Efficacy and Safety of Different Weight Reduction Strategies: A Study at Southwell Hospital Kuwait Oil Company

Aref Alabassi [1], Hussain Haji Ali [2], Khaled Khudadah [3], Ghaida Alshoraian [4], Reda Anbar [5]

[1] *Consultant family physician, Manager of Southwell Hospital Kuwait Oil Company. ORCID 0009000443341283*
[2] *Consultant family physician, Head of geriatric and home healthcare unit, Southwell Hospital Kuwait Oil Company. ORCID 0009-0002-7598-4975.*
[3] *Consultant family medicine. Head of occupational medicine department Southwell hospital Kuwait Oil Company. ORCID: 0009000328883423.*
[4] *Consultant Family medicine. Head of Family Medicine Department Southwell Hospital. Kuwait Oil Company. ORCID:000900096842062x.*
[5] *Lecturer Family Medicine. Faculty of medicine. Helwan University. Registrar Family medicine. Southwell hospital Kuwait Oil Company. ORCID: 0000-0003-1535-2503.*

*Corresponding author:E-mail: redaanbar2020@yahoo.comail.com

KEYWORDS
Digital banking, financial inclusion, rural economies, mobile banking, digital wallets, financial literacy, public-private partnerships, cybersecurity, digital divide, economic development.

ABSTRACT:
Background: Obesity and its associated disorders have emerged as significant global health issues, with obesity presently identified as the fifth most prevalent cause of mortality worldwide. Semaglutide is the latest licensed medication in this pharmacological class. Semaglutide is presently offered in both subcutaneous (Ozempic) and oral formulations (Rybelsus). Liraglutide (Saxenda), a GLP-1 analogue, has demonstrated efficacy in reducing body weight by inhibiting appetite and caloric consumption.
Aim: The present aimed to determine the effectiveness of three different anti-obesity medications (Ozempic, Rybelsus and Saxenda).
Methods: This retrospective cohort study was conducted from Southwell Hospital Kuwait Oil Company obesity clinic records from March 2023 to December 2024. A total of 141 patients were enrolled in this study and divided into 4 groups. All groups were treated with the standard diet and exercise in addition to medicines. Group 1 (n=78) was treated with subcutaneous injectable Ozempic, Group 2 (n=24) was treated with Saxenda, Group 3 (n=27) was treated with Rybelsus. Group 4 (n=12) was treated as a placebo control group.
Results: A total of 141 patients were enrolled in the study with the mean age of 44.9 years old and 87.9% of them were females, 44.7% were pre-diabetic. BMI and waist circumferences were statistically significantly reduced after treatments under each medicine groups as all p values were <0.05. Patients under Ozempic showed more reduction in BMI followed by Saxenda compared to Rybelsus. More reduction in waist circumference showed with Ozempic followed
Conclusion: the three anti- obesity medications are effective in weight reduction among overweighr and obese patients in addition to improvement in glycemic control.Ozempic showed the weight reduction valuve while patients under Rybelsus reported higher adverse events.

Introduction

Obesity and its associated disorders have emerged as significant global health issues, with obesity presently identified as the fifth most prevalent cause of mortality worldwide. The World Health Organization (WHO) characterizes obesity as an "abnormal or excessive fat accumulation that may impair health," and elucidates that "the primary cause of obesity and overweight is an energy imbalance between calories ingested and calories expended." Obesity is a multifaceted, varied, chronic, and progressive condition that significantly impacts health, quality of life, and death. Obesity, an oncogenic condition, elevates the risk for metabolic, cardiovascular, and musculoskeletal disorders. Individuals diagnosed with obesity are predisposed to comorbidities, including osteoarthritis (OA) and type 2 diabetes (T2D) (Elmaleh-Sachs et al., 2023; Lingvay et al., 2024).

The prevalence of obesity has risen globally. Over 650 million persons globally are afflicted by obesity, with its prevalence escalating significantly over the past 50 years, prompting the WHO to classify it as a global pandemic. Population-level preventive measures have proven inadequate in mitigating this trend. Various ways for weight management have been a subject of discussion among researchers, nutrition specialists, healthcare professionals, and the general populace (Kheniser et al., 2021).

