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Changes in HbA1c and lipid profile in Obese Patients with prediabetes before and after Laparoscopic Sleeve Gastrectomy

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Abstract:Background: Obesity is considered a multifactorial, and highly preventable disease. Laparoscopic sleeve gastrectomy (LSG) has shown considerable interest as a low morbidity bariatric surgical procedure.This work aims to assess the improvement in lipid profile andhemoglobin A1c HbA1c in obese patients with prediabetes before and after laparoscopic sleeve gastrectomy.

Methods: The study comprises 37 patients, aged 18-60 years, with BMI>35, diagnosed to have prediabetes. The study assesses the changes in HbA1c and lipid profile before and 6 months after sleeve gastrectomy. Patients were recruited from bariatric outpatient clinic at Cairo university hospitals.

Results: HbA1c showed significant reduction 6 months postoperatively. Also, total cholesterol, LDL and triglycerides showed significant reduction 6 months post-operatively and HDL showed significant improvement 6 months post-operatively (P value<0.001).

Conclusion: There was significant reduction in post-operative HbA1c, total cholesterol, LDL and triglycerides also significant improvement in postoperative HDL. This indicates that LSG significantly decreases the risk of developing type 2 diabetes in severely obese patients. Therefore, pre-operative assessment of HbA1c, BMI, total cholesterol, LDL, HDL and triglycerides is essential as this help in identifying the patients who can benefit from LSG.

Keywords:*Prediabetes, HbA1c and lipid profile, Laparoscopic Sleeve Gastrectomy*

Introduction

Obesity is the result of complex relationships between genetic, socioeconomic, and cultural influences. Consumption patterns, urban development, and lifestyle habits influence the prevalence of obesity. The condition may be the result of disease or pharmacologic treatment. It may also be a risk factor for the development of comorbid conditions **(1)**.

The prevalence of obesity is greater in women than men, and increases with age. Although there is some variability between countries and regions, these trends were relatively uniform worldwide. Estimates of obesity prevalence based on World Health Organization (WHO) body mass index (BMI) cut-offs may not adequately capture the full scale of the problem **(2).**

Bariatric surgical procedures are increasingly used worldwide. Bariatric surgery is currently considered the most effective treatment option for morbid obesity; it results in greater improvement in weight loss outcomes and obesity-related comorbidities when compared with non-surgical interventions**(3).**

Laparoscopic sleeve gastrectomy began to be used in 1988 as a variation of biliopancreatic diversion (BPD) with duodenal switch **(4).** LSG consists of subtotal vertical gastrectomy with preservation of the pylorus, including longitudinal resection of fundus, corpus and antrum, to create a tubular duct along the lesser curvature. Resection comprises approximately 80% of the stomach and the capacity of the remaining part > 100 mL. It is easier than other procedures such as RYGB, where multiple anastomoses are required **(5).**Previous studies have found an association between a higher success rate for bariatric surgery and lower preoperative (HbA1c) levels, a shorter duration of T2DM or a shorter duration of medication use and lower daily insulin doses. However, the accuracy of these factors as predictors of outcome in individual patients is limited **(6)**.

This work aims to assess the changes in HbA1c and lipid profile in obese patients with prediabetes before and after laparoscopic sleeve gastrectomy.

Methods

The study comprises 37 patients, aged 18-60 years, with BMI>35, diagnosed to have prediabetes. The study assesses the HbA1c and lipid profile before and 6 months after sleeve gastrectomy. Patients were recruited from bariatric outpatient clinic at Cairo university hospitals.

Inclusion criteria:

Our study included 37 patients, aged between 18 and 60 years with BMI>35 diagnosed to have prediabetes (prediabetes is defined as FBS>100 and <126 mg/dL or HbA1c 5.7-6.5%). These patients underwent laparoscopic sleeve gastrectomy.

