

Original Research Article

Effects of Liraglutide on Weight Reduction & Metabolic Parameters in Patients living with Obesity With and Without Type 2 Diabetes Mellitus at Fujairah Hospital

Abstract

Background:

Obesity has become a global epidemic and is a key contributor to numerous adverse conditions, including Type 2 Diabetes Mellitus, cardiovascular disease, and strokes. Liraglutide, a glucagon-like peptide 1 (GLP-1) receptor agonist, has been found to be useful in promoting weight loss in diabetics and poly-cystic ovary syndrome patients.

Methods:

This study aimed to evaluate the response of patients with and without type 2 diabetes Mellitus who received a Liraglutide 3mg injection in terms of weight reduction and improvement of metabolic parameters in the United Arab Emirates population. This study was conducted in Fujairah Hospital, UAE, with 200 participants aged 18 years and above, including patients with and without type 2 diabetes Mellitus. The primary objective was to assess the reduction of Body Mass Index and changes in metabolic parameters. Secondary objectives included evaluating the effect of weight reduction on fertility for females with PCOS and the potential improvement of psychological well-being and quality of life.

Results:

In terms of weight changes, the average weight at baseline was 100.98 kg and had decreased to 97.54 kg, 96.00 kg, and 96.37 kg at 3, 6, and 12 months, respectively. Males experienced a greater rate of weight reduction than females, while diabetic patients had a lower percentage of weight loss than non-diabetic patients. Additionally, patients with PCOS were able to conceive regularly after reducing 10% of their body weight after using Liraglutide, while the remaining 15 patients who were married but unable to conceive saw an improvement in their menstrual cycle and hirsutism.

Conclusion:

The results demonstrated that Liraglutide is an effective treatment for weight reduction and metabolic parameter improvement in the UAE population. In addition, the study identified a correlation between weight reduction and improvements in psychological health, quality of life, and fertility in females with PCOS.

Keywords: type 2 diabetes, body mass index (BMI), Polycystic ovarian syndrome (PCOS).

INTRODUCTION

Obesity has become a global epidemic that affects diverse societies across both developed and developing countries. It is a key contributor to numerous adverse conditions that include, but are not limited to, Type 2 Diabetes Mellitus, cardiovascular disease, and strokes (1). The first line of therapy for obesity is lifestyle modification in order to achieve significant weight loss. Clinically-relevant weight loss is defined as a loss of more than 5% of one's starting body weight. This typically includes calorie restriction, with a deficit of 500-750kCal/day, as well as 150-180 minutes of physical exercise per week (2). The obesity treatment guidelines advocate for the use of pharmacological therapy in adults with refractory obesity, where patients have a BMI ≥ 30 kg/m², despite attempting lifestyle modification (3). Pharmacological therapy is also advocated for patients with a BMI ≥ 27 kg/m² and at least one comorbid condition, such as hypertension, dyslipidemia, insulin resistance, or type 2 diabetes mellitus (4). It is essential to counsel the patients about the importance of lifestyle changes alongside medical therapy in order to improve outcomes.

Liraglutide is a glucagon-like peptide 1 (GLP-1) receptor agonist that has been successfully used in the treatment of type 2 diabetes mellitus for years. Weight loss has been described as an additional benefit to liraglutide therapy (5). In addition, Liraglutide has been found to be useful in blood pressure reduction as well as the modulation of metabolic parameters (6). To date, few meta-analyses have been conducted regarding Liraglutide's safety and efficacy in individuals without diabetes.

The UAE is among the top 40 countries worldwide for prevalence of obesity (7). At Fujairah hospital, we conducted a follow up study on people living with obesity. Liraglutide 3 mg is one of the few medications licensed by the FDA for use in weight management and the health authority in the UAE made Liraglutide 3 mg available for use in managing obesity.

Since many pharmacological agents show different effects in different regions, we conducted this study on patients in Fujairah, UAE, looking into the effect of Liraglutide on weight reduction and improving metabolic parameters.

PATIENTS AND METHODS

Aim of study

To evaluate the responses of patients, with and without type 2 diabetes Mellitus, who received liraglutide 3 mg injection, in terms of weight reduction and improvement of metabolic parameters.

Primary objective

To assess the reduction of BMI and changes in metabolic parameters. This includes lipid profiles, HbA1C in diabetics, and liver function tests. The parameters were recorded from the day Liraglutide drug and diet were started and continued for 12 months of therapy.

Secondary objectives

To evaluate the effects of weight reduction on fertility for females with PCOS. In addition, to evaluate the benefits of weight reduction in the improvement of psychological well-being and of quality of life.

Study design

All aspects of the study, including consent forms, were Institutional Review Boards (IRB) approved prior to implementation. Fully informed consent was acquired from all participants and it was ensured that they were compliant with all study requirements.

After getting informed consent, patient demographics and comorbidities (diabetes mellitus) were recorded. BMI and HbA1C values were documented at intervals of 0, 3, 6, 9, and 12 months, whereas other laboratory investigations including a lipid profile, Hb, and vitamin D were recorded at intervals of 0, 6, and 12 months. We also measured AST, ALT, and ALP values at 0,3, and 6 months.

An excel sheet was used to collect data for the measurable parameters and a questionnaire was filled out for non-measurable parameters like improvement in functional capacity, cognitive function, and infertility for females with PCOS.

Study population

The study was conducted in Fujairah Hospital, United Arab Emirates. We included 200 patients, all of whom were above the age of 18 years old. This included patients with and without type 2 diabetes mellitus who were started on Liraglutide 3 mg injections for weight management, including those who received other modalities for weight management (bariatric surgery procedures) but developed weight regain. The

participants were willing to participate in the study, including regular follow-up visits to the obesity clinic for 12 months. Patients who stopped taking the drug before 6 months, took the drug for less than 6 months, or did not attend regular follow-ups were excluded from the study.

Recruitment methods

Subjects were identified through existing patient records for follow-up treatment in the obesity clinic at Fujairah hospital. All patients who met the inclusion criteria were recruited and informed about the retrospective nature of the study. Their weight, side effects, adherence to the drug, and improvement in general well-being were monitored. The difference in response to the drug in weight reduction between the individuals in the study was evaluated, as well as other factors that might have contributed to this difference in response, like psychological distress, adherence to physical activities, and dietary advice. Those who agreed to participate in the study were asked to fill out a questionnaire about the compliance and side effects of the drug during the first 6-12 months of treatment. We accessed their medical records to get the information illustrated in the Excel data sheet.

Statistical Analysis

Definition

The percentage of weight loss at 3 months was calculated by dividing the difference between the weight after 3 months and the baseline weight, divided by the baseline weight and multiplied by 100. The percentage of weight loss at 6 and 12 months were similarly calculated. However, the difference between the weight after 6 months and the baseline weight, and the difference between the weight after 12 months and the baseline weight, were used respectively instead.

The study included patients that have been documented on hospital records as having Type 2 diabetes mellitus. The condition is characterized by chronic hyperglycemia due to acquired peripheral insulin resistance. According to the American Diabetes Association (ADA), Diabetes Mellitus is diagnosed when a patient is found to have a fasting plasma glucose of ≥ 126 mg/dL (7.0 mmol/L), plasma glucose after 2-h oral glucose tolerance test (OGTT) ≥ 200 mg/dL (11.1 mmol/L), HbA1c $\geq 6.5\%$ (48 mmol/mol), or a random plasma glucose ≥ 200 mg/dL (11.1 mmol/L). The data was analyzed by ANOVA statistical analysis.

