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# Knowledge, Attitudes, and Use of Antidiabetic Medications for Weight Loss Among Adults in Riyadh, Saudi Arabia: A Cross-Sectional Study

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## Abstract

### Background

The increasing use of anti-diabetic drugs, particularly glucagon-like peptide-1 receptor agonists (GLP-1 RAs), for weight loss has prompted concerns about public awareness, attitudes, and usage. In Saudi Arabia, a substantial proportion of adults have obesity or are overweight, highlighting the considerable burden of obesity. Meanwhile, the increasing use of GLP-1 RAs for weight management underscores the importance of assessing public knowledge and attitudes toward these medications.

### Objective

The objective of this study is to assess knowledge, attitudes, and practices regarding antidiabetic medications used for weight loss among adult residents of Riyadh, Saudi Arabia.

### Methods

The cross-sectional survey included 282 adult residents of Riyadh. A self-administered electronic questionnaire was sent using a non-probability convenience sampling method. The questionnaire evaluated sociodemographic variables, knowledge, attitudes, and practices about antidiabetic medicines used for weight loss. Data were analyzed using nonparametric tests, Spearman's  $\rho$  correlation, and multivariable linear and binary logistic regression analyses.

### Results

Of the 282 participants, 70.9% were female and 68.4% were married. The median knowledge score was 15.0 (interquartile range (IQR), 12.0-18.0), and the median attitude score was 23.0 (IQR, 21.0-25.0). Knowledge and attitude scores showed a weak positive correlation (Spearman's  $\rho = 0.254$ ,  $p < 0.001$ ). Overall, 76 participants (27.0%) reported using antidiabetic medications for weight reduction, with Ozempic (55.3%) and Mounjaro (44.7%) being the most commonly used medications. Female gender was independently associated with higher knowledge scores, whereas non-medical occupation was associated with lower knowledge and attitude scores. Participants with chronic disease had higher odds of weight-loss medication use, whereas higher attitude scores were associated with lower odds of use.

### Conclusion

Adults in Riyadh demonstrated important knowledge gaps regarding weight-loss medications. Knowledge and attitudes varied by occupation, while medication use was independently associated with chronic disease status and attitude scores, highlighting the need for evidence-based education and medically supervised use.

**Categories:** Public Health, Internal Medicine, Endocrinology/Diabetes/Metabolism

**Keywords:** attitudes, glp-1 receptor agonists, knowledge, medication use, saudi arabia, semaglutide, tirzepatide, weight loss

## Introduction

### Background and problem statement

Obesity is a chronic, relapsing, complex disease that poses a significant global public health threat. It is significantly linked to increased morbidity and mortality due to its association with a number of chronic noncommunicable diseases, particularly cardiovascular disease, type 2 diabetes, hypertension, and metabolic syndrome. Obesity continues to increase globally, putting enormous strain on healthcare systems

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and lowering quality of life [1]. In Saudi Arabia, the prevalence of obesity is higher than the global average. Prior national estimates of the prevalence of obesity were around 35%, compared to 13% worldwide, and in 2018, that number rose to 54.3% [2]. More current data from 2024 show that 23.1% of those aged 15 and older were classified as having obesity, and 42.6% were overweight [3].

The significant correlation between this expanding epidemic and type 2 diabetes and cardiovascular disease makes it a serious public health problem. Moreover, Saudi Arabia has one of the highest rates of obesity in the world, according to the United Nations Global Health Targets Report (2025), which also placed the country's chances of meeting its national obesity reduction goals by 2025 at less than 1% [2]. The cornerstone of obesity management continues to be lifestyle adjustment, which includes dietary changes and increased physical activity. However, these methods frequently fail to achieve or maintain adequate weight loss, resulting in an increased reliance on pharmaceutical treatments. Glucagon-like peptide-1 receptor agonists (GLP-1 RAs) have emerged as promising therapeutic medicines. These drugs, which were originally created to improve glycemic control in patients with type 2 diabetes mellitus, have shown great success in weight loss [4]. Clinical trials have shown that semaglutide (Ozempic), paired with lifestyle interventions, resulted in an average weight loss of 14.9%, with the majority of patients losing clinically significant weight [5].

The U.S. Food and Drug Administration has approved liraglutide (Saxenda) and higher-dose semaglutide (Ozempic) for the treatment of obesity, while tirzepatide (Mounjaro) is approved for type 2 diabetes mellitus but is increasingly being used off-label for weight loss [6,7]. Tirzepatide (Mounjaro) is unique in that it acts as a dual agonist at both GLP-1 and glucose-dependent insulinotropic polypeptide (GIP) receptors, resulting in enhanced glycemic control and greater weight reduction compared with GLP-1 RAs alone [6]. These drugs have also shown cardiovascular benefits, including significant reductions in cardiovascular events, cardiovascular mortality, and all-cause mortality [2,7]. GLP-1 RAs have side effects despite their therapeutic advantages; the most frequent ones are gastrointestinal symptoms, such as nausea, vomiting, abdominal discomfort, and appetite suppression. Gallbladder disease and pancreatitis are more severe side effects. There have also been reports of aesthetic alterations, such as "Ozempic face," or the reduction of facial fat. These possible dangers emphasize how crucial proper patient selection, observation, and medical supervision are [8].

In recent years, the usage of weight reduction drugs, notably GLP-1 RAs, has expanded dramatically both globally and locally. In Saudi Arabia, studies found that roughly 18.2% of participants utilized GLP-1 RAs, with semaglutide (Ozempic) being the most often used medication. Although the majority of people began therapy after being recommended by a doctor, a significant number reported starting on their own [3]. Importantly, public awareness of these drugs remains low, with a mere 31% having adequate knowledge. Furthermore, opinions toward these treatments differ, with some people voicing concerns about their safety, cost, and potential side effects [2].

Because these drugs are being used more often, including off-label for weight loss, this information gap is very alarming. To guarantee safe use, maximize treatment results, and avoid abuse, adequate information and suitable attitudes toward weight management drugs are crucial. Comprehending public understanding and perceptions could also aid in directing healthcare policy and educational initiatives.

## Study justification

Despite their extensive use, evidence suggests that public awareness of GLP-1 RAs, such as semaglutide (Ozempic) and tirzepatide (Mounjaro), remains low. Inadequate awareness may lead to inappropriate use, false expectations, poor adherence, and a higher chance of harmful effects. Social, cultural, and educational variables may also influence attitudes about these drugs, affecting treatment acceptance and outcomes. Few studies have been conducted to date to evaluate the Saudi Arabian public's knowledge of and attitudes toward GLP-1 RAs for weight loss, especially in the general population. Limited awareness may lead individuals to misuse these medications, have unrealistic expectations, or overlook potential side effects and necessary medical supervision.

Therefore, this study aims to assess knowledge of and attitudes toward GLP-1 RAs, such as semaglutide (Ozempic) and tirzepatide (Mounjaro), used for weight loss among the general population in Saudi Arabia. Additionally, the study seeks to identify factors associated with knowledge and attitudes to support the development of targeted educational strategies and improve the safe and effective use of these medications.