Exclusion criteria:

- Patients aged<18 or >60 years
- History of chronic illness e.g., chronic kidney disease or chronic liver disease

Informed consent was obtained from all participants.Comprehensive history taking and clinical examination including blood pressure measurement were done to all patients on initial visits preoperatively. Family history of diabetes mellitus and history of gestational diabetes in female patients were noted. The following laboratory data were done to all patients before laparoscopic sleeve gastrectomy operation:

- HbA1c
- Lipid profile

The following data were done 6 months post-operatively:

- HbA1c
- Lipid profile

Statisticalmethods:

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA). Data was summarized using mean and standard deviation for quantitative variables and frequencies (number of cases) and relative frequencies (percentages) for categorical variables. Comparisons between groups were done using unpaired t test. Comparisons between preoperative and

postoperative value were done using paired t test. For comparing categorical data, Chi square (x^2) test was performed. Exact test was used instead when the expected frequency is less than 5. Correlations between quantitative variables were done using Pearson correlation coefficient. P-values less than 0.05 were considered as statistically significant

Results

Baseline characteristics of patients are illustrated in following figures:

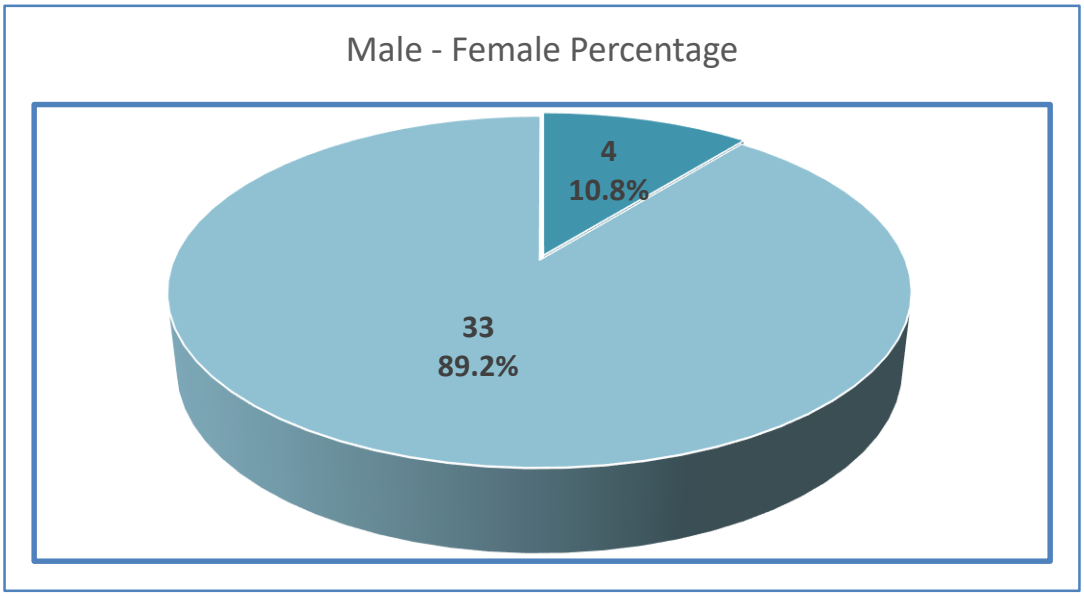

Figure (1): Patients' Distribution according to sex

	Mean	Minimum	Maximum
Age	34.2±8.8	20.0	53.0
Height	162.0±4.9	150.0	173.0

Table (1): patient's age & height

Correlation was done between HbA1c pre and postoperatively showing significant reduction (p value<0.001) which denotes remission of prediabetes post-operatively **(table 2) (figure 2)**.

Correlation of pre-operative total cholesterol, LDL, triglycerides with post-operative total cholesterol, LDL, triglycerides showed significant reduction (p value<0.001) **(table 2) (figure 3) (figure 4) (figure 6).**

Correlation of pre-operative HDL with post-operative HDL showed significant improvement (p value<0.001) **(table 2) (figure 5).**

	Mean	Standard Deviation	Minimum	Maximum	P-Value
HbA1C Pre-Operative	5.9	0.2	5.7	6.4	

HbA1C Post-Operative	5.1	0.3	4.5	5.4	
Cholesterol Pre-Operative	173.9	27.5	110.0	235.0	< 0.001
Cholesterol Post-Operative	151.2	32.4	105.0	223.0	
LDL Pre-Operative	117.6	28.0	70.0	183.0	< 0.001
LDL Post-Operative	102.7	22.1	65.0	158.0	
HDL Pre-Operative	37.1	6.3	23.0	48.0	< 0.001
HDL Post-Operative	43.4	8.9	5.0	59.0	
Triglycerides Pre-Operative	123.4	33.3	70.0	196.0	< 0.001
Triglycerides Post-Operative	102.4	23.6	70.0	164.	