Anti-obesity medications (AOM) assist in weight management when combined with a caloric deficit diet and enhanced physical activity for individuals with a body mass index (BMI) ≥ 30 kg/m² or ≥ 27 kg/m² with an obesity-related comorbidity such as type 2 diabetes, hypertension, or dyslipidemia. Patients who cannot meet weight loss objectives, such as a 5% reduction in baseline weight within 3-6 months, may consider adjunctive treatment with AOM (Müller et al., 2022; Gudzune and Kushner, 2024).

Semaglutide is the latest licensed medication in this pharmacological class. Semaglutide is a long-acting GLP-1 receptor agonist exhibiting 94 percent similarity with endogenous human GLP-1. It possesses structural changes that facilitate reversible albumin binding, hence diminishing renal clearance and decreasing degradation by DPP-4, while maintaining a sufficiently high affinity for GLP-1R. This formulation leads to a degradation rate that is slower, with a half-life of 155 to 184 hours, facilitating once-weekly subcutaneous administration without diminishing weight reduction effectiveness. Semaglutide is presently offered in both subcutaneous (Ozempic) and oral formulations (Rybelsus) (Chao et al., 2023; Gasoyan et al., 2024).

Ozempic is approved by the FDA for the management of blood glucose levels in individuals diagnosed with Type 2 Diabetes Mellitus. Rybelsus has been formulated as the first oral medication. The defining feature is the coformulation of the semaglutide peptide with the innovative absorption enhancer sodium N-(8-[2-hydroxybenzoyl] amino) caprylate (SNAC) (Bergmann et al., 2023).

Liraglutide (Saxenda), a GLP-1 analogue, has demonstrated efficacy in reducing body weight by inhibiting appetite and caloric consumption. Liraglutide has received approval for the treatment of overweight and obese individuals (Alruwaili et al., 2021; Lin et al., 2022).

As a result, developing effective and long-lasting pharmaceutical therapies remains an important topic of study. Therefore, the present aimed to determine the effectiveness of three different anti-obesity medications (Ozempic, Rybelsus and Saxenda).

Methodology

This retrospective cohort study was conducted from Southwell Hospital Kuwait Oil Company obesity clinic records from March 2023 to December 2024. Both males and females aged 18 or older who were overweight or obese were recruited. Obesity and overweight were defined according to the WHO criteria, using a BMI of ≥25.0 kg/m2 for obesity and 23.0–24.9 kg/m2 for overweight (WHO, 2024). Patients who did not complete follow-up visits, diabetics, and patients with missed data were excluded from the study.

A total of 141 patients were enrolled in this study and divided into 4 groups. Group 1 (n=78) was treated with subcutaneous injectable Ozempic doses as 0.5, 1.0 and 2.0 mg once per week, Group 2 (n=24) was treated with the FDA-approved Saxenda dose for treatment of obesity (3.0 mg), Group 3 (n=27) was treated with Rybelsus. Rybelsus was administered for increasing doses of 3mg, 7mg, and a maximum dose of 14 mg daily. Group 4 (n=12) was treated as a placebo control group. All groups were treated with the diet and exercise in addition to medicines. Health education was given in the physiotherapy clinic about the multifaceted approach of exercise and nutrition clinic suggesting the most suitable diet for each patient.

The participant's medical history related to their initial visit was acquired by an examination of medical records, encompassing age and gender. Data on underlying comorbidities, including hypertension, diabetes, dyslipidemia, psychiatric disorders, thyroid disease, sleep apnea, fatty liver disease, obesity-related arthritis, and gout; pre-existing medications; smoking status; prior bariatric surgery; and physical activity levels were documented.

Waist circumference and body mass index were assessed prior to and following the trial. The BMI was determined by dividing weight in kilos by height in square meters.

Laboratory and diagnostic assessments, including hemoglobin A1c (HbA1c) tests and lipid profiles (total cholesterol, triglycerides, LDL, and HDL), were conducted prior to and following the trial.

Adverse effects of the medication were documented. Major gastrointestinal adverse events (intestinal obstruction, cholecystitis, gastroparesis, and pancreatitis) were planned to stop and discontinue the medication. Mild unpleasant reactions, such as nausea and vomiting, gas distention and GIT upset were recorded as mild side effects that does not require to stop medication.

Statistical analysis

Data was analyzed using SPSS version 27. Normality was checked using Kolmogorov-Smirnov test. Wilcoxon sign rank test was used to compare paired non-parametric quantitative variables. Kruskal Wallis was used to compare non-parametric quantitative variables between the four groups. Tukey test (Post hoc test) was used to find difference between groups. Fisher exact test was used to find the difference in categorical variables between groups. McNemar test was used to compare between paired categorical variables. Significance was set at 95% CI.