## Materials And Methods

### Study design and population

A survey-based cross-sectional design was used to investigate adults' knowledge, attitudes, and use of antidiabetic medications for weight loss in Riyadh, Saudi Arabia. Eligible adults were recruited through a convenience-based approach and completed an electronic questionnaire adapted from previously published instruments. Responses were collected from March to June 2026 to allow sufficient time for participant recruitment and survey completion. The survey was circulated electronically through WhatsApp, Twitter,

Instagram, and Facebook to reach adult residents of Riyadh. Adults were eligible to participate if they were aged 18 years or older, lived in Riyadh, and agreed to take part in the survey. Responses from individuals who did not meet the age or residency requirements, as well as incomplete or internally inconsistent submissions, were omitted from the analysis.

The sample requirement was determined using the 60.8% prevalence of adequate knowledge reported by Kreidieh et al. (2026) [9]. With a 95% confidence level, a 6% absolute precision, and the assumption of a large underlying population, 254 respondents were required. The 6% precision level was chosen as a pragmatic compromise between the desired statistical precision and the feasibility of recruitment within the available resources. Allowing for approximately 10% unusable or missing responses increased the recruitment target to 280. The final analytic sample comprised 282 respondents. The calculation was performed using Epi Info [10].

The sample-size calculation was intended primarily to provide adequate precision for estimating the prevalence of knowledge rather than to determine the number required for the regression analyses. Consequently, adjusted estimates, particularly those with confidence intervals close to the null value, are regarded as exploratory and require confirmation in studies specifically designed and powered to evaluate these associations.

## Data collection

Information was obtained through an online structured survey adapted mainly from the instrument described by Abutaima et al. (2024) [6]. Modifications were made to ensure that the survey addressed the objectives and setting of the current study. It covered sociodemographic and clinical characteristics, knowledge concerning antidiabetic medications used for weight loss, attitudes toward their use, and participants' self-reported medication use. Abutaima et al.'s original work is freely accessible and distributed under the Creative Commons Attribution (CC BY) license. This license allows the material to be reused and modified, provided that the original source is appropriately acknowledged. The scored version of the questionnaire can also be accessed through the Open Science Framework (OSF; <https://osf.io/8y7tw/files/osfstorage>). On this basis, no additional authorization was necessary for the present adaptation. The questionnaire was pilot-tested among 30 participants who were not included in the final analysis to assess clarity and comprehensibility. Questionnaires containing missing or inconsistent responses were excluded from the analysis.

Content validity of the questionnaire was assessed through expert review, during which questionnaire items were evaluated for relevance, clarity, and suitability for the study objectives. Similar approaches have been employed in cross-sectional knowledge, attitude, and practices (KAP) studies, where instrument adaptation and assessment of face and content validity are commonly used to support questionnaire suitability for the target population.

## Scoring system

Knowledge was assessed by assigning 1 point to each correct response and 0 points to incorrect or "not sure" responses. For multiple-response questions, each response option was scored separately as correct or incorrect according to the predefined scoring key. The scoring key was retained from the adapted source instrument to preserve consistency with the original questionnaire. The total knowledge score ranged from 0 to 27, with higher scores indicating greater knowledge. Attitude was assessed using seven items rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Negatively worded items were reverse-coded before calculating the total score. The total attitude score ranged from 7 to 35, with higher scores indicating more favorable attitudes toward the appropriate and safe use of antidiabetic medications for weight loss. As the total knowledge and attitude scores were non-normally distributed, they were summarized using the median and interquartile range (IQR). The scoring key was retained from the adapted source instrument to preserve consistency with the original questionnaire. Accordingly, item-level classifications reflect the scoring framework of the source instrument and should not be interpreted as an independent assessment of current drug-specific regulatory approval.

## Statistical analysis

Data analysis was conducted with IBM SPSS Statistics for Windows, Version 27 (Released 2019; IBM Corp., Armonk, NY, USA). Distributional characteristics of the continuous measures were assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests, supplemented by quantile-quantile (Q-Q) plots and measures of skewness and kurtosis. As the knowledge and attitude scores were non-normally distributed, medians and IQRs were used to describe them. The Mann-Whitney U test was applied when comparing two groups, and the Kruskal-Wallis H test was applied when comparisons involved three or more categories. Spearman's rank correlation was used to quantify the association between knowledge and attitude scores. Associations involving categorical data were evaluated with Pearson's chi-square test. Continuous knowledge and attitude scores were each examined in their own linear regression model. Medication use for weight loss, coded as use versus no use, was examined through logistic regression. Predictors showing an unadjusted p-value < 0.10 for a given outcome in the univariable analysis were carried forward to the corresponding

multivariable model and entered together using the Enter method. Knowledge score was additionally included in the attitude model because knowledge and attitude are conceptually related domains of the KAP framework and were associated in the bivariate analysis. For the exploratory bivariate analyses, Benjamini-Hochberg (BH)-adjusted p-values were calculated separately within each outcome family to address multiplicity. Variable inclusion in the multivariable models, however, was based on the unadjusted rather than BH-adjusted p-values. Model assumptions for the linear regressions were evaluated from the residuals, with attention to approximate normality, linearity, and constant variance. Tolerance and variance inflation factor (VIF) values were inspected to identify possible collinearity among predictors. These diagnostic checks did not indicate important assumption violations or problematic collinearity. For each linear model, unstandardized coefficients (B), standard errors (SE), standardized coefficients ( $\beta$ ), 95% confidence intervals (CIs), and p-values are reported. Model-level results include the F statistic together with  $R^2$  and adjusted  $R^2$ . For the logistic model, adjusted odds ratios (AORs) and their 95% CIs are provided. Goodness of fit was examined using the Hosmer-Lemeshow test, with Nagelkerke  $R^2$  also reported. Statistical tests were two-sided, and p-values below 0.05 were considered statistically significant.

## Ethical considerations

Participants received a full explanation of the study objectives and procedures before participation. Electronic informed consent was obtained through the first question of the online survey, and participation was voluntary. All study data were treated confidentially. Ethical approval was obtained from the Institutional Review Board of Almaarefa University, Riyadh, Saudi Arabia (IRB approval No. IRB26-012; March 30, 2026).

## Results

### Participant characteristics

The analysis included 282 respondents. Women represented 70.9% of the sample, and 68.4% were married. An undergraduate degree was reported by 59.9% of respondents, while 65.2% worked in non-medical professions. Participants aged 18-29 years constituted the largest age group (29.1%). Health insurance coverage was reported by 66.0% of the sample, while 34.8% reported having a chronic disease. Among the reported chronic conditions, obesity accounted for the largest proportion (29.6%) (Table 1).

| Characteristic                           | Category                          | n (%)      |
|------------------------------------------|-----------------------------------|------------|
| Age (years)                              | 18-29                             | 82 (29.1)  |
|                                          | 30-39                             | 61 (21.6)  |
|                                          | 40-49                             | 68 (24.1)  |
|                                          | 50-59                             | 45 (16.0)  |
|                                          | >59                               | 26 (9.2)   |
| Gender                                   | Male                              | 82 (29.1)  |
|                                          | Female                            | 200 (70.9) |
| Marital status                           | Married                           | 193 (68.4) |
|                                          | Unmarried                         | 89 (31.6)  |
| Education level                          | High school                       | 32 (11.3)  |
|                                          | Undergraduate                     | 169 (59.9) |
|                                          | Postgraduate                      | 81 (28.7)  |
| Occupation                               | Medical profession                | 98 (34.8)  |
|                                          | Non-medical profession            | 184 (65.2) |
| Health insurance                         | Yes                               | 186 (66.0) |
|                                          | No                                | 96 (34.0)  |
| Chronic disease                          | Yes                               | 98 (34.8)  |
|                                          | No                                | 184 (65.2) |
| Specific chronic disease reported (n=98) | Obesity                           | 29 (29.6)  |
|                                          | Diabetes                          | 15 (15.3)  |
|                                          | Hypertension                      | 15 (15.3)  |
|                                          | Hyperlipidemia (high cholesterol) | 15 (15.3)  |
|                                          | Thyroid disease                   | 11 (11.2)  |
|                                          | Other chronic diseases*           | 13 (13.3)  |

**TABLE 1: Sociodemographic and Health Characteristics of Participants (N=282)**

Data are presented as n (%). Percentages were calculated based on the total sample (N = 282), except for specific chronic diseases, which were calculated among participants who reported having a chronic disease (n = 98).

