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Article

A Cross-Sectional Study of Liraglutide Efficacy and Safety in Obesity Management among Egyptian Adults

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Abstract

Background: Liraglutide, a glucagon-like peptide-1 receptor agonist, was initially approved for type 2 diabetes mellitus and later for obesity management at a higher daily dose of 3 mg. Evaluating its efficacy and safety, particularly regarding adverse effects, is essential for optimizing obesity treatment.
Objective: To assess the efficacy and safety of liraglutide, alone and with a structured diet plan, in promoting weight reduction among obese adults.
Methods: A six-month cross-sectional study included 142 obese adults aged 16–60 years (mean BMI 33.71 ± 6.45 kg/m²). Participants completed validated self-administered questionnaires covering sociodemographic data, health and lifestyle factors, weight management strategies, and the use and side effects of liraglutide and diet regimens. Baseline anthropometric indices (BMI and waist circumference) were recorded. Data were analyzed using SPSS and GraphPad Prism, with Chi-square tests applied for group comparisons.
Results: Participants receiving liraglutide with a diet plan achieved greater reductions in body weight, waist circumference, and appetite over six weeks compared with those using liraglutide or diet alone. Mild gastrointestinal side effects were the most frequent adverse events. Reports of weight regain and increased appetite after liraglutide discontinuation were noted. These outcomes highlight the added value of combining liraglutide with dietary interventions while emphasizing the need for adverse event monitoring.
Conclusion: Liraglutide, especially when combined with a diet plan, significantly enhances weight loss compared with diet alone, though mild side effects are more common. Careful monitoring and long-term studies are required to confirm its sustained safety and efficacy in obesity management within the Egyptian population.

Keywords: Liraglutide, Obesity management, Dietary intervention, Glucagon-like peptide-1 receptor agonist (GLP-1 RA), Adverse effects, Body mass index (BMI), Pharmacotherapy

Introduction

Obesity is a complicated, persistent disorder that increases the risk of many physical and mental comorbidities and requires long-term management, leading to cardiovascular disease, type 2 diabetes, depression, and certain malignancies, as well as increasing mortality rates(Abdullah et al., 2010). Annually, about 4.7 million premature deaths occur due to obesity. It was ranked fifth among the leading preventable causes of death(Mehrzad, 2020). According to the World Health Organization (WHO), Egypt ranks 18th with the highest prevalence of obesity worldwide(*Most Obese Countries in the World | ProCon.Org*, 2020). Based on the findings of the "100 Million Health" survey, which screened 49.7 million adult Egyptians (≥18 years old) in Egypt in 2019, it was determined that 39.8% of the adult Egyptian population was obese (BMI ≥ 30 kg/m^2). The incidence of obesity was comparatively higher among adult females than adult males in Egypt (29.5% for males versus 49.5% for adult females)(Elezbawy et al., 2020). Despite Egypt's high obesity rates, existing therapeutic options are limited. Obesity treatment has relied heavily on lifestyle changes such as diet and exercise

routines. However, their long-term performance is generally restricted, and the effects are typically small. Although medication may have a role in assisting chosen people in losing weight, particularly when accompanied by lifestyle modifications, its effectiveness is often moderate, and adverse effects are prevalent. As a result, there is a critical need to identify and evaluate novel therapy approaches for obesity. The anti-obesity medications have undergone significant changes with the approval of liraglutide for treating chronic obesity(fda & cder, 2022).

Liraglutide, a peptide agonist of the glucagon-like peptide 1 receptor (GLP-1RA), has been shown to improve cardiovascular health and result in double-digit weight loss (≥10%). The American Gastroenterological Association (AGA) recommends using liraglutide 3.0 mg in addition to lifestyle modifications for adults who are obese or overweight and have weight-related complications. However, there are some implementation considerations to be aware of, as liraglutide may delay gastric emptying and cause undesirable side effects like nausea and vomiting, as well as increase the risk of pancreatitis and gallbladder disease(Grunvald et al., 2022).