Results

Baseline Characteristics

A total of 200 patients complying with the inclusion criteria were included in the study. 73% of the population were females (n=156) with a mean weight of 97.16 kg, compared to 27% (n=44) males with a mean weight of 113.82 kg (Table 1 and Table 2). Arab nationals constituted 99% of the study (n=198), 93% being Emirati nationals (n= 186) and 1% (n=2) non-Arabs. A total of 39 (19.5%) patients were diagnosed with type 2 diabetes mellitus with a mean Hba1c of 5.83 before starting the liraglutide treatment. 43 patients (21.5 %) had previously undergone bariatric surgery. 23 female patients (14.7 %) had PCOS, 15 of which were married and unable to conceive

In accordance with our inclusion criteria, all 200 patients underwent a minimum of 6 months of follow-ups. Of those, 54 patients (27%) were followed up with for between 6 to 12 months and 146 patients (73%) were followed up for more than 1 year.

Lifestyle modifications are necessary to manage excess weight and obesity in adults. Such changes were recommended to all patients from the start of liraglutide treatment and were restated with each follow-up visit. Of the sample size, 109 patients (54.5 %) were compliant with dietary changes, and 95 patients (47.5%) were compliant with regular physical activity. 5 patients discontinued the drug due to major side effects, mainly severe nausea and vomiting. A minority of patients (n=28, 14%) continued to take the drug despite experiencing such symptoms. Few patients (n<10) did not adhere to treatment due to social reasons and failure to achieve the desired weight.

Weight Changes

In terms of anthropometric measurements, weight, BMI, and percentage loss of excess weight were assessed. The mean baseline weight was 100.98kg, which had significantly dropped to 97.54 kg, 96.00 kg, and 96.37 kg at 3, 6, and 12 months respectively (Table 3). This change was statistically significant ($P<0.001$) at each point in time. The mean BMI baseline was calculated to be 38.44 kg/m², which dropped to 37.33 kg/m², 36.72 kg/m², and 36.74 kg/m² at 3, 6, and 12 months respectively (Table 3-3). 15 patients reported a lack of response to liraglutide in reducing their weight after the initial response during the first 6 months. This is known as the weight loss plateau, which can be explained by the body's physiological response. This response could either be due to a physiological adaptation to energy expenditure or the lack of adherence to weight loss interventions, including lifestyle modification as well as medication adherence, after 6 months 9,10.

The male patients had on average a higher baseline weight than the females, which was also true in each of the follow-ups (3 months, 6 months, and 12 months). Upon further analysis, we found that there were no statistically significant differences between genders in terms of BMI at baseline, or 3, 6, and 12 months (Table 3). However, the percentages of weight loss in males at 3, 6, and 12 months were higher than the percentages of weight loss in females.

In a patient with diabetes, the percentage of weight loss was 3.7% at 3 months, in comparison to 4.2% weight loss in the non-diabetic group. At 6 months the percentage of weight loss increased to 6.4% in the diabetic group in comparison to 8.5% in the non-diabetic group. At 12 months the

diabetic group had lost 11.9% of their weight, while the non-diabetic group had lost 9.5%. This could be due to other modalities of treatment that contributed to weight loss in the diabetic group.

46 patients in the non-bariatric group had lost 5% of their body weight at 3 months (response to treatment group), while 13 patients in the same group had lost 10% of their weight at 3 months (super response group). When combined with diet and exercise in a real-world setting, liraglutide 3.0 mg demonstrated significant weight loss.

Out of a total of 200 patients, 43 patients (21.5%) underwent bariatric surgery and received liraglutide for the management of post-bariatric weight regain. Tables [show](#) the average weight loss at 3, 6, and 12 months in bariatric patients and non-bariatric patients, respectively. Upon analysis, we noticed that the mean weight loss at 3 months was higher in patients who had previous bariatric surgery by 0.6 kg. However, at the 6 and 12 month follow-ups, the mean weight loss was higher in patients who had not undergone previous bariatric surgery (Figure 2). Therefore, we conclude that over a long period of time, liraglutide had a better effect on patients who had not undergone bariatric surgery before. Despite the difference in weight loss between the two groups (bariatric vs. non-bariatric), we found that post-bariatric surgery patients with insufficient weight loss or excessive weight regain who use liraglutide 3.0 mg were able to achieve statistically significant weight loss, regardless of the type of bariatric surgery they had undergone.

Post-bariatric surgery patients taking liraglutide 3.0 mg continued to lose weight at 1 year, although to less of an extent than those in the non-bariatric group, and have a similar side effect profile to what is observed in patients without bariatric surgery, with the exception being potentially more severe adverse events reported. These results are promising as current methods for weight management in post-bariatric surgical patients are limited and carry greater risks to the patients.

Metabolic Parameters

The baseline HBA1c in diabetic patients was 7.00, which dropped to 6.83 at the 12 month follow-up, which is represented in Table 4. The levels of LDL in diabetic patients were not significantly affected, as demonstrated. Also, the improvement in ALT and ALP for liver function was significant. The reduction of LDL-c from baseline was 0.14 at 6 months, while ALT reduction was 1.19% at 6 months, and there was a 2.7% reduction in ALP from baseline.

Other Parameters

Of the 23 female patients who had PCOS, we noted an improvement in their general well-being and cognitive function after starting Liraglutide treatment. The percentage of weight loss for patients with PCOS was 4.5 % of their weight at 3 months, which increased to 8.35 % at 6 months, and reach 24% at 12 months. As a result, 5 patients were able to conceive normally after losing 10% of their body weight, while 2 patients

succeeded in getting pregnant with IVF. 15 of the remaining group were married and failed to conceive, but their menstrual cycle and hirsutism improved.

Overall, we noted that Liraglutide was well tolerated in our study group. Mild nausea was dominant at the beginning of the treatment as well as gastrointestinal side effects with one patient reporting severe bloating. One patient with a known history of allergy developed a skin rash and stopped the treatment. Treatment with liraglutide in combination with metformin and lifestyle intervention resulted in a significant weight loss in overweight and obese women with PCOS, indicating that liraglutide may be an effective alternative for weight loss in this group of patients

Functional disabilities like breathing difficulties and snoring in a patient with obstructive sleep apnea, along with knee, joint, and back pain, improved for those who achieved 10% weight loss.

Discussion

The current study indicates that Liraglutide use is an effective approach to weight loss in persons who are obese, diabetic, or have PCOS. Our treatment strategy resulted in a statistically significant decline in weight, BMI, and percentage of extra weight over a 12-month period. In our study, anthropometric measurements were taken to determine weight, BMI, and excess weight loss (%). The average weight at the start of the trial was 100.98 kg. This was reduced to 97.54 kg after three months, 96.00 kg after six months, and 96.37 kg at the end of the 12-month trial. At each time point, weight loss was statistically significant, with a p-value of less than 0.001. This study's findings are corroborated by another study in which statistically significant decreases in BMI and weight parameters were achieved with the use of liraglutide compared to the use of a placebo. These changes were detected through the end of 52 weeks, but not at 26 weeks. Similarly, our findings agree in part with those of prior studies in the Chinese population (8), in which people with a higher initial BMI experienced substantial weight loss after 24 weeks of treatment with Liraglutide, and in a Northern East Italian cohort (9), where weight loss was linked to baseline body weight.

Additionally, this study's results are consistent with previous research, which demonstrated the influence of gender on the efficacy of Liraglutide in managing weight (10). In our study, both male and female patients lost weight, though the percentage of male patients who lost weight was slightly higher. This contradicts previous research in which the female gender predominated; this may be owing to women's greater exposure to Liraglutide.

In our study, we also noticed statistically significant changes in the weight loss of diabetic patients. This finding was replicated by a trial in which a total of 69 individuals reported a reduction in body weight one year after beginning liraglutide medication, while 58 patients (67.4%) demonstrated an improvement in blood sugar control (11). The patient's body mass index (BMI) decreased from 27.3 ± 5.4 kg/m² to 25.9 ± 4.8 kg/m² and the reduction in body weight was statistically significant and sustained over 4% at the 2-year mark after starting liraglutide. However, in our study, this decrease in weight was less than experienced by the non-diabetics.