\*Other chronic diseases included less frequently reported conditions.

## Participants' knowledge regarding antidiabetic medications for weight loss

Participants reported several channels for obtaining information. The corresponding percentages were 45.0% for family and friends, 44.0% for social media, 40.4% for healthcare providers, and 27.7% for scientific articles (Figure 1). Knowledge of the medications assessed in the survey varied across participants. Overall, 78.4% indicated that antidiabetic medications may have a role in weight loss; 8.2% answered "No," and 13.5% were uncertain. Among medications perceived as usable for weight loss, Amaryl had the highest proportion of "Yes" responses (98.9%), followed by Mounjaro (85.5%) and Ozempic (79.1%). Glucophage and Saxenda were selected by 37.9% and 34.8% of participants, respectively, whereas insulin (5.0%) and Jardiance (4.6%) were selected by relatively few participants. Regarding perceived regulatory approval for weight loss, Mounjaro (75.9%) and Ozempic (71.6%) had the highest proportions of "Yes" responses, followed by Saxenda (30.9%) and Glucophage (23.4%). For potential adverse effects, nausea and vomiting were recognized by 81.6% of participants, fatigue by 55.7%, abdominal pain by 55.0%, and diarrhea by 41.8%.

The overall knowledge score had a median of 15.0 (IQR: 12.0-18.0) (Table 2).

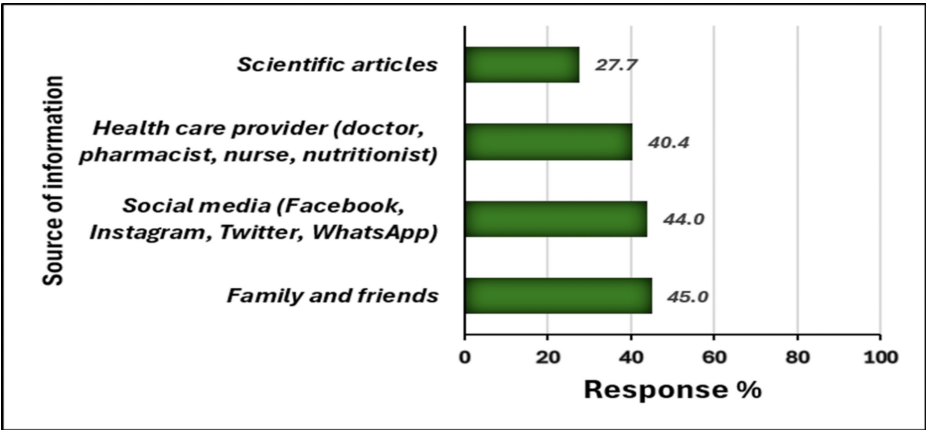


FIGURE 1: Sources of Information Regarding Antidiabetic Medications Used for Weight Loss

Participants could select more than one source of information; therefore, percentages do not sum to 100% (N = 282).

| Domain                                                                                                          | Item                      | Response / Yes, n (%) |
|-----------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------|
| Participants' responses regarding whether some antidiabetic medications can be used for weight loss             | Yes                       | 221 (78.4)            |
|                                                                                                                 | No                        | 23 (8.2)              |
|                                                                                                                 | Not sure                  | 38 (13.5)             |
| Medications perceived as usable for weight loss                                                                 | Amaryl                    | 279 (98.9)            |
|                                                                                                                 | Mounjaro*                 | 241 (85.5)            |
|                                                                                                                 | Ozempic*                  | 223 (79.1)            |
|                                                                                                                 | Glucophage*               | 107 (37.9)            |
|                                                                                                                 | Saxenda*                  | 98 (34.8)             |
|                                                                                                                 | Insulin                   | 14 (5.0)              |
|                                                                                                                 | Jardiance                 | 13 (4.6)              |
|                                                                                                                 |                           |                       |
| Medications perceived as approved for weight loss by regulatory authorities as the Food and Drug Administration | Mounjaro*                 | 214 (75.9)            |
|                                                                                                                 | Ozempic*                  | 202 (71.6)            |
|                                                                                                                 | Saxenda*                  | 87 (30.9)             |
|                                                                                                                 | Glucophage*               | 66 (23.4)             |
|                                                                                                                 | Insulin                   | 17 (6.0)              |
|                                                                                                                 | Jardiance (Empagliflozin) | 5 (1.8)               |
|                                                                                                                 | Amaryl                    | 4 (1.4)               |
|                                                                                                                 |                           |                       |
|                                                                                                                 | Nausea and vomiting       | 230 (81.6)            |
|                                                                                                                 | Fatigue                   | 157 (55.7)            |
|                                                                                                                 | Abdominal pain            | 155 (55.0)            |
|                                                                                                                 |                           |                       |

|                                                                                     |                          |                  |
|-------------------------------------------------------------------------------------|--------------------------|------------------|
| Knowledge about the side effects of the injectable medications used for weight loss | Diarrhea                 | 118 (41.8)       |
|                                                                                     | Depression               | 97 (34.4)        |
|                                                                                     | Headache                 | 95 (33.7)        |
|                                                                                     | Pancreatitis             | 60 (21.3)        |
|                                                                                     | Tumours                  | 59 (20.9)        |
|                                                                                     | Skin swelling            | 44 (15.6)        |
|                                                                                     | Dark skin patches        | 23 (8.2)         |
|                                                                                     | UTI*                     | 23 (8.2)         |
|                                                                                     | Weight gain*             | 12 (4.3)         |
|                                                                                     | Unwanted sexual response | 10 (3.5)         |
| Total knowledge score                                                               | Median (IQR)             | 15.0 (12.0-18.0) |

TABLE 2: Participants’ Knowledge of Antidiabetic Medications Used for Weight Loss, Their Regulatory Approval and Potential Side Effects (N = 282)

Data are presented as frequency and percentage, n (%), unless otherwise indicated. For medication and side-effect items, frequencies represent participants who responded “Yes.” An asterisk (\*) indicates items for which a “Yes” response was considered correct according to the original scoring system of the adapted questionnaire. For calculation of the total knowledge score, each correct response was assigned a score of 1 and each incorrect response a score of 0. The total knowledge score is presented as median (interquartile range (IQR)).