Liraglutide is not licensed for use in Egypt, and its effectiveness and safety in the Egyptian population have not been studied before. The planned study will investigate the effectiveness and safety of liraglutide in treating obesity in Egypt. We plan on conducting the first study in Egypt to evaluate its safety and effectiveness in the Egyptian population with obesity who have failed trials of lifestyle modification. The findings of this research will help guide clinical choices about obesity therapy in Egypt and might open the way for the drug to be licensed for use in Egypt. Furthermore, the study provides and facilitates safe and efficient medication utilization.

Material and Methods

Design and settings

An observational cross-sectional study was carried out by using a validated questionnaire. Ethical approval for this study was obtained from the Research Ethics Committee, Faculty of Pharmacy, Al-Salam University in Egypt (Approval No. SUEP/REC/08/25/07/006), and the study was conducted in accordance with the principles of the Declaration of Helsinki. Each survey took 15–20 minutes to complete. The questionnaire was constructed after reviewing the literature. Regarding the web-based survey, the purpose of the research was stated at the beginning of the questionnaire, and the participants were able to accept or reject participation. They could also withdraw from the survey at any time before its completion. Baseline measurements of various anthropometric indices, such as BMI and waist circumference, were obtained. Side effects with diet plans were self-reported in the questionnaire.

Study setting/location

A convenient sampling method was adopted to distribute the survey. We distributed the survey in multiple settings in different regions of Egypt (e.g., diet centers, healthcare centers, and clinics), where electronic surveys were spread using social media applications. Also, a multistage sampling technique was used to select the study participants. A proportional allocation was employed to obtain the sample size from the selected health facilities, and a systematic random sampling method was used to select the study participants from each antenatal clinic in the respective hospital.

Population

Obese male and female adults aged between 16 and 60 years old from the general population of Egyptians were included. Participants use weight management medication except liraglutide, and participants with thyroid dysfunction and end-stage organ failure were excluded.

Statistical methods

Data management and statistical analysis were done using IBM SPSS software version 25. (IBM, Armonk, New York, United States). Descriptive analyses were based on frequencies and percentages. A descriptive test of significance was employed appropriately. The chi-square test was used for categorical variables, and numerical data were expressed as mean ± standard deviation (SD). Graphic representations were used to interpret the analyzed data visually. P-value < 0.05 was considered to be significant.

Results

Sociodemographic data

The total number of participants was 277, and after applying inclusion and exclusion criteria, the final number for analysis included 142 participants in the study **(Figure 1)**. The result revealed that the majority were females, 127 (89.44%), aged between 35 and 45 [60 (42.25%)]. The most common professional status of participants was employed 51 (35.92%), and the majority, according to the

education level, held a university degree 113 (79.58%), as shown in **(Table 1)**.

Table 1: Sociodemographic data of the study participants.

Topics	Frequency (n)	Percent (%)
Sex		
Male	15	10.56
Female	127	89.44
Age		
16-25	18	12.68
26-35	34	23.94
35-45	60	42.25
45-60	30	21.13
Professional status		
No work	38	26.76
Employed	51	35.92
Business	22	15.49
Student	26	18.31
Retired	5	3.52
Educational level		
Secondary or lower	9	6.34
Higher education	113	79.58
Postgraduate education	20	14.08
Height (cm)	**162.96± 8.71**	
Weight (Kg)	**89.69± 19.84**	
BMI (Kg/m2)	**33.71± 6.45**	
Data are expressed as mean ± SD		

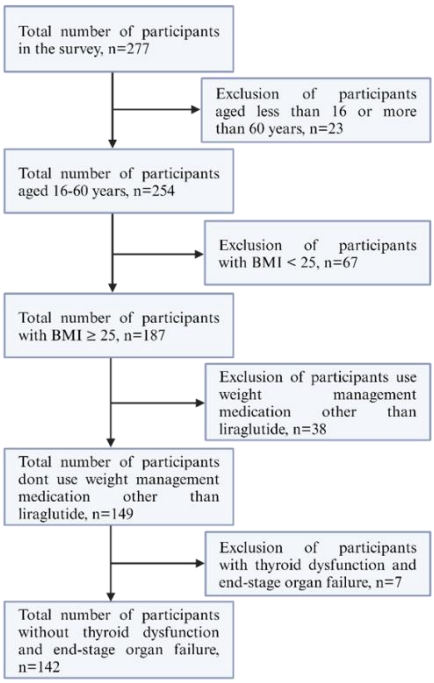

Figure 1: Total number of participants before and after exclusion.