Results

A total of 141 patients were enrolled in the study with the mean age of 44.9 years old and 87.9% of them were females, 44.7% were pre-diabetic, 18.4% had bariatric surgery, 56% had mild physical activity, 20.6% had medications induced obesity, 65.2% had positive family

history of obesity and 37.6% had psychological distress or emotional eating (Table 1). The results revealed that BMI and waist circumferences were statistically significantly reduced after treatments under each medicine groups as all p values were <0.05. In all groups the weight reduction was >5%. Patients under Ozempic showed more reduction in BMI followed by Saxenda compared to Rybelsus. More reduction in waist circumference showed with Ozempic followed by Saxenda group with significant difference (Table 2 and 3).

Rybelsus showed higher side effects (16.7%), 11.5% among patients treated with Ozempic and 7.4% among patients treated with Saxenda reported side effects with no significant difference between the groups using Fisher Exact test (p=0.789) (Figure 1).

HbA1C showed significant improvement after treatment among all groups. Ozempic improved systolic and diastolic blood pressure. Saxenda improved systolic blood pressure. Rybelsus improved diastolic blood pressure (Table 4).

The highest improvement in sleep apnea was reported among Rybelsus followed by Saxenda but with no significant difference in improvements among all groups using McNemar test (Figure 2). All age groups showed significant improvement in BMI, waist circumference, HbA1C. However, patients aged 40 years or less showed the best improvement among all age groups (Table 5).

Table 1. Socio-demographic details of the study population

Parameters (n=141)	No.	%
Gender		
Male	17	12.1
Female	124	87.9
Age : Mean±S.D	44.92±14.46	
Pre-Diabetes	63	44.7
Bariatric Surgery done	26	18.4
Physical Activity		
Nil	19	13.5
Mild	80	56.7
Moderate	36	25.5
Severe	6	4.3
Family history of Obesity	92	65.2
Medication induced obesity	29	20.6
Pshychological distress/Emotional eating	53	37.6

Table 2. Comparison of BMI distribution between before and after treatment among various medicine groups

Medicines group	Before treatment	After treatment	Paired Differences			
	Mean±S.D	Mean±S.D	Mean±S.D	Weight reduction (%)	95% C.I.	p value a;Pre-post
Placebo (n=12)	34.076±6.41	33.087±6.07	1.99±1.42	2.75± 4.18	1.085-2.89	<0.001*
Inj.Ozembic (n=78)	37.332±6.11	32.035±6.54#	5.297±3.21	7.13± 7.9	1.574-3.021	<0.001*
Inj.Saxenda (n=24)	36.798±6.26	33.215±5.82#	4.583±1.68	6.89± 4.44	1.872-3.294	<0.001*
T.Rybelsus (n=27)	38.261±6.88	36.444±6.99#	2.818±2.09	5.49± 5.71	1.99-3.64	<0.001*
P value (b;between groups)	0.225	0.035*		0.020*		

a; Wilcoxon-signed rank test
b; Kruskal Wallis test
Post hoc test (Tukey test)
*p is significant at <0.05
significant difference from placebo group

Table 3. Comparison of waist circumference (cm.) distribution between before and after treatment among various medicine groups.

Medicines group	Before treatment	After treatment	Paired Differences		
	Mean±S.D	Mean±S.D	Mean±S.D	95% C.I.	p value a;pre-post
Placebo (n=12)	104.42±15.01	102.08±15.39	3.33±6.07	2.48-10.19	0.004*
Inj.Ozembic (n=78)	106.65±13.99	97.14±13.31#	8.51±6.28	2.09-4.93	<0.001*
Inj.Saxenda (n=24)	105.98±11.81	98.15±13.65#	7.83±8.54	4.225-11.44	<0.001*
T.Rybelsus (n=27)	106.25±12.17	101.13±12.34#	5.12±4.66	4.27-7.96	<0.001*
P value (b;Between groups)	0.705	0.046*			

a; Wilcoxon-signed rank test
b; Kruskal Wallis test
Post hoc test (Tukey test)
*p is significant at <0.05
significant difference from placebo group