UTI, urinary tract infection

Correlation between knowledge and attitude scores regarding antidiabetic medications used for weight loss

A weak positive correlation was observed between knowledge and attitude scores (Spearman’s  $r_s = 0.254$ ,  $p < 0.001$ ), indicating that higher knowledge scores were associated with more favorable attitude scores (Figure 2).

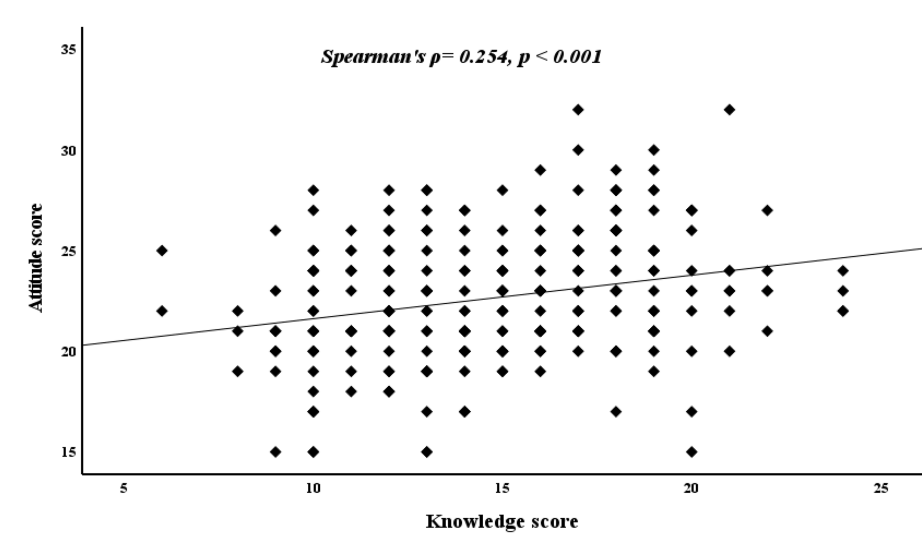


FIGURE 2: Scatter Plot Demonstrating the Correlation Between Knowledge and Attitude Scores Regarding Weight-Loss Medications

Participants’ attitude regarding antidiabetic medications for weight loss

Agreement with adequate regulation of antidiabetic medicines used for weight loss in Saudi Arabia was reported by 65.9% of participants, while 86.5% supported their use for weight loss under medical supervision. A combined 57.1% expressed agreement that these medications could support lifestyle changes related to weight loss and better health. Regarding other attitude items, 50.3% disagreed that antidiabetic medicines were the best option for weight loss, while 47.9% disagreed that their use was free of problems. Guaranteed effectiveness for weight loss received agreement from 51.8% of participants, whereas 44.7% expressed disagreement regarding sustained effectiveness. The median total attitude score was 23.0 (IQR: 21.0-25.0) (Table 5).

| Attitude statement                                                                                                                                        | Strongly disagree n (%) | Disagree n (%)   | Neutral n (%) | Agree n (%) | Strongly agree n (%) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------|---------------|-------------|----------------------|
| There is sufficient supervision in Saudi Arabia by the concerned authorities on the dispensing of antidiabetic medications used for weight loss purposes* | 6 (2.1)                 | 24 (8.5)         | 66 (23.4)     | 96 (34.0)   | 90 (31.9)            |
| These medications can be used for weight loss, but under medical supervision                                                                              | 3 (1.1)                 | 8 (2.8)          | 27 (9.6)      | 93 (33.0)   | 151 (53.5)           |
| The use of these medications is the first and best option for weight loss *                                                                               | 50 (17.7)               | 92 (32.6)        | 76 (27.0)     | 42 (14.9)   | 22 (7.8)             |
| These medications help you make the lifestyle changes you need to lose weight and improve your health                                                     | 16 (5.7)                | 28 (9.9)         | 77 (27.3)     | 114 (40.4)  | 47 (16.7)            |
| These medications are considered safe and can be used without complications *                                                                             | 33 (11.7)               | 102 (36.2)       | 100 (35.5)    | 35 (12.4)   | 12 (4.3)             |
| The effectiveness of these medications for weight loss is guaranteed *                                                                                    | 8 (2.8)                 | 42 (14.9)        | 86 (30.5)     | 113 (40.1)  | 33 (11.7)            |
| The efficacy of these medications is long-lasting *                                                                                                       | 34 (12.1)               | 92 (32.6)        | 98 (34.8)     | 40 (14.2)   | 18 (6.4)             |
| Total attitude score                                                                                                                                      | Median (IQR)            | 23.0 (21.0-25.0) |               |             |                      |

**TABLE 3: Participants' Attitudes Toward Antidiabetic Medications for Weight Loss (N=282)**

Data are presented as n (%), unless otherwise indicated. Individual attitude items were assessed using a five-point Likert scale ranging from strongly disagree to strongly agree. The total attitude score is presented as the median (IQR). An asterisk (\*) indicates negatively worded items that were reverse-coded when calculating the total attitude score based on the original scoring system of the adapted questionnaire.

IQR, interquartile range

## Participants' patterns of antidiabetic medication use for weight reduction

A total of 76 participants (27.0%) reported having used medications originally intended for diabetes management for the purpose of weight loss, whereas 206 (73.0%) reported no use. Among users (n = 76), Ozempic was the most used medication (55.3%), followed by Mounjaro (44.7%). Hospitals (42.1%) and pharmacies (38.2%) were the two leading locations from which users obtained their medication. The most reported weight loss was 5-10 kg (43.4%), followed by <5 kg (25.0%). Most users (92.1%) reported consulting a doctor regarding medication use. Following discontinuation, 77.6% reported regaining weight, while 61.8% reported experiencing side effects (Table 4).

| Characteristic                        | Category                        | n (%)      |
|---------------------------------------|---------------------------------|------------|
| Medication used                       | Yes                             | 76 (27.0)  |
|                                       | Did not use any                 | 206 (73.0) |
| Medication type (n=76)                | Ozempic                         | 42 (55.3)  |
|                                       | Mounjaro                        | 34 (44.7)  |
| Medication sources (n=76)             | Hospitals                       | 32 (42.1)  |
|                                       | Pharmacy                        | 29 (38.2)  |
|                                       | Private clinics/medical centers | 11 (14.5)  |
|                                       | Family or friends abroad        | 4 (5.3)    |
| Weight loss (Kg) (n=76)               | <5                              | 19 (25.0)  |
|                                       | 5-10                            | 33 (43.4)  |
|                                       | 10-15                           | 11 (14.5)  |
|                                       | 15-20                           | 11 (14.5)  |
|                                       | >20                             | 2 (2.6)    |
| Consulted a doctor (n=76)             | Yes                             | 70 (92.1)  |
|                                       | No                              | 6 (7.9)    |
| Regained weight after stopping (n=76) | Yes                             | 59 (77.6)  |
|                                       | No                              | 17 (22.4)  |
| Experienced side effects (n=76)       | Yes                             | 47 (61.8)  |
|                                       | No                              | 29 (38.2)  |

**TABLE 4: Participants' Patterns of Antidiabetic Medication Use for Weight Reduction**

Data are presented as n (%). Percentages for medication use were calculated based on the total study population (N = 282). All subsequent characteristics, including medication type, medication source, weight loss achieved, consultation with a doctor, weight regain after discontinuation, and experienced side effects, were calculated among participants who reported using antidiabetic medications for weight reduction (n = 76).