In addition, we discovered that the HbA1c levels of diabetic patients reduced from 7.00 at baseline to 6.83 after 12 months of follow-ups. This result is consistent with three previous research studies. According to them, six months of treatment with liraglutide resulted in a significant drop in HbA1c values, ranging from 0.5% to 1.15. (12-14). Similarly, in our research, there was a significant improvement in ALT and ALP for liver function. The reduction in LDL-c from baseline was 0.14 at 6 months, while the reduction in ALT was 1.19% at 6 months and 2.7% in ALP from baseline. This finding aligns with previous research, showing significant improvements in total cholesterol and triglycerides when compared to active comparators(15).

Furthermore, our data suggest that Liraglutide treatment can lead to improvement in general well-being and cognitive function for female patients with PCOS. Additionally, it appears to be an effective weight loss therapy for PCOS patients, as a weight loss of 4.5% at 3 months, 8.35% at 6 months, and 24% at 12 months were noted in our study. The treatment also had a positive effect on the fertility of patients, as results demonstrated 5 patients conceived normally and 2 patients conceived through IVF after losing 10% of their body weight. This is similar to another study in which a 6-month controlled trial evaluated the effectiveness of daily liraglutide 1.8 mg on weight loss in 19 women with obesity and Polycystic Ovary Syndrome (PCOS) and 17 control subjects of similar age and weight. Both groups experienced a weight loss of 3-4% as a result of liraglutide treatment (16). However, this research did not assess the cognitive function of these women. Our study is the first to evaluate weight loss along with cognitive function in patients with PCOS. Our study also reported some side effects, such as nausea and vomiting, that led to some patients discontinuing the treatment.

Strength & Limitations

The strengths of this study include a relatively large sample size of 200 patients and the fact that the study population was diverse, including a mix of genders and patients with different comorbidities such as type 2 diabetes and PCOS. The study also had a relatively long follow-up period of at least 6 months, allowing for the assessment of weight reduction over an extended time. In addition to liraglutide, the research included dietary and exercise interventions, offering a more comprehensive perspective of the drug's effectiveness in conjunction with lifestyle improvements.

The major limitation of this study was that the group included was not representative of the general population, as all patients were Arab nationals and the majority were Emirati. In addition, the trial lacked a control group, which would have permitted a comparison of the efficacy of liraglutide with other treatments or a placebo. Since only one patient stopped taking the drug because of severe nausea and vomiting, more data should have been collected on these adverse effects. Moreover, the data on pregnancy rates is limited. The study was also retrospectively designed across the year 2021-2022, which may introduce bias in the data collection. However, it is one of the few trials done in the UAE with a total of 200 patients to evaluate the effect of liraglutide on weight, BMI, and its adverse effects. In addition, we evaluated other metabolic parameters, including effects on HbA1c and LDL.

Clinical Implications

The therapeutic implications of this study imply that the liraglutide 3 mg injection may be an effective weight management strategy for patients with or without type 2 diabetes. In diabetics, the study revealed a significant decrease in BMI and improvements in metabolic indicators such as lipid profiling and HbA1c. In addition, weight loss improved the fertility of women with PCOS, as well as their psychological health and quality of life. These results imply that liraglutide may be a viable therapy choice for patients with type 2 diabetes in terms of weight management and metabolic control. Moreover, it appears to be beneficial for PCOS patients.

Conclusion

The study on the drug Liraglutide showed that it induced significant weight loss, as well as improvement in HbA1c levels when combined with lifestyle modification. The results of this study were as predicted and support the findings of previous studies, with non-substantial variations attributed to differing ethnicities within trial groups. As a result, we recommend the usage of liraglutide 3.0 mg injection as an integral part of weight loss management for patients living with obesity.

Disclosure: The authors report no conflict of interest in this study

RESULTS:

Table 1: Baseline characteristics for all subjects in the study:

Baseline character	Total Number of patients=- 200
Male	44
Female	156
UAE National	186

Age 26-60 years	97
Diabetic	39
Non- Diabetic	161

Table 2: Duration of treatment (month):

Duration of treatment (Months)	Total Number of Patients
3 - 6	200
7- 9	193
10 - 12	167
More than 12	146

Table 2-2: Baseline characteristics for all subjects: Gender:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	44	5.9	22.0	22.0
	Female	156	20.9	78.0	100.0
	Total	200	26.8	100.0	

Table 2-3: Baseline characteristics for all subjects: Nationality:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UAE	186	24.9	93.0	93.0
	Arab	12	1.6	6.0	99.0
	Non-Arab	2	.3	1.0	100.0
	Total	200	26.8	100.0	

Table 2-4: Patient with Type2 Diabetes:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	DM	39	5.2	19.5	19.5
	NO DM	161	21.6	80.5	100.0
	Total	200	26.8	100.0	

Table 2-5: Patients with PCOS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	HAS PCOS	23	3.1	11.5	11.5
	NO PCOS	177	23.7	88.5	100.0
	Total	200	26.8	100.0	

Table 2-6: the patient had bariatric surgery in the past and was treated with Liraglutide 3.0 mg for weight regain:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	HAD SURGERY	43	5.8	21.5	21.5
	NO SURGERY	157	21.0	78.5	100.0
	Total	200	26.8	100.0	

Primary outcome results for the study:

Change in body weight (kg):

Table 3-1: Mean of weight loss during the course of treatment:

Time Interval	Mean of weight loss during the course of treatment with Liraglutide 3.0 mg for weight management
Mean of weight at 0 months	100.98
Mean of weight at 3 months	97.54
Mean of weight at 6 months	96.00
Mean of weight at 12 months	96.37

Table 3-2: Percentage of weight loss in obesity after starting Liraglutide 3mg by gender:

n=200	Percentage loss (%)	3 months	6 months	12 months
Weight (Kg)	Female	2.932	4.541	5.237
	Male	3.996	5.177	6.663

BMI (Kg/m2)	Female	2.361	4.165	5.278
	Male	4.192	5.233	6.376

Table 3-3: Changes in obesity measures after starting Liraglutide (changes in body weight):

	AGE /YEAR	WEIGHT 0 (BASELINE)	WEIGHT 1(AT 3 MONTH)	WEIGHT 2 (AT 6 MONTH)	WEIGHT 3(AT 12 MONTH)
N Valid	200	200	200	200	166
Mean	38.04	100.87	97.57	96.03	96.30
Median	38.00	98.50	94.00	93.00	94.50
Minimum	18	65	64	64	61
Maximum	77	164	158	156	156

Table 3-4: Changes in obesity measures after starting Liraglutide (changes in BMI):

		BM1 (0) BEFORE STARTING THE DRUG	BMI-1 (3 MONTH)	BMI (6 MONTH)	BMI (9 MONTH)	BMI (12 MONTH)
N	Valid	200	200	200	190	165
Mean		38.44	37.35	36.73	36.39	36.73
Median		37.00	36.00	35.00	35.00	36.00
Minimum		25	25	23	5	22
Maximum		58	58	59	59	59

Table 3-5: percentage and number of patients' weight loss:

Time interval	Number of non-bariatric patients with weight loss of	
	>5%	>10%
3 months	46	13
6 months	65	23
12 months	65	38

Table 3-6: Mean weight lost in post-bariatric weight regain patients:

Time interval	Mean of weight loss (kgs)
Mean of weight lost at 3 months	3.78

Mean of weight lost at 6 months	4.71
Mean of weight lost at 12 months	5.60

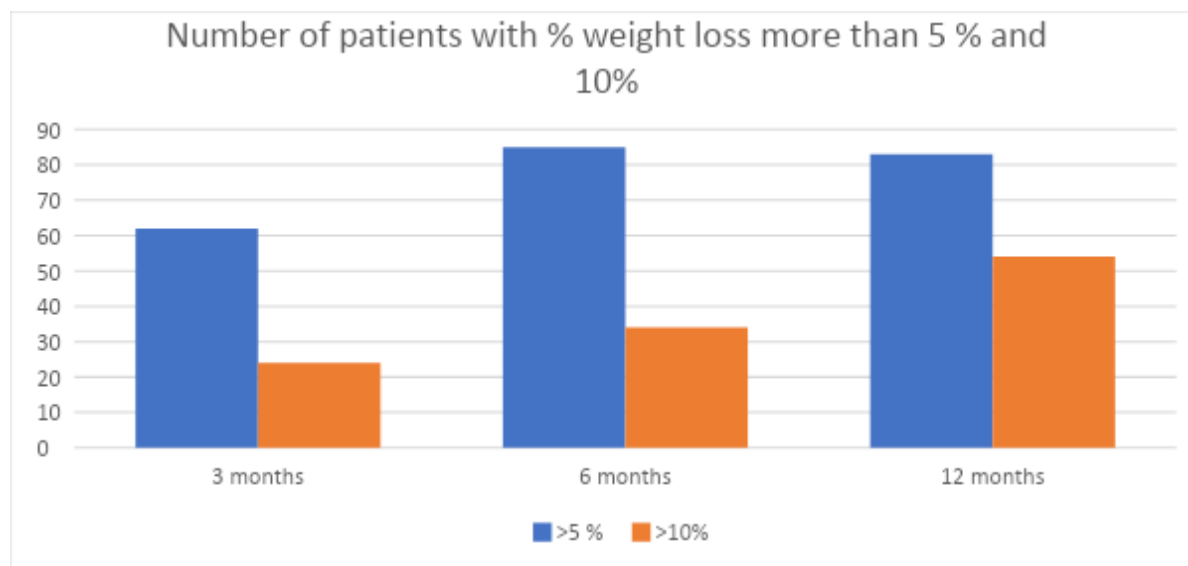


Figure: 1 Bar graph showing Weight lose scinario

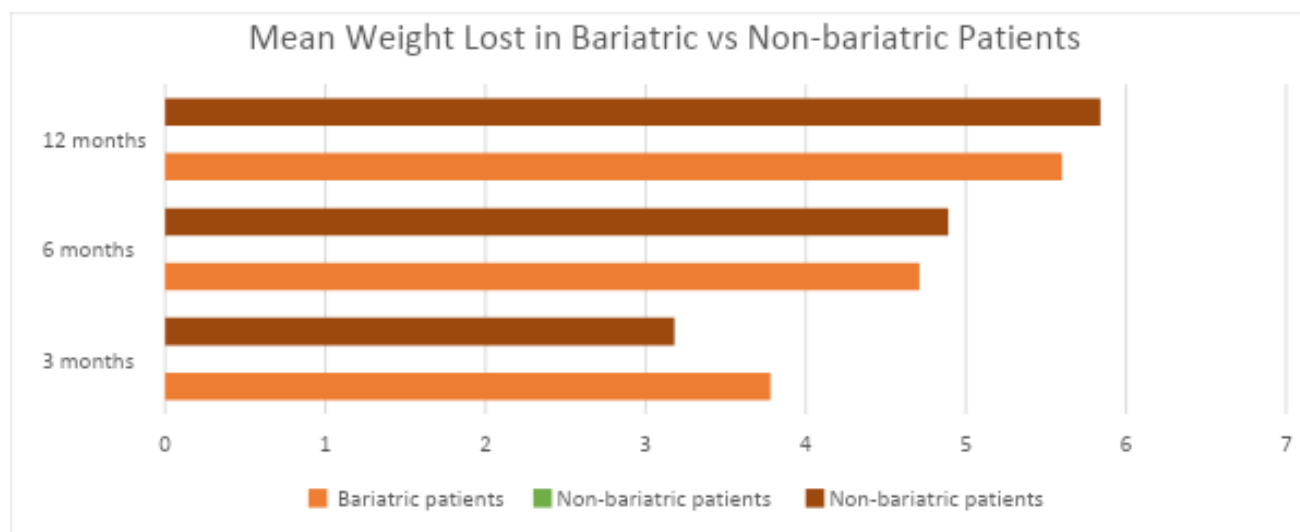


Figure:2 Mean weight loss in Bariatric vs Non-Bariatric patients

Table : Time interval for diabetic and non diabetic patients

Time Interval	Average Weight (kg/m2)	
	Diabetic	Non-Diabetic
0 months	100.7093168	101.4487179
3 months	97.2584472	98.72051282
6 months	95.57509317	97.76923077
12 months	95.84485075	98.246875

	Percentage weight loss (%)	
Time Interval	Diabetic	Non-Diabetic
3 months	3.79	4.29
6 months	6.43	8.59
12 months	11.95	9.59

	Number of diabetic patients with weight loss of	
Time interval	>5%	>10%
3 months	15	7
6 months	21	9
12 months	20	11

	Number of non-diabetic patients with weight loss of	
Time interval	>5%	>10%
3 months	46	10
6 months	63	21
12 months	62	34

	Average BMI (kg/m2)	
Time Interval	Diabetic	Non-Diabetic
0 months	38.16189441	39.59794872
3 months	38.16189441	38.99205128
6 months	38.30025641	38.30025641
12 months	36.15781955	39.184375

Time Interval	Average BMI (kg/m2) in Females	
	PCOS	No PCOS
0 months	36.79	38.67
3 months	35.38	37.59
6 months	34.09	37.07
9 months	33.59	36.78
12 months	32.99	37.21

Time Interval	Average Weight in Females (Kgs)	
	PCOS	No PCOS
0 months	95.11	101.6
3 months	90.71	98.43
6 months	87.62	97.10
12 months	87.15	97.44

Time Interval	Percentage weight loss (%)	
	PCOS	No PCOS
3 months	4.59	4.58
6 months	8.35	8.35
12 months	24.52	5.88

Time interval	Number of female patients having PCOS with weight loss of	
	>5%	>10%
3 months	11	2
6 months	12	7
12 months	12	6

Time interval	Number of female patients having no PCOS with weight loss of	
	>5%	>10%
3 months	50	15
6 months	72	23
12 months	70	39

Percentage weight loss during 3 months

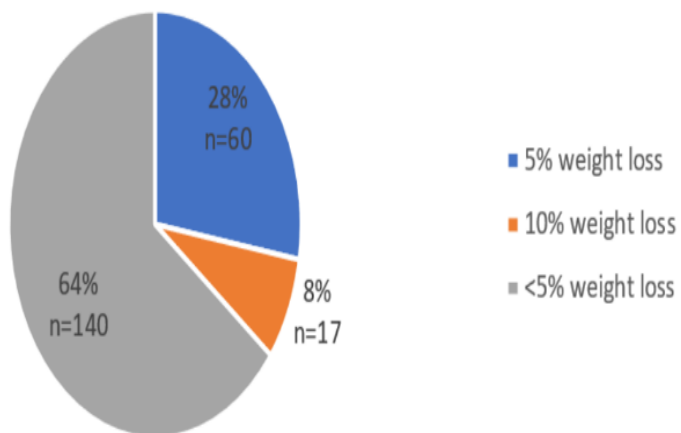


Figure 2 Percentage weight loss during 3 months

Percentage weight loss during the first 12 months

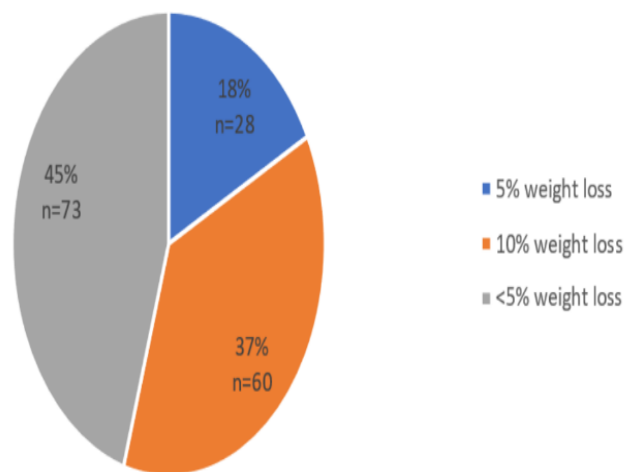


Figure 3 Percentage weight loss during first 12 months

Table 3-7: Body weight variability between Diabetic and Non-diabetic patients during the course of treatment with Liraglutide 3.0 mg:

		DM		Total
		DM	NO DM	
Body weight variability	decrease	24	126	150
	stable	7	5	12
	increase	8	30	38
		39	161	200

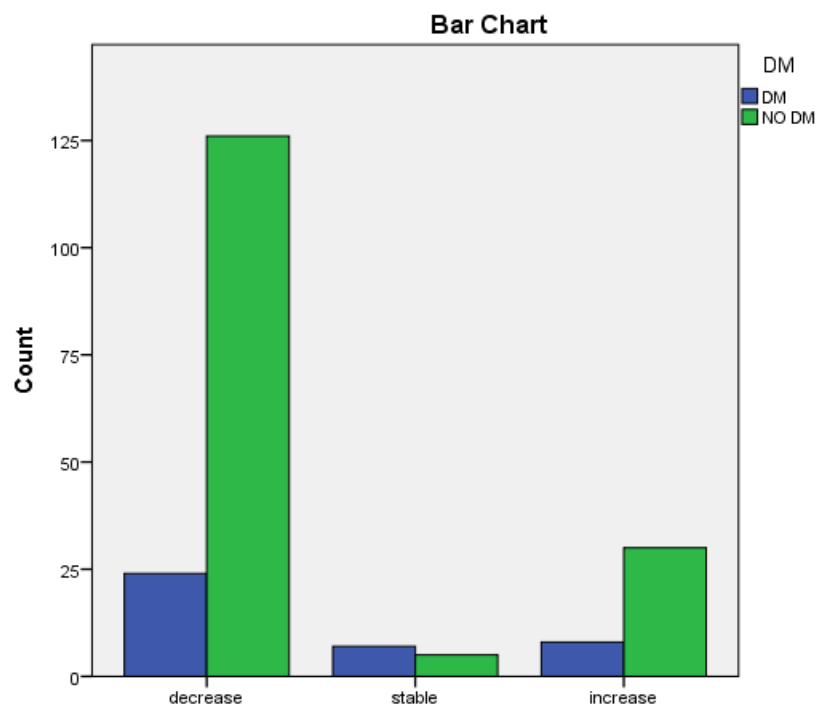


Chart:1 Body weightvariability

IMPROVEMENT IN METABOLIC PARAMETERS

Table 4-1: changes in metabolic parameters during the course of treatment:

Parameter	Baseline	Follow-up	Difference
HBA1C	5.828	5.65	0.141
LDL	3.18	3.22	0.214
ALT	33.81	34.25	1.195
ALP	71.67	69.37	2.74

Table4-2: Changes in HBA1C during the course of treatment for patients with Type2 DM

	HBA1C (0) before starting liraglutide	HBA1C at 3 months	HBA1C at 6 months	HBA1C at (9) month	HBA1C at 12 months
N Valid	200	200	200	192	166
Mean	5.85	5.73	5.71	5.74	5.81
Median	6.00	6.00	6.00	6.00	6.00
Variance	1.073	.831	.862	1.081	1.066
Minimum	4	3	4	4	4
Maximum	12	10	10	12	12

Table 4-3: Significance between DM and HBA1c after 6 months

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Recoded_HBA1C	Equal variances assumed	273.304	.000	4.770	198	.000	.40054	.08398	.23494	.56615

Equal variances not assumed			6.34 5	93.586	.000	.40054	.06312	.27520	.52588
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Recoded_HBA1C

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid below or equal 5	85	11.4	42.5	42.5
Valid above 5	115	15.4	57.5	100.0
Total	200	26.8	100.0	

Table4-4: Changes in LDL-C for a patient with Type2 DM during the treatment course:

	LDL -C BEFORE STARTING LIRAGLUTIDE	LDL -C AT 6 MONTHS	LDL -C AT 12 MONTHS
N Valid	200	199	198
Mean	2.96	3.15	3.19
Median	3.00	3.00	3.00
Minimum	1	1	1
Maximum	6	50	48

Table4-5: Changes in LDL-patients’ patient with Type2 DM during the treatment course:

	LDL –C BEFORE STARTING LIRAGLUTIDE	LDL –C AT 6 MONTHS	LDL -C AT 12 MONTHS
N Valid	200	199	198
Mean	2.96	3.15	3.19
Median	3.00	3.00	3.00
Minimum	1	1	1
Maximum	6	50	48

Table 4-6: Significance between DM and LDL after 12 months:

	DM	N	Mean	Std. Deviation	Std. Error Mean
LDL AT 12 MONTHS FROM STARTING LIRAGLUTIDE	DM	39	3.92	7.296	1.168
	NO DM	159	3.01	1.936	.154

Table 4-7: LDL--c at 12 months from starting Liraglutide 3.0 mg for weight management:

Independent Samples Test

	Levene's Test for Equality of Variances	t-test for Equality of Means

	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
LDL(2) AT 12 MONTH FROM STARTING LIRAGLUTIDE	6.421	.012	1.395	196	.165	.910	.653	-.377	2.198
			.773	39.321	.444	.910	1.178	-1.472	3.293

Table 4-8: average LDL-C reduction in patients with PCOS:

Time Interval	Average LDL in Females (mg/dl)	
	PCOS	No PCOS
0 months	3.10	3.10
6 months	5.15	5.15
12 months	2.94	2.94

Body weight variability between Diabetic and Non-diabetic patients during the course of treatment with Liraglutide 3.0 mg:

Table 4—9: Body weight variability between Diabetic and Non-diabetic patients during the course of treatment with Liraglutide 3.0 mg:

	DM		Total
	DM	NO DM	
Body weight variability	decrease	126	150
	stable	5	12
	increase	30	38
		161	200

Table 4-10: Changes in ALT during the treatment course:

		ALT before starting Liraglutide 3.0 mg	ALT at 3 months	ALT at 6 months
N	Valid	200	200	200
	Missing	546	546	546
Mean		33.80	32.75	34.21
Median		27.00	28.00	27.00
Minimum		4	2	3
Maximum		134	166	467

Table 4—11: Significance between DM and ALT after 6 months

ALT at 6 months

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1598.288	1	1598.288	1.146	.286
Within Groups	276236.307	198	1395.133		
Total	277834.595	199			

Table 4-12: Significance of ALP changes in the DM group after 6 months

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ALP at 6 months	Equal variances assumed	2.910	.090	1.330	197	.185	5.634	4.235	-2.717	13.986

Equal variances not assumed		1.138	49.603	.260	5.634	4.949	-4.308	15.577
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Table 4-13: Significance between DM and BMI reduction at 6 months:

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
DM	39	2.2564	.67738	.10847	2.0368	2.4760	1.00	3.00
NO DM	161	2.0745	.61799	.04870	1.9783	2.1707	1.00	3.00
Total	200	2.1100	.63238	.04472	2.0218	2.1982	1.00	3.00

Table 4-14 Significance between DM and BMI reduction at 6 months:

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.039	1	1.039	2.618	.107
Within Groups	78.541	198	.397		
Total	79.580	199			

Independent Samples Test		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Body weight variability	Equal variances assumed	1.393	.239	1.316	198	.190	.18602	.14135	-.09272	.46476

Equal variances not assumed		1.284	56.206	.205	.18602	.14490	-.10424	.47627
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Table 4—16