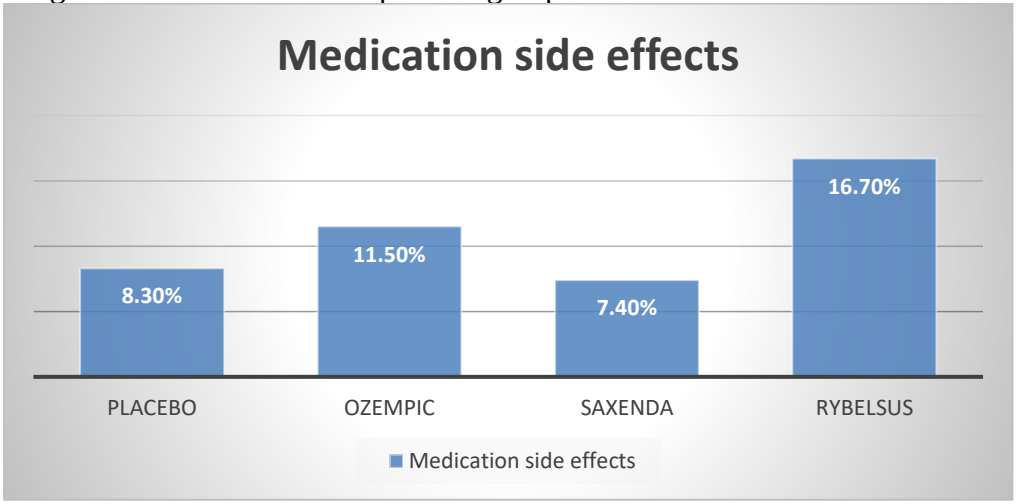

Figure 1. Comparison of medication side effects among the groups

Table 4. Comparison of biochemical findings between before and after treatment among various medicine groups

Parameters	Placebo (n=12)			Inj.Ozembic (n=78)			Inj.Saxenda (n=24)			T.Rybelsus (n=27)		
	Before Median (IQR)	After Median (IQR)	p value	Before Median (IQR)	After Median (IQR)	p value	Before Median (IQR)	After Median (IQR)	p value	Before Median (IQR)	After Median (IQR)	p value
SBP	130 (120-139.5)	124.5 (118.5-134.25)	0.248	130 (120-136)	120 (110-130.25)	0.001*	129 (115.5-136.5)	117 (110-128.5)	0.035*	126 (118-140)	128 (110-133)	0.135
DBP	80 (79.25-83.75)	76.5 (72.5-80)	0.075	80 (70-80)	70 (70-80)	<0.001*	70 (70-80)	70 (62.5-74)	0.644	80 (70-90)	70 (70-80)	0.001*
FBS	5.46 (5.16-7.7)	5.57 (5.03-6.2)	0.79	5.28 (4.84-5.8)	5 (4.6-5.4)	0.790	4.9 (4.6-5.4)	5.08 (4.7-5.3)	0.931	5.3 (5-5.5)	5.2 (4.7-5.1)	0.563
HbA1c	5.76 (5.51-6.2)	5.43 (5.2-5.85)	0.025*	5.43 (5.16-5.89)	5.2 (5-5.5)	<0.001*	5.5 (5.3-5.8)	5.2 (4.97-5.56)	0.002*	5.8 (5.3-6.1)	5.4 (5.2-5.8)	<0.001*
TC	4.64 (4-5.42)	4.75 (4.01-5.38)	0.657	4.7 (4.2-5.4)	4.7 (3.97-5.35)	0.226	4.63 (4.15-5.63)	4.5 (3.9-5.6)	0.738	4.9 (4.6-5.2)	4.8 (4.4-5.6)	0.829
LDL	3.01 (2.39-3.21)	3.05 (2.22-3.9)	0.814	2.9 (2.3-3.5)	2.8 (2.2-3.3)	0.080	2.8 (2.4-3.9)	2.76 (2.08-3.41)	0.732	3.0 (2.8-3.3)	2.9 (2.5-3.5)	0.629
HDL	1.38 (0.99-1.55)	1.32 (1.20-1.53)	0.929	1.5 (1.2-1.8)	1.5 (1.2-1.8)	0.055	1.4 (1.2-1.9)	1.4 (1.1-1.9)	0.455	1.42 (1.07-1.65)	1.4 (1.3-1.7)	0.237
TG	0.96 (0.74-1.44)	0.85 (0.74-1.46)	0.036*	1.01 (0.8-1.3)	0.99 (0.7-1.2)	0.182	1.01 (0.8-1.4)	1.06 (0.76-1.53)	0.394	1.2 (0.8-1.4)	0.99 (0.8-1.3)	0.087