Health and lifestyle

According to the health and lifestyle analysis in **(Table 2)** shows that most disease-related characteristics among participants were insulin resistance, hypertension, dyslipidemia, and fatty liver 37(26.06%), 18 (12.68%), 17(11.97%), and 17(11.97%), respectively. Most of the participants had a

family history of obesity, 108 (76.06%), and there were 5(3.52%) with a family history of thyroid cancer. About 61(42.96%) of participants eat two meals daily, followed by 39(27.46%), who eat three meals daily. Most of the participants were characterized by local obesity in the abdomen area 74(52.11%), followed by the buttocks and the back region 53(37.32%) and 46(32.39%), respectively. Also, a small number of individuals practice physical exercise 9(6.34%), and most participants consumed fast foods 106(74.65%). Most participants adhere to a balanced, low-calorie diet 33(33.0%), while 31(31.0%) follow a Low-carbohydrate diet.

Table 2: Health and lifestyle data.

Topics	Frequency (n)	Percent (%)
Disease-related characteristics (Multiple responses)		
Hypertension	18	12.68
Diabetes	15	10.56
Dyslipidemia	17	11.97
Fatty liver	17	11.97
Polycystic ovaries	14	9.86
Insulin resistance	37	26.06
Nothing	48	33.8
Family history of obesity	108	76.06
Family history of thyroid cancer	5	3.52
Number of meals/day		
One meal	9	6.34
Two meals	61	42.96
Three meals	39	27.46
Furthermore	33	23.24
Local obesity (Multiple responses)		
In the abdomen area	74	52.11
In the buttocks area	53	37.32
In the back area	46	32.39
No, I don't	27	19.01
Physical exercise		
Yes	9	6.34
No	133	93.66
Eating fast foods		
Yes	106	74.65
No	36	25.35
The type of diet follows (n=100)		
Low -carb	31	31.0
Balanced low-calorie diet	33	33.0
Intermittent fasting	25	25.0
Keto	11	8.0

Evaluation of the efficacy of each weight management system in specific parameters

In this study, when we assessed the percent of weight and waist circumference loss changes by baseline in the three groups, we observed significant reductions across all subgroups, with the greatest percent in those using liraglutide with diet plans compared with liraglutide alone or using diet plans

alone. Overall, 26(66.67%) and 29(74.36%) participants achieved > 10-15% weight and waist circumference loss, respectively **(Figures 2 and 3)** ($p < 0.05$). Also, both liraglutide only and liraglutide with diet plans groups exhibited a significant decrease in appetite, with the liraglutide with diet plans group 43(89.58%) showing the greatest reduction compared to the diet plans only group **(Figure 4)**.

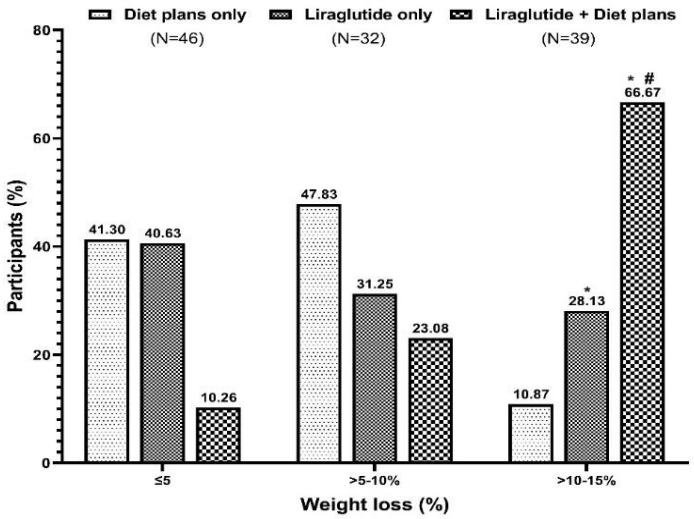

Figure 2: Weight loss (%) from the baseline. The data are expressed as percentages of participants in each group. *p<0.05 compared to the diet plans only group, #p<0.05 compared to the liraglutide only group.