Descriptive

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	
					Lower Bound	Upper Bound			
BM1 (0) BEFORE STARTING THE DRUG	DM	39	39.62	7.188	1.151	37.29	41.95	28	57
	NO DM	161	38.15	6.090	.480	37.20	39.10	25	58
	Total	200	38.44	6.327	.447	37.55	39.32	25	58
BMI-1 (3 MONTH)	DM	39	38.95	7.688	1.231	36.46	41.44	25	58
	NO DM	161	36.96	6.026	.475	36.02	37.89	25	58
	Total	200	37.35	6.412	.453	36.45	38.24	25	58
BMI (6 MONTH)	DM	39	38.26	7.903	1.266	35.69	40.82	25	58
	NO DM	161	36.36	6.163	.486	35.40	37.32	23	59
	Total	200	36.73	6.560	.464	35.82	37.64	23	59
BMI (9 MONTH)	DM	37	38.41	8.315	1.367	35.63	41.18	25	59
	NO DM	153	35.91	6.791	.549	34.82	36.99	5	58
	Total	190	36.39	7.159	.519	35.37	37.42	5	59
BMI (12 MONTH)	DM	32	39.16	8.520	1.506	36.08	42.23	25	59
	NO DM	133	36.15	6.536	.567	35.03	37.27	22	58
	Total	165	36.73	7.037	.548	35.65	37.82	22	59

Table 5-1: COMPLIANCE TO DIET MG DURING THE COURSE OF TREATMENT:

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid COMPLIANT TO DIET	109	14.6	54.5	54.5
NO COMPLIANT TO DIET	91	12.2	45.5	100.0
Total	200	26.8	100.0	

Table 5-2: COMPLIANCE TO PHYSICAL ACTIVITY DURING THE COURSE OF TREATMENT:

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid COMPLIANT WITH PHYSICAL ACTIVITY	95	12.7	47.5	47.5
NO COMPLIANCE	105	14.1	52.5	100.0

Total	200	26.8	100.0
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Table 5—3: COMPLIANCE TO MEDICAL TREATMENT WITH LIRAGLUTIDE 3.0 MG:

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	COMPLIANT WITH MEDICAL TREATMENT	142	19.0	71.7
	NO COMPLIANT	56	7.5	28.3
	Total	198	26.5	100.0

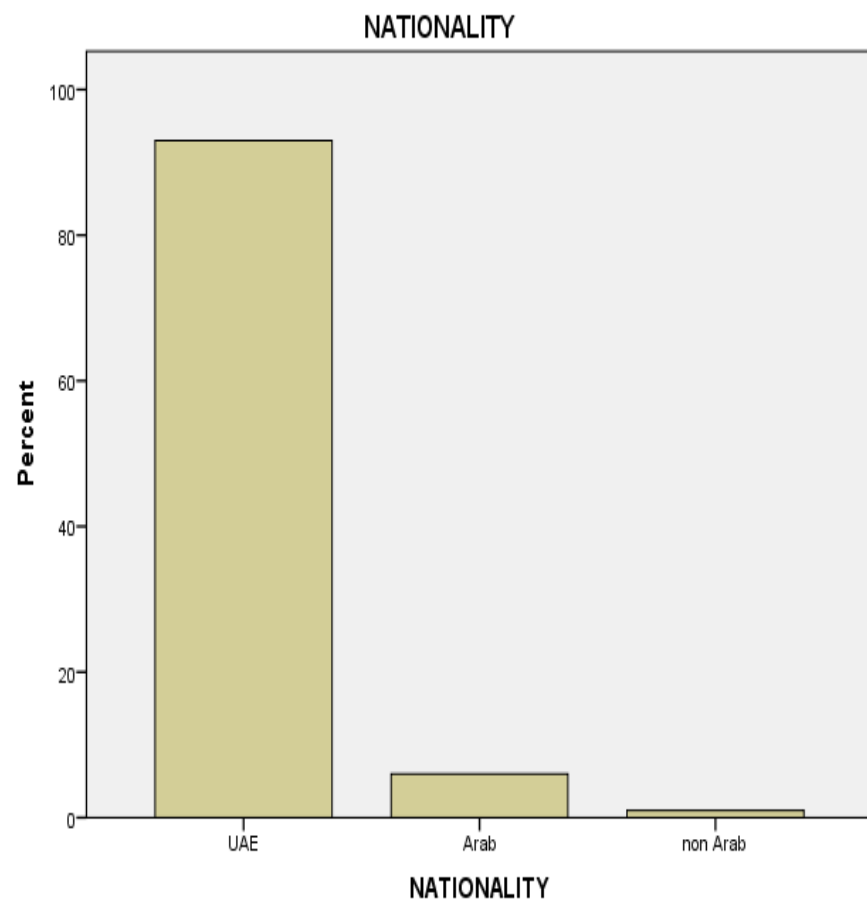
Table 5—4: Major adverse effects of Liraglutide 3.0 mg:

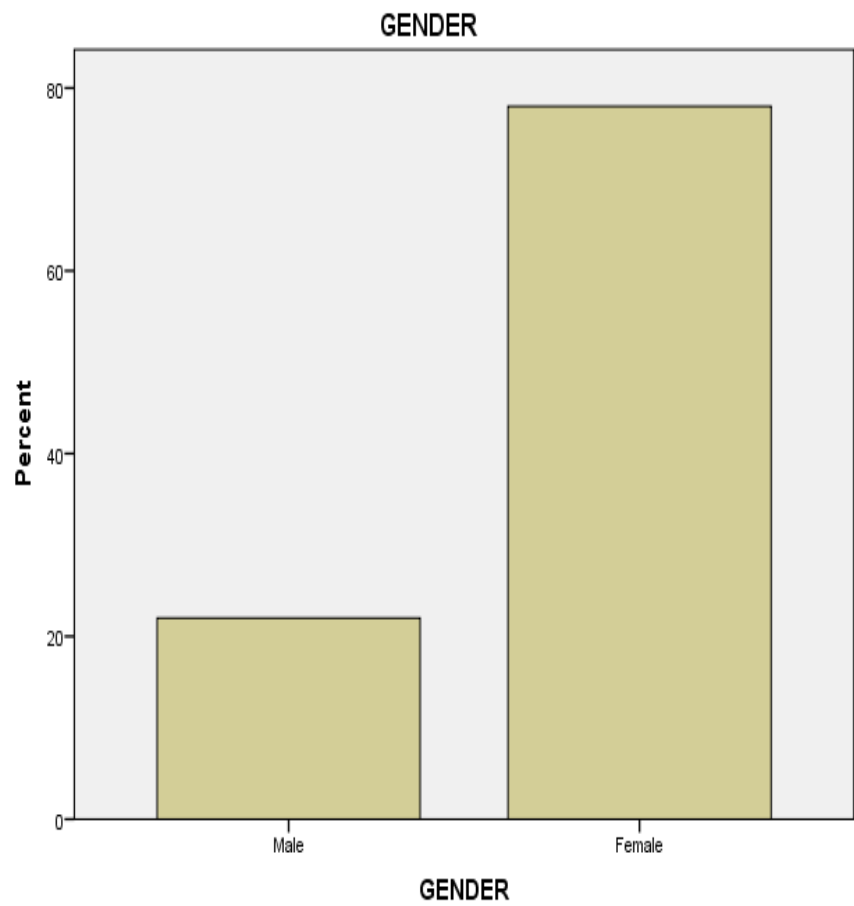
Side effects	Number of patients
Nausea	150
Abdominal pain and bloating	100
Menstrual irregularities	3
Constipation	100
Headache	75
Anxiety	3