Wilcoxon-signed rank test *p is significant at <0.05

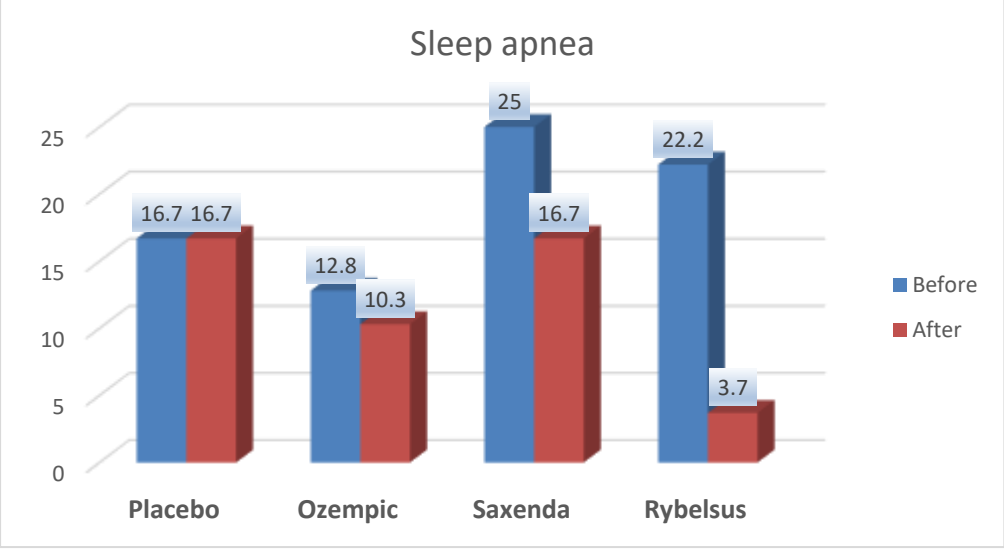

Figure 2. Comparison of sleep apnea before and after treatment among the four groups

Table 5. Comparison of paired mean differences between before and after treatment among various age categories.

Parameters	Age category ≤40 yrs. (n=48)			Age category=41-55 yrs. (n=52)			Age category≥55 yrs. (n=41)		
	Mean±S.D	95% C.I.	p value	Mean±S.D	95% C.I.	p value	Mean±S.D	95% C.I.	p value
BMI (Kg/m2)	3.25±2.27	2.59-3.91	<0.001*	1.92±3.34	0.99-2.85	<0.001*	2.08±1.87	1.49-2.67	<0.001*
Waist Circumference	6.06±5.83	4.37-7.75	<0.001*	4.7±6.8	2.82-6.58	<0.001*	4.1±7.24	1.81-6.38	<0.001*
HbA1C	0.25±0.4	0.14-0.37	<0.001*	0.23±0.38	0.12-0.33	<0.001*	0.23±0.33	0.34-4.58	<0.001*

Wilcoxon-signed rank test *p is significant at <0.05

Discussion

Overweight and obesity are common conditions linked to heightened morbidity and death. Pharmacologic interventions for weight reduction have been scarce, poorly tolerated, and yield minimal effects on weight loss (Elmaleh-Sachs et al., 2023).

Obesity results from a multifaceted interaction of genetic, metabolic, socioeconomic, environmental, and behavioral influences. Understanding and managing these characteristics is crucial for addressing the global issue of overweight and obesity. The disorder is defined by abnormal or excessive buildup of adipose tissue in the body. (Gudzune and Kushner, 2024).

Recent pharmacological agents, including the glucagon-like peptide 1 receptor agonist (GLP-1 RA) semaglutide and the dual GLP-1 RA/gastric inhibitory polypeptide (GIP) agonist tirzepatide, have demonstrated significant weight reduction in individuals with obesity (Wilding et al., 2021).

Nutrient-stimulated hormone-based medications, including liraglutide, semaglutide, and tirzepatide, replicate the functions of entero-pancreatic hormones that influence central appetite regulation and provide various cardiometabolic weight-loss advantages (Müller et al., 2022).

This retrospective cohort study was conducted from Southwell Hospital Kuwait Oil Company nutrition clinic records. The present aimed to determine the effectiveness of three different anti-obesity medications (Ozempic, Rybelsus and Saxenda).

