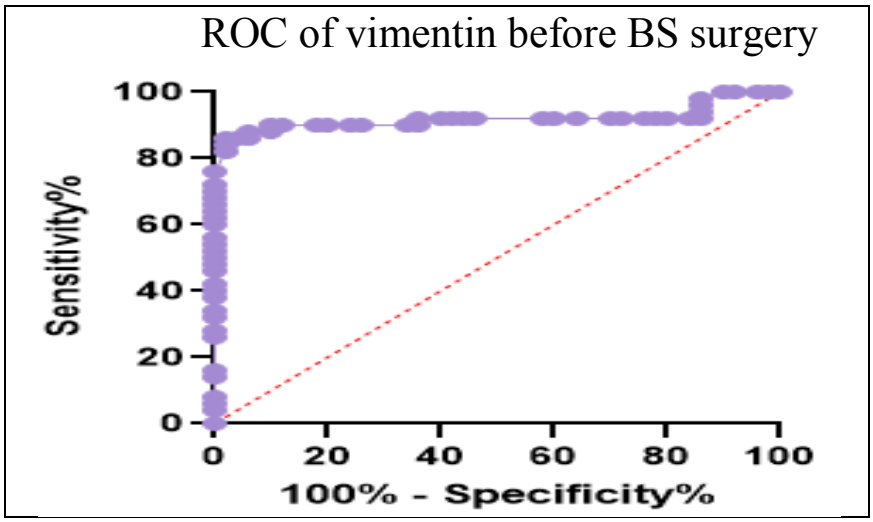

Figure 2: ROC of vimentin before BS surgery

Conclusion

The results of the current study approved that high levels of AFM are associated with high levels of lipid profile, kidney function, BMI and HbA1c in obesity groups before and after BS. From ROC statistical, serum levels of AFM may be a new biomarker for detecting and monitoring obesity with D.M.

DECLARATIONS

Funding

None

Competing interest statement

None

Ethics statement

The authors declare that the author approved that this research follows the journal's Attach Ethic Approval guidelines as appeared on the journal's author guidelines page.

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