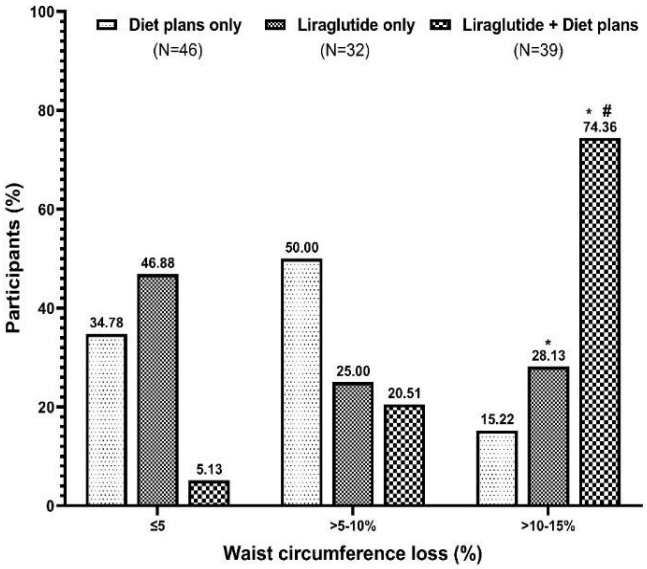

Figure 3: Waist circumference loss (%) from the baseline. *p<0.05 compared to the diet plans only group, #p<0.05 compared to the liraglutide only group.

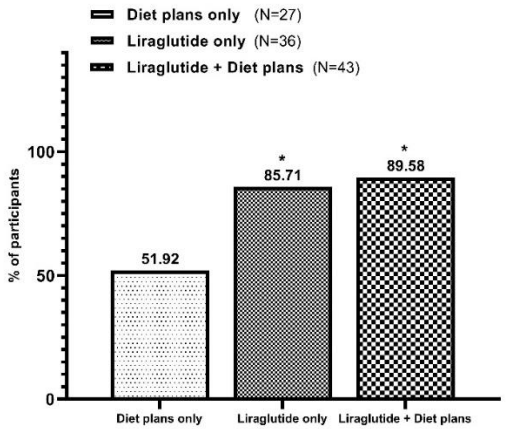

Figure 4: Percent of participants that feel a decrease in appetite. *p<0.05 compared to the diet plans only group.

Side effects reported by the participants

A total of 208 side effects were reported from 142 participants after using the three weight management systems. A comparison between the three groups found a statistically significant difference. In contrast, the greatest frequencies of adverse effects reported by the participants are fatigue or dizziness, GIT disturbance such as (nausea, abdominal pain, vomiting, and diarrhea), Tachycardia, Hypoglycemia, and Pancreatitis 32(35.56%), 72(80.0%), 22(24.44%), 38(42.29%), and 7(7.78%), respectively **(Figure 5).** One of the consequences of these side effects is stopping the use of liragutide in 19(21.11%) of participants. In addition, this study found that participants who stopped using liraglutide alone or combined with diet gained weight in a short period compared with those who followed diet plans only 20(76.92%), 19(67.86%), and 13(38.24), respectively **(Figure 6)**. Also, participants who stopped receiving liraglutide alone or combined with the diet plans reported a significant increase in appetite compared with the diet plans group 15(57.69%), 13(46.43%), and 7(20.59%), respectively **(Figure 7),** indicating a notable rebound in appetite upon discontinuation of the therapy.