The main findings of this study are that Ozempic, Rybelsus, and Saxenda showed significant reduction in BMI and waist circumference with no significant difference between them. Rybelsus showed the highest side effects. HbA1C showed significant improvement after treatment among all groups. The highest improvement in sleep apnea was reported among Rybelsus followed by Saxena but with no significant difference in improvements among all groups. Young patients aged 40 years or less showed the best improvement.

All groups analyzed in this study showed weight reduction over 5%. This aligns with the objective of achieving a loss of ≥5% body weight in over 35% of treated patients, a criterion utilized by the FDA to assess the efficacy of AOMs (FDA, 2007).

Consistent with these findings, another study evaluated six anti-obesity medications

(AOMs): phentermine, phentermine/topiramate, liraglutide, naltrexone/bupropion, lorcaserin, and orlistat, and determined the prevalence of achieving a weight loss of ≥5% of baseline body weight within six months of initiating treatment with each AOM (Song et al., 2024).

In this study, patients under Ozempic showed more reduction in BMI followed by Saxenda compared to Rybelsus. More reduction in waist circumference showed with Ozempic followed by Saxenda group with significant difference. A network meta-analysis examining the differential effects of anti-obesity medications (orlistat, lorcaserin, naltrexone/bupropion, phentermine/topiramate, and liraglutide) over an extended duration revealed that phentermine/topiramate and liraglutide exhibited the greatest efficacy in weight reduction (Khera et al., 2016).

Another cohort research, using data obtained from individuals in the Mayo Clinic Health System prescribed Semaglutide. At 3 and 6 months, weight loss indicated a significant difference from baseline.(Ghusn et al., 2022).

A cohort trial comparing injectable versions of semaglutide with liraglutide for treating type 2 diabetes and obesity. There was a considerable difference between them, with semaglutide outperforming the others in terms of weight loss. In this study, individuals who took their medication for T2D had significantly reduced likelihood of attaining 10% or higher weight reduction at year 1 compared to those who received it for obesity (Gasoyan et al., 2024).

In addition to weight loss, all research groups experienced a significant drop in HbA1C. Consistent with the findings of a comprehensive review and meta-analysis on the efficacy of subcutaneous semaglutide. The meta-analysis results reveal a positive link between Semaglutide and weight loss, with additional advantages to metabolic health including, but not limited to, glycemic management and lipid profiles (Palana et al., 2024).

In addition, another retrospective observational study investigated the effects of subcutaneous Semaglutide in a diabetic population. Overall, HbA1c in these patients "decreased by -0.9% (95% C.I. -1.04; -0.76, $p < 0.0001$) after 6 months and the reduction was sustained after 12 months (-0.96%; 95% C.I. -1.09; -0.82, $p < 0.0001$); body weight was reduced by -3.43 kg (95% C.I. -4.51; -2.34, $p < 0.0001$) after 6 months and benefit was substantially maintained after 12 months (-3.68 kg; 95% C.I.-4.93; -2.44, $p < 0.0001$) (Berra et al., 2023).

De Lucas et al. conducted an observational, retrospective clinical trial to assess the effects of Semaglutide on patient HbA1c and total body weight in diabetics receiving a weekly injection. After 24 months of follow-up, the cohort's HbA1c levels decreased significantly. 77.1% achieved a HbA1c level of <7%, while 12.7% achieved between 7.1% and 7.5%. In addition, 66.9% lost at least 5% of their body weight. These promising results for glycemic control and weight management suggest the addition of Semaglutide to the list of strategies accessible to medical practitioners for battling diabetes development in their patients (Garcia de Lucas et al., 2022).

In terms of safety, Rybelsus showed higher side effects (16.7%), 11.5% among patients treated with Ozempic and 7.4% among patients treated with Saxenda reported side effects with no significant difference between the groups.

A meta-analysis examined the efficacy and safety of liraglutide and semaglutide and showed that the serious adverse events were more common among patients treated with liraglutide followed by semaglutide with no significant difference compared to placebo (Xie

et al., 2022).

This study has significant drawbacks. The current study employed data from Southwell Hospital Kuwait Oil Company's nutrition clinic records, which is a retrospective cohort. Also, the relatively short follow-up period is due to the difficulty of observing obese patients over long periods of time. Despite its limitations, the study has numerous major strengths. This was the first study of its kind to examine the efficacy of injectable and oral semaglutide and liraglutide for weight loss in a real-world clinical context.

In conclusion, the three anti-obesity medications are effective in weight reduction among overweight and obese patients in addition to improvement in glycemic control. Ozempic showed the best weight reduction values while patients under Rybelsus reported higher adverse events.