Skin allergy	2
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Table 5—6: Major adverse effects reported during the treatment course:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	REPORT SIDE EFFECT	28	3.8	14.0	14.0
	NO SIDE EFFECT	172	23.1	86.0	100.0
	Total	200	26.8	100.0	





graph showing gender variability

Chart:2,3. Bar

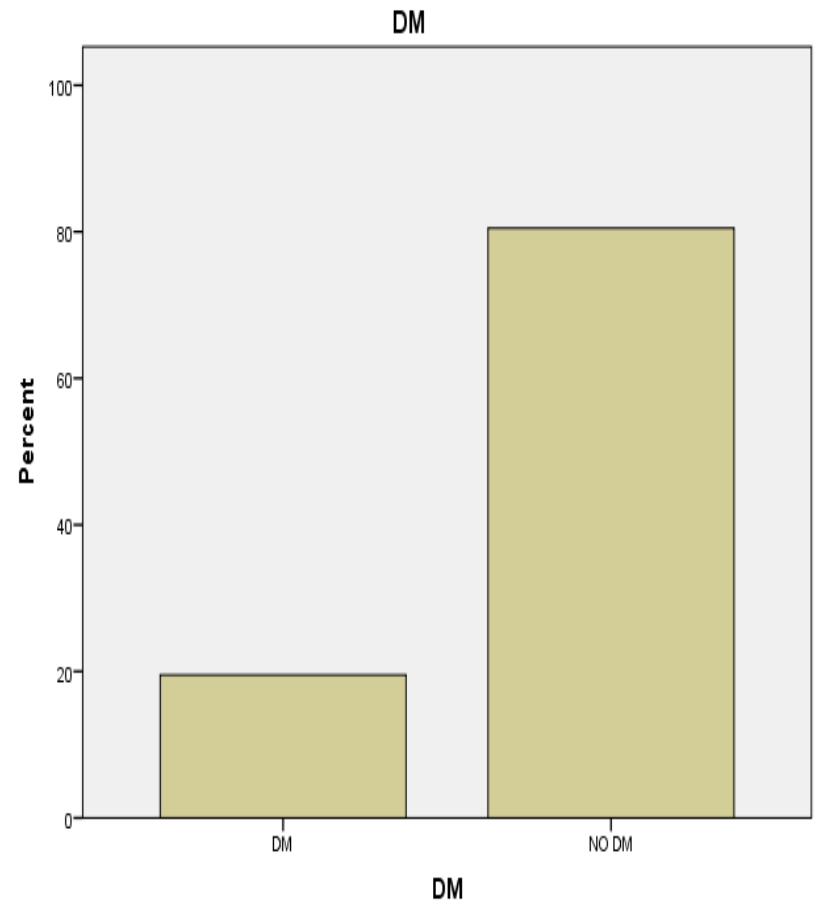
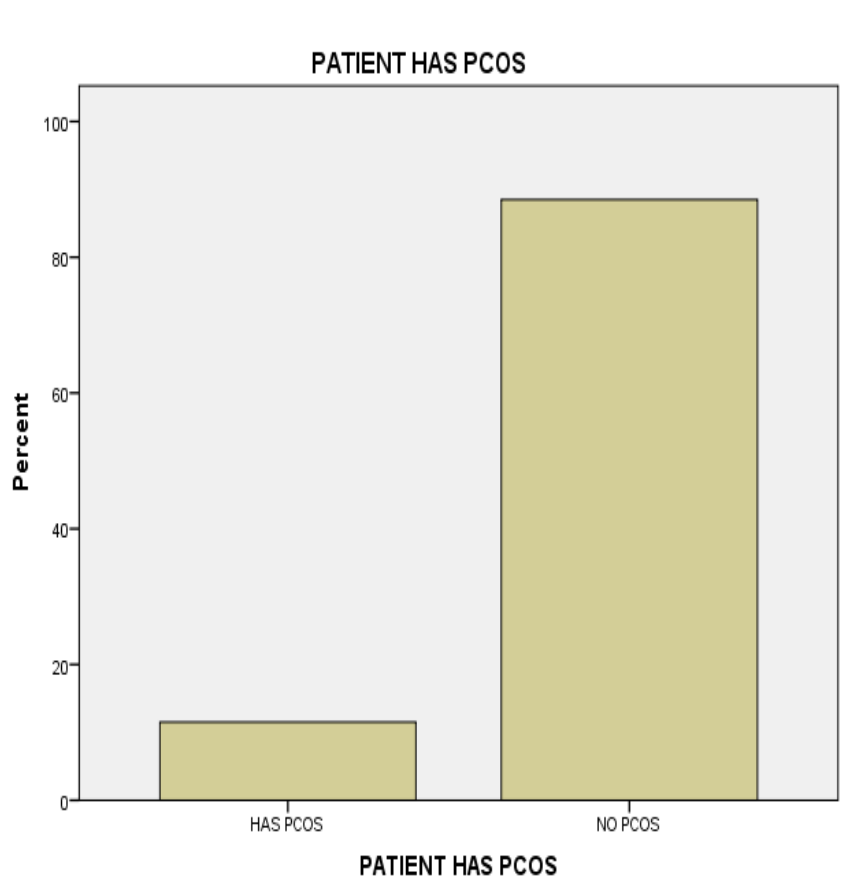