### Univariate analysis of sociodemographic characteristics in relation to knowledge, attitude, and patterns of antidiabetic medication use for weight loss

Bivariate analysis showed variation in knowledge scores according to gender, educational level, and occupation. Females had a higher median knowledge score than males (15.0 (IQR: 12.0-18.0) vs. 14.0 (11.0-17.0); Mann-Whitney U = 9,543.5, unadjusted p = 0.030); however, this association did not remain significant following Benjamini-Hochberg (BH) adjustment (BH-adjusted p = 0.070). Knowledge scores also varied across educational categories (Kruskal-Wallis H = 8.916, unadjusted p = 0.012; BH-adjusted p = 0.042). In addition, participants in medical occupations had higher knowledge scores than those in non-medical occupations.

For attitude score, occupation was the only sociodemographic or clinical factor that retained an association after BH adjustment. Participants in medical professions had a higher median attitude score than those in non-medical professions (23.0 (21.0-26.0) vs. 22.0 (20.0-24.0); Mann-Whitney U = 6,884.5, unadjusted p = 0.001; BH-adjusted p = 0.004;  $|r_p|$  = 0.236). Attitude score also differed according to knowledge level: participants with knowledge scores  $\geq 15$  had a median attitude score of 23.0 (21.0-25.0), compared with 21.0 (20.0-24.0) among those scoring  $< 15$  (Mann-Whitney U = 12,750.5, p < 0.001;  $|r_p|$  = 0.285).

In analyses of weight-loss medication use, occupation ( $\chi^2(1) = 5.620$ , unadjusted p = 0.018) and the presence of chronic disease ( $\chi^2(1) = 4.575$ , unadjusted p = 0.032) showed associations before correction for multiple comparisons; however, neither association persisted following BH adjustment. Medication use also differed according to attitude score ( $\chi^2(1) = 10.847$ , p = 0.001). Participants with attitude scores  $< 23$  had greater odds

of medication use than those with scores  $\geq 23$  (35.7% vs. 18.3%; OR = 2.48, 95% CI: 1.43-4.29). Knowledge category, however, showed no association with medication use (27.4% vs. 26.5%;  $\chi^2(1) = 0.027$ ,  $p = 0.868$ ; OR = 1.05, 95% CI: 0.62-1.77) (Table 5).

| Variable         | Category               | n   | Knowledge median (IQR) | Effect size (rrb or $\epsilon^2$ ) | Test statistic; Unadjusted p-value  | BH-adjusted p-value | Attitude median (IQR) | Effect size (rrb or $\epsilon^2$ ) | Test statistic; Unadjusted p-value  | BH-adjusted p-value | Medication use n (%) | Unadjusted OR (95% CI) | Test statistic; df; Unadjusted p-value      | BH-adjusted p-value |
|------------------|------------------------|-----|------------------------|------------------------------------|-------------------------------------|---------------------|-----------------------|------------------------------------|-------------------------------------|---------------------|----------------------|------------------------|---------------------------------------------|---------------------|
| Age (years)      | 18-29                  | 82  | 15.0 (12.0-18.0)       | $\epsilon^2=0.007$                 | Kruskal-Wallis H =5.898; $p=0.207$  | 0.362               | 23.0 (21.0-25.0)      | $\epsilon^2=0$                     | Kruskal-Wallis H 3.181; $p=0.528$   | 0.993               | 19.0 (23.2)          | 1.00 (Ref.)            | Pearson $\chi^2 = 3.497$ ; df= 4; $p=0.478$ | 0.638               |
|                  | 30-39                  | 61  | 15.0 (12.0-17.0)       |                                    |                                     |                     | 22.0 (20.0-25.0)      |                                    |                                     |                     | 14.0 (23.0)          | 0.99 (0.45-2.17)       |                                             |                     |
|                  | 40-49                  | 68  | 15.0 (13.0-18.0)       |                                    |                                     |                     | 22.0 (21.0-24.0)      |                                    |                                     |                     | 24.0 (35.3)          | 1.81 (0.89-3.70)       |                                             |                     |
|                  | 50-59                  | 45  | 12.0 (10.0-17.0)       |                                    |                                     |                     | 22.0 (21.0-25.0)      |                                    |                                     |                     | 12.0 (26.7)          | 1.21 (0.52-2.78)       |                                             |                     |
|                  | $\geq 60$              | 26  | 15.0 (12.75-18.0)      |                                    |                                     |                     | 22.0 (20.0-24.5)      |                                    |                                     |                     | 7.0 (26.9)           | 1.22 (0.45-3.34)       |                                             |                     |
| Gender           | Male                   | 82  | 14.0 (11.0-17.0)       | $r_B=0.164$                        | Mann-Whitney U = 9543.5; $p=0.030$  | 0.07                | 21.0 (20.0-25.0)      | $r_B=0.142$                        | Mann-Whitney U=9366.0; $p=0.059$    | 0.157               | 25.0 (30.5)          | 1.00 (Ref.)            | Pearson $\chi^2=0.735$ ; df=1; $p=0.391$    | 0.638               |
|                  | Female                 | 200 | 15.0 (12.0-18.0)       |                                    |                                     |                     | 23.0 (21.0-25.0)      |                                    |                                     |                     | 51 (25.5)            | 0.78 (0.44-1.38)       |                                             |                     |
| Marital status   | Married                | 193 | 15.0 (12.0-18)         | $r_B=0.012$                        | Mann-Whitney U=8694.0; $p=0.868$    | 0.868               | 23.0 (21.0-25.0)      | $r_B=0.012$                        | Mann-Whitney U = 8694.5; $p= 0.867$ | 0.993               | 57.0 (29.5)          | 1.00 (Ref.)            | Pearson $\chi^2 = 2.073$ ; df=1; $p= 0.150$ | 0.338               |
|                  | Unmarried              | 89  | 15.0 (12.0-17.5)       |                                    |                                     |                     | 23.0 (21.0-25.0)      |                                    |                                     |                     | 19.0 (21.3)          | 0.65 (0.36-1.17)       |                                             |                     |
| Education level  | High school            | 32  | 13.0 (11.25-15.0)      | $\epsilon^2= 0.025$                | Kruskal-Wallis H =8.916; $p=0.012$  | 0.042               | 23.0 (21.0-25.0)      | $\epsilon^2=0$                     | Kruskal-Wallis H 0.434; $p= 0.805$  | 0.993               | 11.0 (34.4)          | 1.00 (Ref.)            | Pearson $\chi^2=1.404$ ; df=2; $p=0.496$    | 0.638               |
|                  | Undergraduate          | 169 | 15.0 (12.0-17.0)       |                                    |                                     |                     | 22.0 (21.0-24.5)      |                                    |                                     |                     | 46.0 (27.2)          | 0.71 (0.32-1.60)       |                                             |                     |
|                  | Postgraduate           | 81  | 16.0 (12.0-19.0)       |                                    |                                     |                     | 23.0 (21.0-25.0)      |                                    |                                     |                     | 19 (23.5)            | 0.59 (0.24-1.43)       |                                             |                     |
| Occupation       | Medical profession     | 98  | 17.5 (14-19.0)         | $r_B=0.467$                        | Mann-Whitney U = 4805.5; $p <0.001$ | <0.001              | 23.0 (21.0-26.0)      | $r_B=0.236$                        | Mann-Whitney U=6884.5; $p=0.001$    | 0.004               | 18.0 (18.4)          | 1.00 (Ref.)            | Pearson $\chi^2=5.620$ ; df=1; $p= 0.018$   | 0.081               |
|                  | Non-medical profession | 184 | 14.0 (11.0-16.0)       |                                    |                                     |                     | 22.0 (20.0-24.0)      |                                    |                                     |                     | 58.0 (31.5)          | 2.05 (1.12-3.72)       |                                             |                     |
| Health insurance | No                     | 96  | 14.0 (12.0-17.0)       | $r_B=0.068$                        | Mann-Whitney U = 9532.5; $p=0.350$  | 0.49                | 22.0 (20.3-24.8)      | $r_B=0.025$                        | Mann-Whitney U=9147.5; $p=0.734$    | 0.993               | 26.0 (27.1)          | 1.00 (Ref.)            | Pearson $\chi^2=0.001$ ; df=1; $p= 0.971$   | 0.971               |
|                  | Yes                    | 186 | 15.0 (12.0-18.0)       |                                    |                                     |                     | 23 (21.0-25.0)        |                                    |                                     |                     | 50.0 (26.9)          | 0.99 (0.57-1.72)       |                                             |                     |