Table (2): comparison between HbA1c and lipid profile pre and post operatively

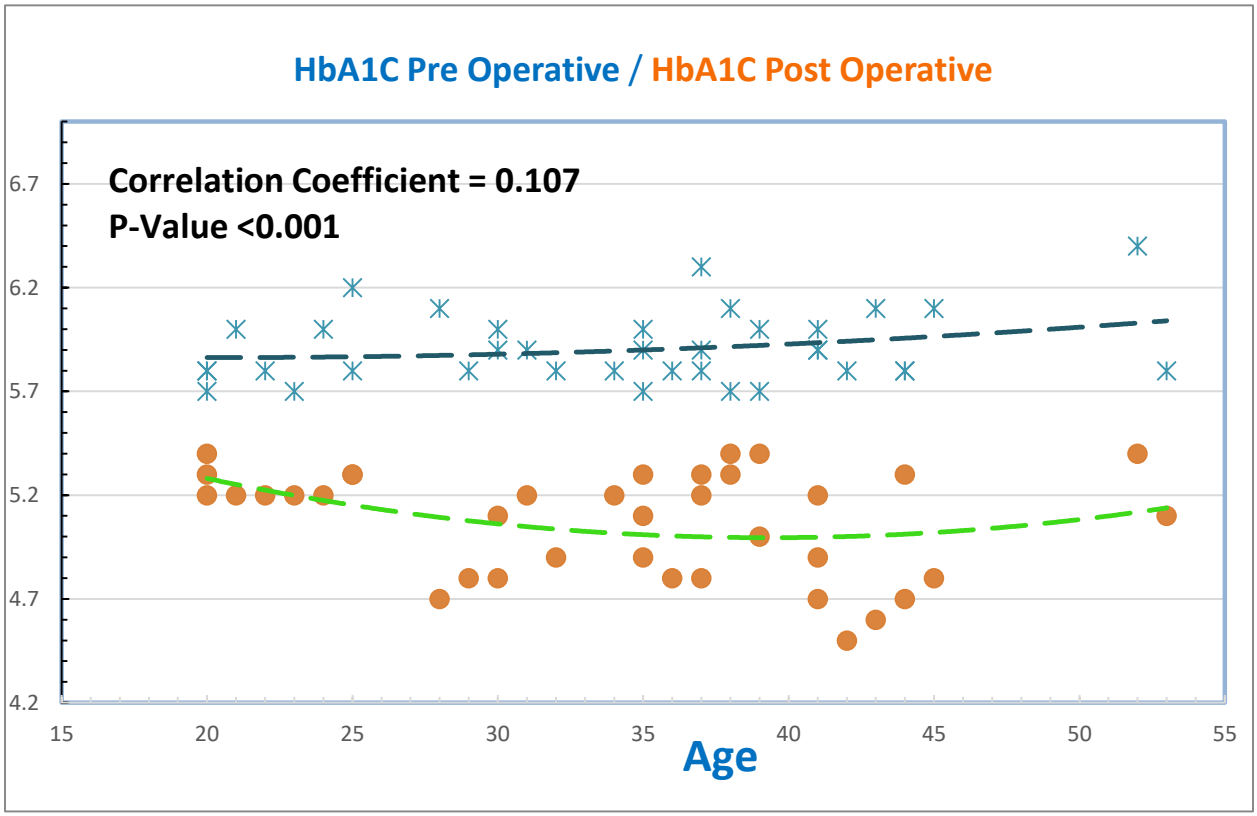

Figure (2): change in HbA1c 6 months postoperatively

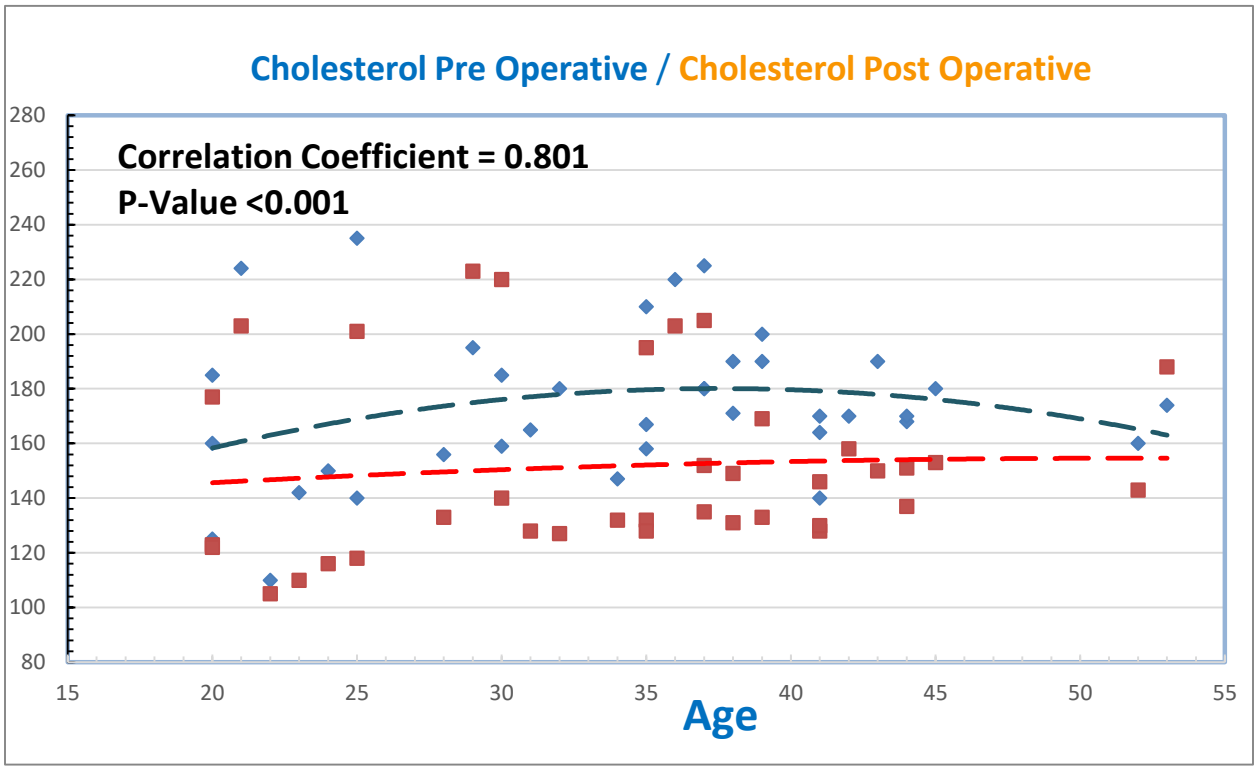

Figure (3): change in total cholesterol 6 months post-operatively

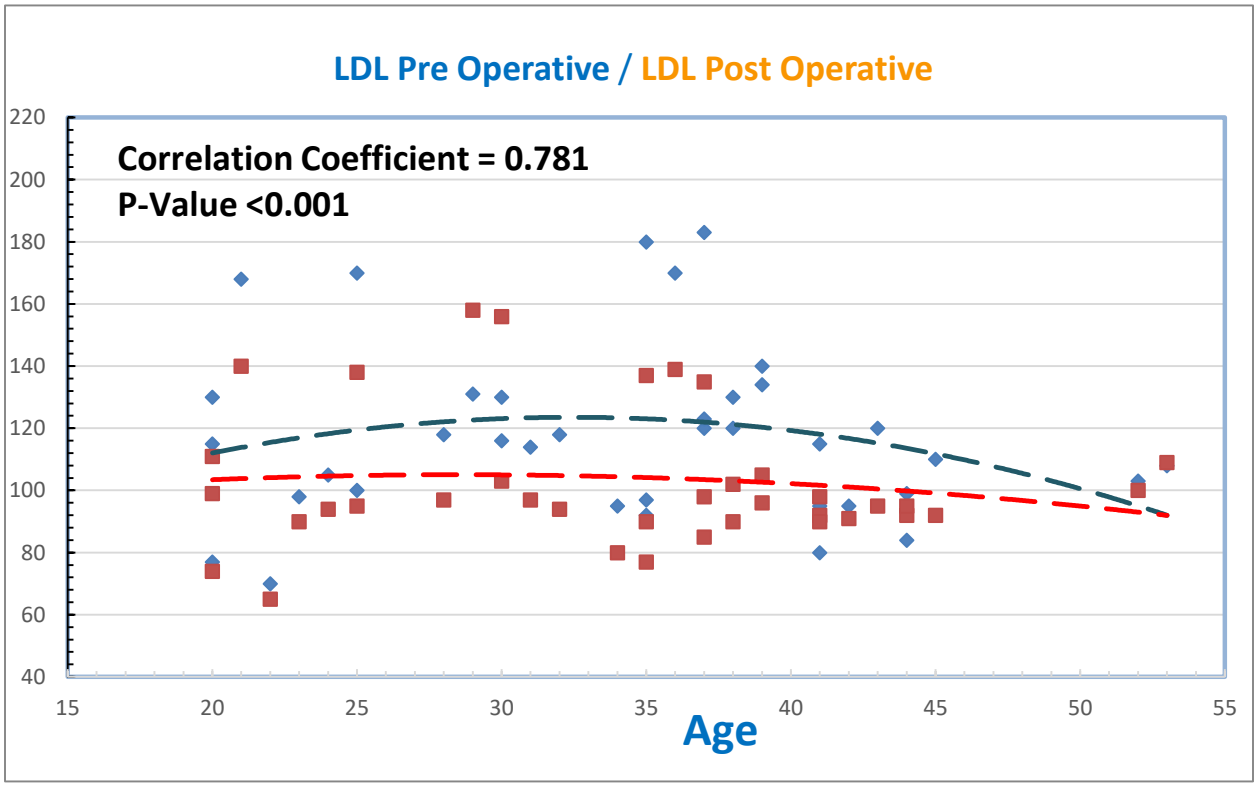

figure (4): changes in LDL 6 months post-operatively

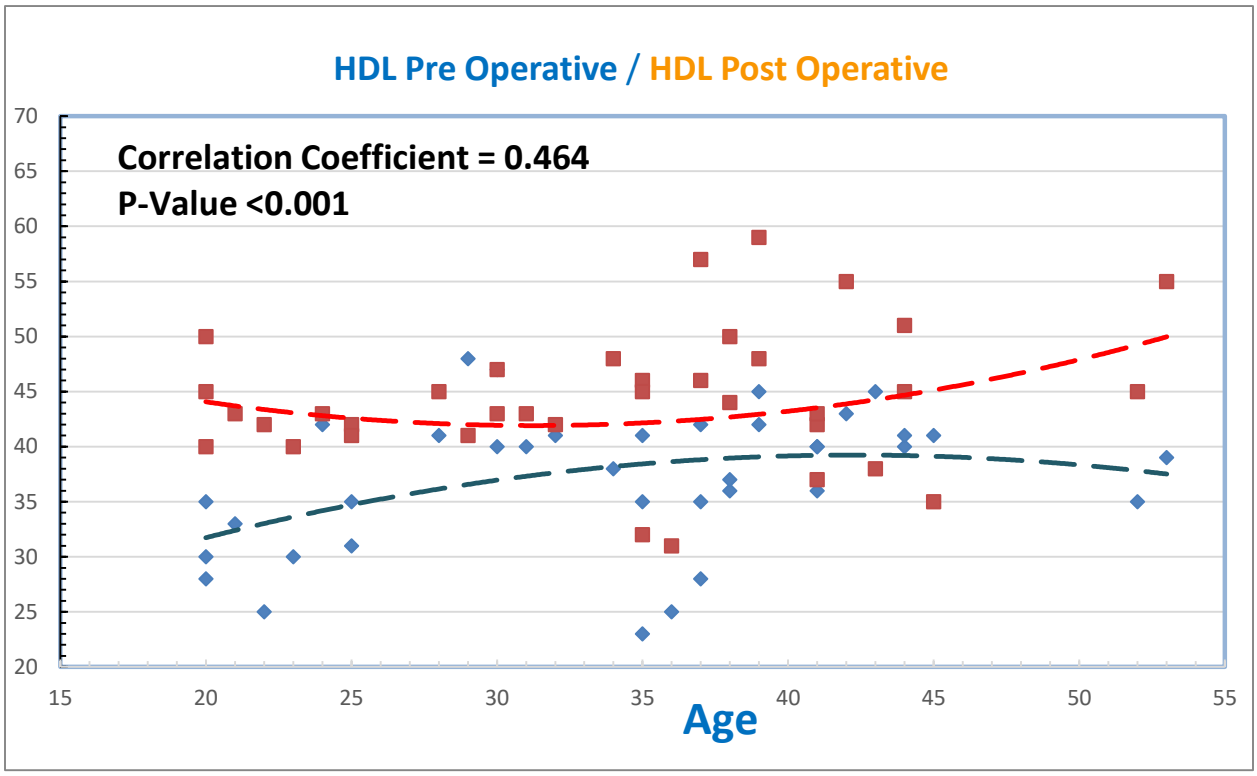

figure (5): changes in HDL 6 months post-operatively

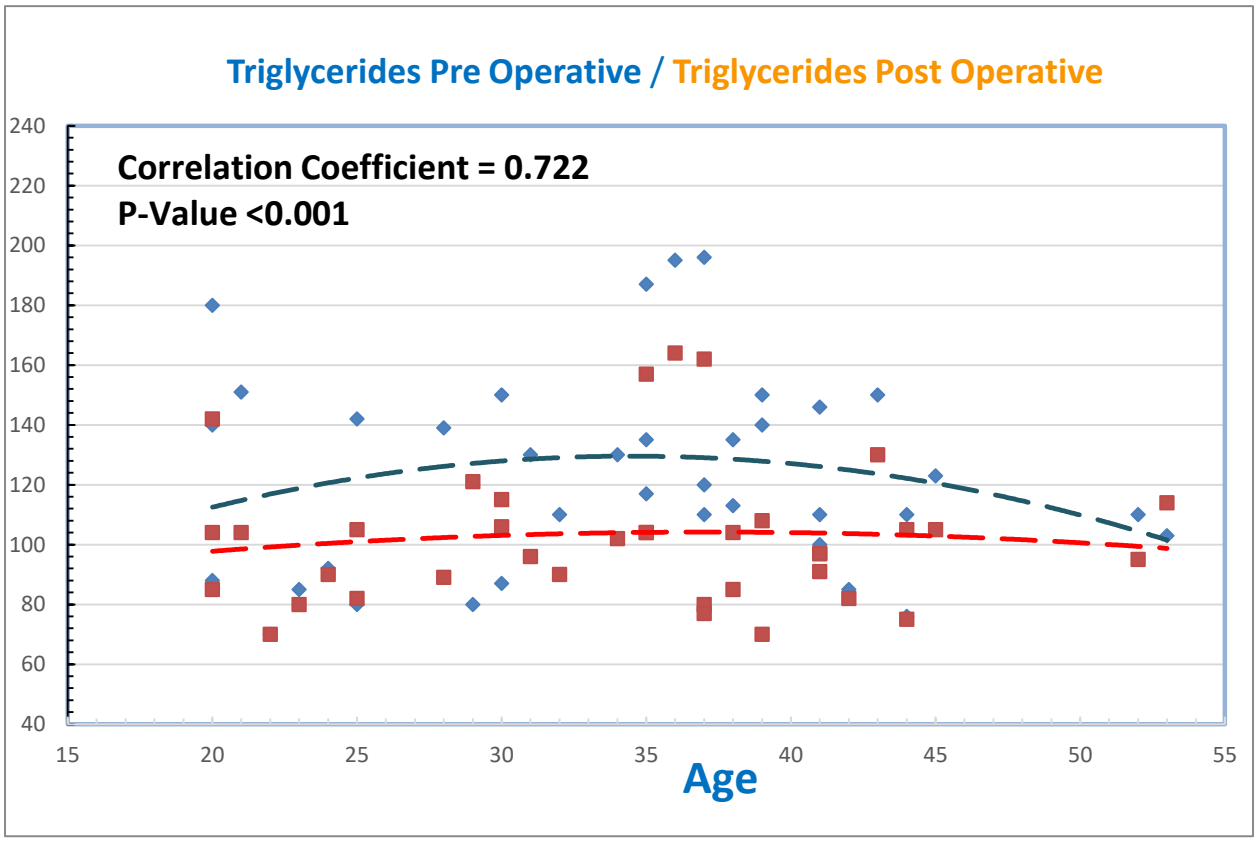

Figure (6): changes in triglycerides 6 months post-operatively

Discussion

Laparoscopic sleeve gastrectomy has become a popular bariatric surgical procedure due to its comparable effectiveness and safety profile. In line with previous studies, significant weight loss as well as a significant improvement in markers of glycaemia and resolution of metabolic syndrome were observed post-operatively **(7).