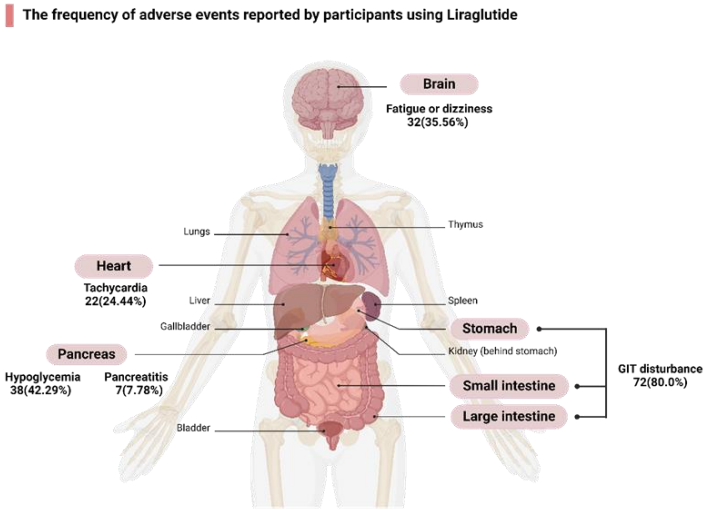

Figure 5: The frequency of adverse events reported by participants using liraglutide

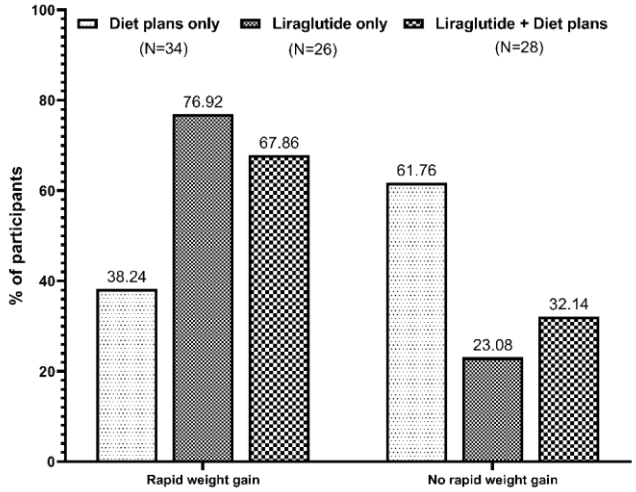

Figure 6: Percent of weight gain among participants after stopping treatment with liraglutide

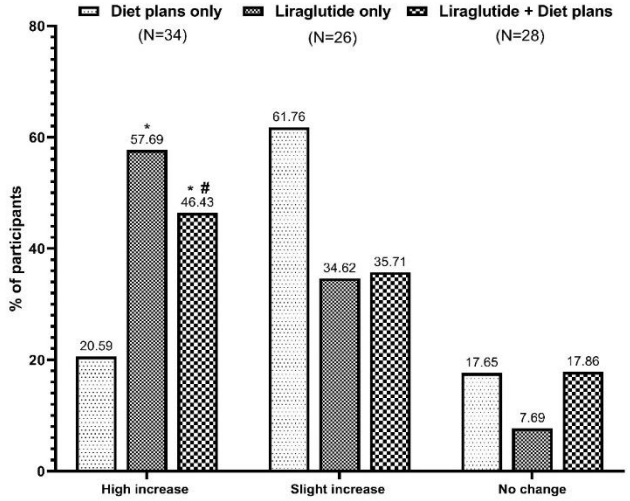

Figure 7: Percent of participants that feel an increase in appetite after stopping use of liraglutide. *p<0.05 compared to the diet plans only group, #p<0.05 compared to the liraglutide only group.

Discussion

Obesity is a critical barrier to preventing metabolic disorders and their consequences(Jin et al., 2023). In recent years, there has been a surge of interest in managing obesity by targeting the modulation of GLP-1 signaling(Kelly et al., 2020; Wilding et al., 2021). It has been revealed that GLP-1 receptor agonists have been identified to play essential roles in weight loss, which happens mostly due to a decrease in adipose tissue(Popoviciu et al., 2023). Liraglutide is an analogue of glucagon-like peptide 1 (GLP-1) that raises the postprandial insulin level in a glucose-dependent way, decreases the release of glucagon, slows the emptying of the stomach, and stimulates weight loss by reducing hunger and the amount of energy that is consumed(Wilding et al., 2021).