|                 |      |     |                  |             |                                      |       |                     |             |                                        |        |             |                  |                                               |       |
|-----------------|------|-----|------------------|-------------|--------------------------------------|-------|---------------------|-------------|----------------------------------------|--------|-------------|------------------|-----------------------------------------------|-------|
| Chronic disease | No   | 184 | 15.0 (12.0-17.8) | $r_B=0.042$ | Mann-Whitney<br>U=9393.0;<br>p=0.562 | 0.656 | 23.0<br>(21.0-25.0) | $r_B=0.001$ | Mann-Whitney<br>U=9010.0; p=0.993      | 0.993  | 42.0 (22.8) | 1.00 (Ref.)      | Pearson $\chi^2=4.575$ ;<br>df=1; p=0.032     | 0.096 |
|                 | Yes  | 98  | 15.0 (12.0-18.0) |             |                                      |       | 22.5<br>(21.0-25.0) |             |                                        |        | 34.0 (34.7) | 1.80 (1.05-3.08) |                                               |       |
| Knowledge score | < 15 | 135 | NA               | NA          | NA                                   | NA    | 21.0<br>(20.0-24.0) | $r_B=0.285$ | Mann-Whitney U =<br>12,750.5; p <0.001 | <0.001 | 37 (27.4%)  | 1.05 (0.62-1.77) | Pearson $\chi^2=0.027$ ;<br>df=1; p=0.868     | 0.971 |
|                 | ≥ 15 | 147 | NA               |             |                                      |       | 23.0<br>(21.0-25.0) |             |                                        |        | 39 (26.5%)  | 1.00 (Ref.)      |                                               |       |
| Attitude score  | < 23 | 140 | NA               | NA          | NA                                   | NA    | NA                  | NA          | NA                                     | NA     | 50 (35.7)   | 2.48 (1.43-4.29) | Pearson<br>$\chi^2=10.847$ ; df=1;<br>p=0.001 | 0.009 |
|                 | ≥ 23 | 142 | NA               |             |                                      |       | NA                  |             |                                        |        | 26 (18.3)   | 1.00 (Ref.)      |                                               |       |

**TABLE 5: Associations of Sociodemographic and Clinical Characteristics With Knowledge, Attitude, and Weight-Loss Medication Use Among Participants (N = 282)**

Data are presented as n (%) or median (interquartile range (IQR)), as appropriate. Differences in knowledge and attitude scores were assessed using the Mann-Whitney U test for two-group comparisons and the Kruskal-Wallis test for comparisons involving three or more groups. Effect sizes are reported as the absolute rank-biserial correlation ( $|r_B|$ ) for Mann-Whitney U tests and epsilon-squared ( $\epsilon^2$ ) for Kruskal-Wallis tests; negative  $\epsilon^2$  estimates were truncated to zero. Associations with weight-loss medication use were assessed using the Pearson chi-square test and are presented as unadjusted odds ratios (ORs) with 95% confidence intervals (CIs), where applicable. The Benjamini-Hochberg (BH) false discovery rate procedure was applied separately within each outcome family (knowledge score, attitude score, and weight-loss medication use) to account for multiple comparisons. Both unadjusted and BH-adjusted p-values are reported. Statistical significance after correction was defined as a two-sided BH-adjusted p-value < 0.05.

## Multivariable linear regression model of factors associated with knowledge, attitude, and weight-loss medication use

The adjusted regression model indicated a higher knowledge score for females compared with males ( $B = 1.593$ , 95% CI: 0.685-2.501,  $p = 0.001$ ). By contrast, participants employed in non-medical fields had lower knowledge scores than those employed in medical fields ( $B = -3.001$ , 95% CI: -3.894 to -2.108,  $p < 0.001$ ). Education level was not retained as an independent predictor of knowledge score. The model was significant overall,  $F(4, 277) = 16.570$ ,  $p < 0.001$ , and accounted for 19.3% of the variability in knowledge scores ( $R^2 = 0.193$ ; adjusted  $R^2 = 0.181$ ). In the adjusted model for attitude score, participants in non-medical occupations had lower scores than those in medical occupations ( $B = -0.865$ , 95% CI: -1.676 to -0.053,  $p = 0.037$ ). Attitude scores increased as knowledge scores increased ( $B = 0.161$ , 95% CI: 0.055-0.267,  $p = 0.003$ ). Gender did not contribute significantly to the adjusted model ( $p = 0.069$ ). The model reached overall statistical significance,  $F(3, 278) = 8.714$ ,  $p < 0.001$ , and accounted for 8.6% of the variability in attitude scores ( $R^2 = 0.086$ ; adjusted  $R^2 = 0.076$ ). Participants with chronic disease had higher odds of weight-loss medication use than those without chronic disease (AOR = 1.795, 95% CI: 1.024-3.145,  $p = 0.041$ ). Conversely, for every additional point in the attitude score, the odds of medication use decreased by 16.2% (AOR = 0.838, 95% CI: 0.761-0.923,  $p < 0.001$ ). No significant contribution was found for occupation (AOR = 1.686, 95% CI: 0.906-3.139,  $p = 0.099$ ). For the model,  $\chi^2(3) = 23.655$  ( $p < 0.001$ ), and the Nagelkerke  $R^2$  was 0.117. The Hosmer-Lemeshow statistic was  $\chi^2(8) = 6.648$  ( $p = 0.575$ ), supporting adequate model fit. Given the exploratory nature of the analyses, the regression findings are intended primarily for hypothesis generation and warrant confirmation in adequately powered studies based on probability sampling (Table 6).