References

[1] Alruwaili, H., Dehestani, B. and le Roux, C. W. (2021) 'Clinical impact of liraglutide as a treatment of obesity', Clinical pharmacology: advances and applications, pp. 53–60.

[2] Bergmann, N. C., Davies, M. J., Lingvay, I., et al. (2023) 'Semaglutide for the treatment of overweight and obesity: a review', Diabetes, Obesity and Metabolism, 25(1), pp. 18–35.

[3] Berra, C. C., Rossi, M. C., Mirani, M., et al. (2023) 'Real world effectiveness of subcutaneous semaglutide in type 2 diabetes: A retrospective, cohort study (Sema-MiDiab01)', Frontiers in Endocrinology, 13, p. 1099451.

[4] Chao, A. M., Tronieri, J. S., Amaro, A., et al. (2023) 'Semaglutide for the treatment of obesity', Trends in cardiovascular medicine, 33(3), pp. 159–166.

[5] Elmaleh-Sachs, A., Schwartz, J. L., Bramante, C. T., et al. (2023) 'Obesity management in adults: a review', Jama, 330(20), pp. 2000–2015.

[6] FDA (2007) Guidance for industry on developing products for weight management, National Archives and Records Administration.

[7] Garcia de Lucas, M. D., Miramontes-González, J. P., Avilés-Bueno, B., et al. (2022) 'Real-world use of once-weekly semaglutide in patients with type 2 diabetes at an outpatient clinic in Spain', Frontiers in Endocrinology, 13, p. 995646.

[8] Gasoyan, H., Pfoh, E. R., Schulte, R., et al. (2024) 'One-year weight reduction with semaglutide or liraglutide in clinical practice', JAMA Network Open, 7(9), pp. e2433326–e2433326.

[9] Ghusn, W., De la Rosa, A., Sacoto, D., et al. (2022) 'Weight loss outcomes associated with semaglutide treatment for patients with overweight or obesity', JAMA Network Open, 5(9), pp. e2231982–e2231982.

[10] Gudzune, K. A. and Kushner, R. F. (2024) 'Medications for obesity: A review', Jama, 332(7), pp. 571–584.

[11] Kheniser, K., Saxon, D. R. and Kashyap, S. R. (2021) 'Long-term weight loss strategies for obesity', The Journal of Clinical Endocrinology & Metabolism, 106(7), pp. 1854–1866.

[12] Khera, R., Murad, M. H., Chandar, A. K., et al. (2016) 'Association of pharmacological treatments for obesity with weight loss and adverse events: a systematic review and meta-analysis', Jama, 315(22), pp. 2424–2434.

[13] Lin, Q., Xue, Y., Zou, H., et al. (2022) 'Efficacy and safety of liraglutide for obesity and people who are overweight: a systematic review and meta-analysis of randomized controlled trials', Expert Review of Clinical Pharmacology, 15(12), pp. 1461–1469.

[14] Lingvay, I., Cohen, R. V, le Roux, C. W., et al. (2024) 'Obesity in adults', The Lancet, 404(10456), pp. 972–987.

[15] Müller, T. D., Blüher, M., Tschöp, M. H., et al. (2022) 'Anti-obesity drug discovery: advances and challenges', Nature Reviews Drug Discovery, 21(3), pp. 201–223.

[16] Palana, C., Aburumman, A., Kachungunu, C. N. K., et al. (2024) 'Analyzing The Effects Of Semaglutide (Ozempic/Wegovy) On Metabolism: Investigating Correlations With Weight Reduction', Journal of Positive Psychology and Wellbeing, 8(4), pp. 19–41.

[17] Song, J.-E., Ko, H.-J. and Kim, A.-S. (2024) 'Comparison of the Efficacy of Anti-Obesity Medications in Real-World Practice', Drug Design, Development and Therapy, pp. 845–858.

[18] WHO (2024) Obesity and Overweight, Asia Pacific Persp. Available at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

[19] Wilding, J. P. H., Batterham, R. L., Calanna, S., et al. (2021) 'Once-weekly semaglutide in adults with overweight or obesity', New England Journal of Medicine, 384(11), pp. 989–1002.

[20] Xie, Z., Yang, S., Deng, W., et al. (2022) 'Efficacy and safety of liraglutide and semaglutide on weight loss in people with obesity or overweight: a systematic review', Clinical epidemiology, pp. 1463–1476.