Chart:4,5 Bar graph showing PCOS and DM

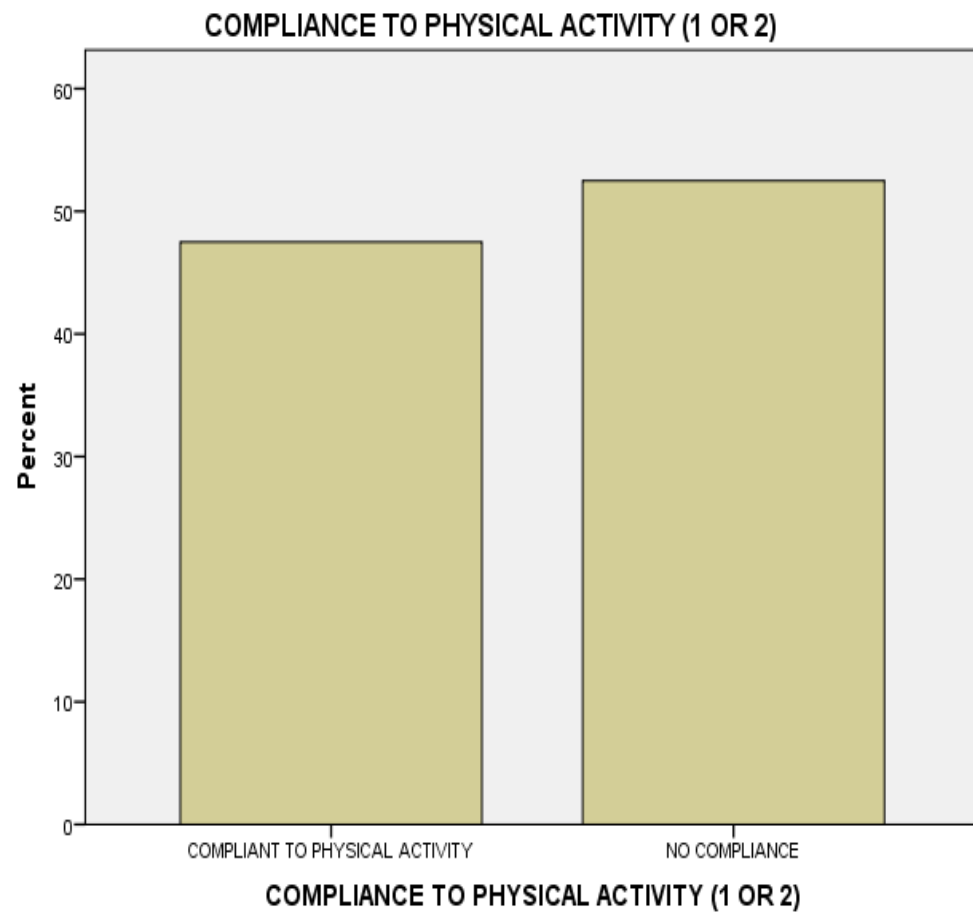
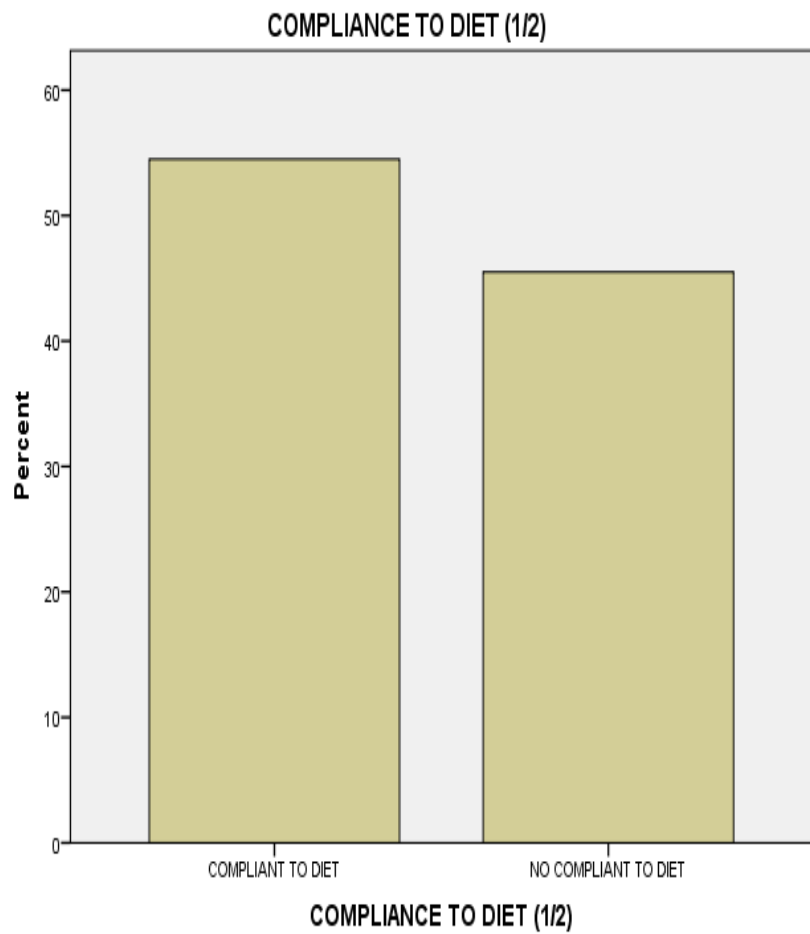


Chart:6,7 Compliance to diet and physical activity

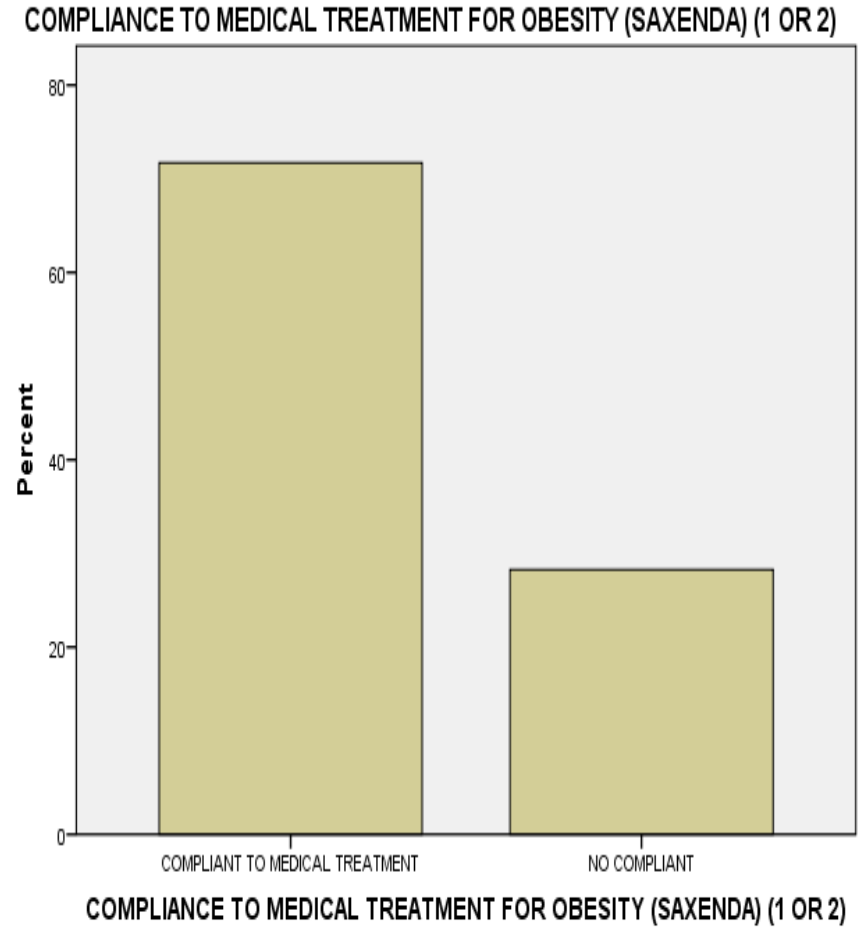
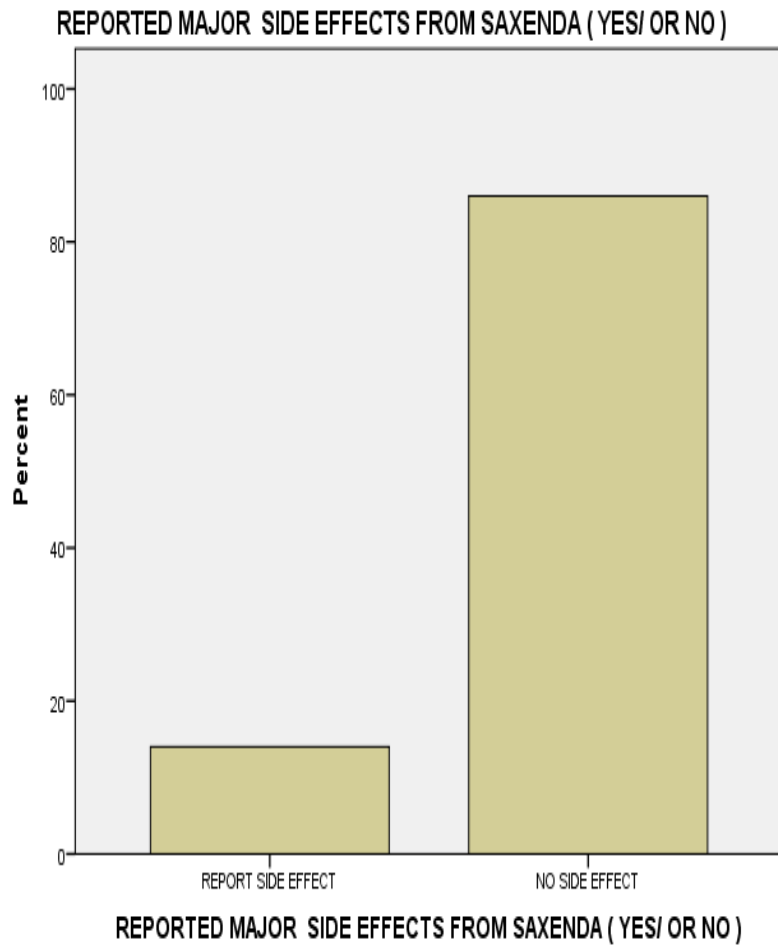


Chart 8,9: Side effect from saxenda



Chart:10 Bariatric survey report

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