| Outcome/predictor                                            | B      | SE    | Standardized $\beta$ /AOR | Test statistic         | 95% CI           | p-value |
|--------------------------------------------------------------|--------|-------|---------------------------|------------------------|------------------|---------|
| Knowledge score                                              |        |       |                           |                        |                  |         |
| Gender (Ref: Male)                                           | 1.593  | 0.461 | 0.199                     | t = 3.455              | 0.685 to 2.501   | 0.001   |
| Occupation (Ref: Medical profession)                         | -3.001 | 0.454 | -0.394                    | t = -6.615             | -3.894 to -2.108 | <0.001  |
| Education: Undergraduate (Ref: High school)                  | 0.926  | 0.638 | 0.125                     | t = 1.451              | -0.331 to 2.182  | 0.148   |
| Education: Postgraduate (Ref: High school)                   | 1.121  | 0.747 | 0.14                      | t = 1.502              | -0.348 to 2.591  | 0.134   |
| Attitude score                                               |        |       |                           |                        |                  |         |
| Gender (Ref: Male)                                           | 0.734  | 0.402 | 0.108                     | t = 1.828              | -0.056 to 1.525  | 0.069   |
| Occupation (Ref: Medical profession)                         | -0.865 | 0.412 | -0.134                    | t = -2.097             | -1.676 to -0.053 | 0.037   |
| Knowledge score                                              | 0.161  | 0.054 | 0.19                      | t = 2.985              | 0.055 to 0.267   | 0.003   |
| Weight-loss medication use                                   |        |       |                           |                        |                  |         |
| Occupation: Non-medical profession (Ref: Medical profession) | 0.523  | 0.317 | 1.686                     | Wald $\chi^2$ = 2.719  | 0.906 to 3.139   | 0.099   |
| Chronic disease: Yes (Ref: No)                               | 0.584  | 0.286 | 1.795                     | Wald $\chi^2$ = 4.163  | 1.024 to 3.145   | 0.041   |
| Attitude score                                               | -0.177 | 0.049 | 0.838                     | Wald $\chi^2$ = 12.803 | 0.761 to 0.923   | <0.001  |

**TABLE 6: Multivariate Regression Analysis of Factors Associated With Knowledge, Attitude, and Weight-Loss Medication Use (N = 282)**

Multiple linear regression was used for knowledge and attitude scores, and binary logistic regression was used for weight-loss medication use (used vs. did not use). Variables with  $p < 0.10$  in univariable analyses were entered simultaneously into the respective multivariate models using the Enter method. For linear regression models, results are presented as B, SE, standardized  $\beta$ , and 95% CI for B. For the logistic regression model, results are presented as B, SE, AOR (Exp(B)), and 95% CI for the AOR. A two-sided  $p$ -value  $< 0.05$  was considered statistically significant.

B, unstandardized regression coefficient; SE, standard error;  $\beta$ , standardized regression coefficient; AOR, adjusted odds ratio; CI, confidence interval; Ref, reference category

## Discussion

This exploratory cross-sectional study provides insight into knowledge, attitudes, and weight-loss medication use among adults in Riyadh, Saudi Arabia. The findings identified several potential sociodemographic and clinical correlates of knowledge, attitudes, and medication use. Given the exploratory design, these associations should be regarded as hypothesis-generating rather than confirmatory.

Our cross-sectional study included 282 participants, the majority of whom were young adults aged 18-29 years and predominantly female. These demographic characteristics were comparable to those reported by Rušić et al., whose study included 290 participants and was also predominantly composed of women, with most participants aged 26-35 years [11]. The predominance of younger women may partly reflect the online convenience-sampling strategy and differential engagement with social-media-based recruitment. Similar demographic patterns have been reported in previous studies of attitudes toward weight-loss medications [12].

Education level represents another important demographic factor when interpreting knowledge and attitudes toward weight-loss medications. In our study, more than half of the participants had an undergraduate level of education. This finding is comparable with the study by Al-Shawabkeh et al., in which a considerable proportion of participants held a bachelor's degree [13]. Education level was associated with knowledge in the bivariate analysis; however, this association did not persist after multivariable adjustment.

Although higher educational attainment may increase exposure to health information, it does not necessarily ensure accurate knowledge of medication indications, safety, or effectiveness. The loss of the association after adjustment suggests that educational attainment alone may not adequately explain medication-related knowledge, particularly after accounting for professional background. These findings highlight the importance of providing reliable, evidence-based health information regardless of educational level.

In a study conducted in Lebanon, Ozempic was the most commonly reported medication used for weight reduction, followed by Glucophage, while other medications were reported less frequently [9]. In contrast, participants in our study identified a broader range of antidiabetic medications as potentially applicable to weight loss, with Amaryl, Mounjaro, and Ozempic among the most frequently selected options. The frequent selection of Mounjaro and Ozempic may reflect their increasing visibility and widespread discussion as pharmacological options for weight management. However, the substantial selection of medications not primarily indicated for weight management, such as Amaryl, may suggest uncertainty regarding the distinction between glucose-lowering therapies and medications specifically indicated for obesity management. These findings highlight the need for clear, evidence-based education regarding medication-specific indications and appropriate use. Nevertheless, item-level findings should be interpreted in the context of the scoring framework retained from the adapted source instrument.

Regarding knowledge of adverse effects, participants most frequently recognized gastrointestinal symptoms, particularly nausea and vomiting, followed by fatigue and abdominal pain. This finding is consistent with a cross-sectional study conducted in Jordan, in which nausea and vomiting were also the most commonly recognized adverse effects, followed by fatigue, diarrhea, abdominal pain, and headache. The similarity between the two studies suggests that participants are relatively familiar with the common gastrointestinal and general adverse effects associated with injectable medications used for weight loss [6]. In contrast, recognition of less common and potentially serious adverse effects was considerably lower in our study. Although pancreatitis was recognized by some participants, other important complications were less frequently identified. A similar pattern was observed in the Jordanian study, where pancreatitis and thyroid tumors were recognized by fewer participants than the common gastrointestinal symptoms. This suggests that public awareness may be greater for frequent and easily recognizable adverse effects than for rare but clinically important complications. Clinical trial data further demonstrate that serious adverse events such as acute pancreatitis, acute renal failure, and gallbladder-related disorders occur infrequently compared with gastrointestinal symptoms. Although participants should be reassured that serious complications are uncommon, appropriate counseling remains essential to ensure that patients are aware of important warning symptoms and understand when medical assessment is required [6,14].

In this study, most participants did not perceive antidiabetic medications as the first and best option for weight loss. This finding is consistent with a previous study conducted in Saudi Arabia in 2023 in which pharmaceutical drugs were less frequently identified as a weight-loss strategy compared with lifestyle-based approaches, particularly diet and exercise [15]. This suggests that participants in both studies may place greater emphasis on lifestyle modification than on pharmacological treatment for weight management. The relatively lower recognition of pharmaceutical drugs as a weight-loss strategy in the previous study may reflect differences in knowledge, study populations, or the timing of data collection, particularly given the increasing visibility and use of newer pharmacological weight-management therapies.

Similarly, findings from a Saudi Arabian study conducted in 2022 demonstrated considerable uncertainty regarding the use of antidiabetic medications as a standalone approach to weight reduction. In that study, many participants were unsure whether Saxenda, Ozempic, and Trulicity could achieve effective weight loss without diet and exercise [16]. This finding complements our results, in which more than half of participants agreed and strongly agreed that these medications help individuals make the lifestyle changes needed to lose weight and improve their health. These findings suggest that participants may recognize the importance of combining pharmacological treatment with lifestyle modification rather than relying on medication alone. However, the considerable proportion of neutral responses in our study indicates that some uncertainty remains regarding the role of these medications in supporting lifestyle changes. Therefore, public education should emphasize that, when pharmacological treatment is indicated, it should complement rather than replace dietary modification, physical activity, and behavioral interventions.