**The remission of diabetes correlates with weight reduction **(8).**

Bariatric surgery is an excellent solution to diabetes remission and weight reduction in most cases **(9).** However, only a few studies have researched the impact of sleeve gastrectomy on prediabetes. In this study, the changes in glucose and lipid profile in prediabetes patients who underwent LSG were evaluated and discussed.

In our study, there was significant reduction in HbA1c 6 months post-operatively (p value<0.001). This indicates that LSG can prevent development of type 2 diabetes in obese patients with prediabetes.

Similarly in a study by Natoudi et al.,LSG was done to 62 obese patients which were divided into three groups according to their glycemic profile preoperatively, first group (normal oral glucose tolerance test (OGTT)), second group abnormal OGTT undiagnosed (borderline, *n* = 20), and third group diagnosed and treated as type 2 diabetes mellitus patients (*n* = 12) and showed significant change in OGTT in all groups with significant improvement in glycemic state in second group which prevented the development of diabetes in this group **(10).**

Also in a study by Mak et ai., at 1 year post-surgery, patients with prediabetes exhibited a continuous significant reduction in weight, BMI, HbA1c, insulin, C-peptide, glucose, and TG ($P \leq 0.05$)**(11).**

Also this result corresponded with the findings of Rubio-Almanza et al., who suggested that bariatric surgery improves glycaemic control and obesity comorbidities in prediabetes patients**(12).**

In the current study, total cholesterol, LDL and triglycerides showed significant reduction 6 months post-operatively and HDL showed significant improvement 6 months post-operatively (P value<0.001).

In comparison to a meta-analysis done by Gloy et al., The mean changes in total cholesterol concentration were pooled for seven studies. Change of cholesterol was not significantly different between bariatric surgery and non-surgical treatment (P value 0.05). Changes in HDL cholesterol concentration was available for eight studies. Concentration increased more after bariatric surgery than after non-surgical treatment (P value 0.06). The mean changes in triglyceride concentrations were available for eight studies. Triglycerides decreased more after bariatric surgery (P value<0.001) **(13).**

Therefore, the current study detected lowering in total cholesterol, LDL and triglycerides and improvement in HDL, which is most probably related to weight reduction occurred after LSG and improvement of insulin resistance.

Conclusion

There was significant reduction in post-operative HbA1c, total cholesterol, LDL and triglycerides also significant improvement in postoperative HDL. This indicates that LSG significantly decreases the risk of developing type 2 diabetes in severely obese patients. Therefore, pre-operative assessment of HbA1c, BMI, total cholesterol, LDL, HDL and triglycerides is essential as this help in identifying the patients who can benefit from LSG.

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