The Food and Drug Administration (FDA) and the European Medicines Agency (EMA) have authorized the use of liraglutide (3.0 mg) along with lifestyle modification or weight management strategies for obese or overweight individuals who also have at least one comorbid condition related to weight(*FDA Approves Weight Management Drug for Patients Aged 12 and Older | FDA*, 2014; *Saxenda | European Medicines Agency*, 2015).

The cross-sectional research conducted in Egypt evaluates the use of Liraglutide as a treatment for obesity, providing valuable insights into the effectiveness and safety of this medicine within the Egyptian community. Our results indicate a significant reduction (> 10-15%) in weight and waist circumference loss ($p<0.05$) from baseline among participants who use liraglutide combined with diet plans after approximately six months, compared with the use of liraglutide alone or diet plans alone. According to previous studies' findings, liraglutide substantially impacts weight loss and waist circumference reduction in overweight or obese patients between 5.9 and 8.0%(A. Christou et al.,

2016). In addition, liraglutide has been observed to be effective in appetite suppression, which was found to decrease appetite in 85.71% and 89.58% of groups using liraglutide alone or with diet plans, respectively, compared with 51.92% of the group using diet plans alone.

These results are in line with meta-analysis studies in which adults with obesity who were treated with liraglutide reported greater reductions in appetite and food preoccupation, as well as greater increases in satiety(Moon et al., 2021; Tronieri et al., 2019). Also, according to another study, liraglutide inhibited response to a target cue in rats only in the presence of an inhibitory stimulus. This finding suggests that liraglutide promoted a form of behavioral inhibition dependent on the hippocampus instead of merely diminishing the value of food reward(Jones et al., 2019). The results of this study indicate that liraglutide might exert an appetite-suppressing influence, a property that might account for its effectiveness in the treatment of obesity and weight loss.

On the other hand, the study found that liraglutide is associated with certain adverse events, such as fatigue or dizziness, gastrointestinal disturbance, and hypoglycemia. Previous studies have shown the same side effects(Le Roux et al., 2017; Lean et al., 2014). In addition, there are reported serious adverse events, such as tachycardia and pancreatitis, with a limited number of participants. These findings have also been reported in other studies. However, the risk of tachycardia and pancreatitis resulting from liraglutide therapy was shown to be quite low(Javed et al., 2023; Kumarathurai et al., 2017). These findings underscore liraglutide's effectiveness in promoting weight loss while stressing the need for vigilant observation of possible adverse events.

A significant increase in appetite was reported by 46.43 to 57.69% of participants who discontinued liraglutide, compared to 20.59% of participants who solely utilized diet plans. Additionally, 67.86 to 76.92% of participants achieved full weight regain or exceeded their initial weight, in contrast to 38.24% of individuals who only utilized diet plans. Patients who were overweight or obese and participated in one of three phase II/III studies had their weight partially regained after stopping liraglutide administration, according to their individual longitudinal body weight data (Papathanasiou et al., 2020).

Overall, Liraglutide shows promise as a therapy for obesity in Egypt, according to these results. Healthcare providers must regularly monitor patients' side effects and give proper assistance during their therapy.

Conclusion

liraglutide may be a useful addition to a healthy lifestyle as a first-line pharmacotherapeutic drug for the management of obesity. Nevertheless, the effect of weight loss in this study did not last long. Special consideration should be given to patients who stop taking liraglutide due to the adverse impacts. The weight increases gradually after discontinuous liraglutide usage. Thus, in addition to liraglutide's adverse effects, medical professionals should address numerous variables that impact medication adherence and boost compliance with treatment to help patients maintain their weight.

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Declaration of competing interest

The authors declare that there is no conflict of interest.

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