A study by DePietro et al. captured patient viewpoints, where many people eligible for GLP-1 RA therapy had not yet tried them [17]. This aligns with our findings, where the majority of participants reported not using any medication. A similar pattern was observed in a study conducted in Jeddah, where fewer than one-quarter of participants reported previous use of weight-loss medications [18]. These findings may indicate that, despite the increasing visibility of GLP-1 RAs, their use among the general population remains relatively limited.

In our study, Ozempic was found to be the most frequently used drug, being used by 42 individuals (55.3%). In a similar study, semaglutide has attained increasing prominence in the Middle East as an option for weight loss through the use of drugs [19]. This is also the case for a study done in Jordan that found Ozempic to be the most frequently used drug among those who had used drugs for weight loss [6]. These findings suggest that semaglutide has become a prominent pharmacological option for weight management across

different populations in the region.

Another important aspect is how the general population obtains these medications. A majority of prescriptions for sodium-glucose cotransporter 2 (SGLT2) inhibitors or GLP-1 analogues were issued in public healthcare settings, although occupational healthcare also played a significant role. A study by Rättö et al. also showed that medications requiring long-term monitoring are prescribed across all primary care sectors [20].

Among participants who reported medication use, hospitals were the most frequently reported source of medication, followed by pharmacies. This suggests that much of the reported acquisition occurred through healthcare-related channels. Nevertheless, acquisition through healthcare settings does not necessarily establish appropriate prescribing, indication, or clinical monitoring. In contrast, the Jordanian study reported medication acquisition outside regulated healthcare channels among some participants [6]. These findings highlight the importance of ensuring that weight-loss medications are prescribed and dispensed through appropriate healthcare channels and accompanied by adequate medical assessment and follow-up. Public education emphasizing the importance of medical supervision may help reduce inappropriate self-medication and promote safer use of pharmacological weight-management therapies.

Several sociodemographic characteristics were associated with knowledge scores, although the pattern differed between the bivariate and multivariate analyses. In the bivariate analysis, education level and occupation remained significantly associated with knowledge after BH correction, whereas the association with gender did not remain significant after correction. In the multivariate analysis, however, female gender was independently associated with higher knowledge scores, while participants in non-medical professions had significantly lower knowledge scores than those in medical professions. Education level was no longer independently associated with knowledge after adjustment. These findings suggest that professional exposure to health-related information may play an important role in knowledge regarding weight-loss medications. The higher adjusted knowledge scores among women may also reflect differences in exposure to or interest in weight-management information. Similar differences according to gender, educational background, and medical background have been reported in previous studies [9]. Despite the higher knowledge scores among women, gender was not significantly associated with actual weight-loss medication use in our study. This finding is consistent with a Saudi Arabian study that reported no significant difference between males and females regarding attitudes toward weight-loss treatment [21].

Another study in Lebanon showed that the presence of chronic disease or the use of chronic medication was not significantly related to the use of weight-loss medication, contrary to the finding in this study that people with chronic disease used weight-reduction medications at a higher frequency than healthy individuals [22]. Chronic disease status was independently associated with weight-loss medication use. Participants with chronic disease had approximately 1.8 times the odds of medication use compared with those without chronic disease. This finding should be interpreted cautiously because of potential confounding by indication; participants with obesity, diabetes, or other chronic conditions may have been more likely to receive these medications for clinical reasons. Interestingly, higher attitude scores were independently associated with lower odds of weight-loss medication use. Each one-point increase in attitude score was associated with approximately a 16% reduction in the odds of medication use (AOR = 0.838). The direction of this association agreed with the unadjusted findings: medication use was more frequent among participants whose attitude scores were below the median than among those with scores at or above the median. Higher attitude scores reflected more favorable views regarding the appropriate and safe use of these medications, which may partly explain the lower likelihood of reported use among participants with higher scores. However, the study design does not establish whether attitudes preceded medication use or were shaped by prior experience with these medications. This finding should therefore be viewed as an association rather than evidence of a temporal or causal relationship.

Higher knowledge scores were independently associated with more favorable attitude scores, suggesting that greater knowledge and more favorable attitudes tend to coexist. However, given the cross-sectional design, the temporal direction of this relationship cannot be established. Although occupation and knowledge were independently associated with attitude, the relatively modest explanatory power of the model ( $R^2 = 0.086$ ; adjusted  $R^2 = 0.076$ ) suggests that attitudes are likely influenced by additional psychosocial, experiential, and contextual factors not measured in this study.

## Strengths

This study's emphasis on public knowledge, attitudes, and behaviors surrounding GLP-1 RAs specifically, semaglutide and tirzepatide, in light of their growing use for weight management is one of its main advantages. By investigating this subject in Riyadh, the study sheds light on the attitudes and drug-use habits of the local population. The evaluation of sociodemographic traits, health condition, knowledge, attitudes, and medication use is another asset since it offers a more comprehensive understanding of the variables related to the use of these drugs.

## Limitations

There are some important limitations of this study that must be mentioned while considering the results. First, as the study uses a cross-sectional design, no conclusions about temporality and causality can be made, and additional longitudinal research is needed. Second, all information about weight loss medications, as well as the rest of the collected data, was self-reported and therefore can suffer from possible recall and social desirability biases. The survey did not make the necessary distinction between whether medications were taken to treat obesity as a medical condition, to manage diabetes, or for cosmetic reasons, and that may complicate the interpretation of factors associated with medication use. This issue is especially important when discussing the relationship between chronic diseases and medication use (confounding by indication). Third, even though the questionnaire used in this study was modified based on existing questionnaires and tested during piloting, it was not fully validated, and the measures of internal consistency reliability, construct validity, and factor analysis were not assessed. In addition, some questions related to medication usage might not reflect contemporary drug-specific regulations. Confounding cannot be ruled out entirely because such important potential confounders as obesity severity, diabetes, psychological distress, motivation for weight loss, access to healthcare services, health literacy, and social media exposure were not measured. Moreover, due to the convenience sample, there might be a certain selection bias and low external validity. In particular, a relatively large number of participants with higher education and working in medicine may lead to overestimation of the knowledge of weight loss medications. Finally, although the BH false discovery rate adjustment was performed in exploratory bivariate analyses to minimize possible type I error due to multiple comparisons, those analyses remain exploratory and require careful interpretation.

## Implications and future research

The results indicate the importance of making available an evidence-based educational program that would help people gain information about appropriate indications, adverse effects, contraindications, and medical supervision of pharmacotherapy for weight management, especially in people lacking any medical knowledge. An educational campaign would be required to combat misinformation related to medications that can be found on social media. Since there seems to be some relationship between knowledge and attitudes, an improvement in knowledge on medication can have a positive impact on forming safe perspectives, but due to the cross-sectional study design, no causation can be inferred.

Longitudinal designs and probability-based samples should be used in future research to better understand how knowledge, attitudes, and medication use relate to each other. Future research should make a distinction between medications taken to treat medical conditions such as obesity and diabetes and medications taken specifically for weight loss purposes. In addition, other factors that are worth considering include obesity level, presence of diabetes and comorbid conditions, health care availability, health literacy, body image, distress, and weight stigma, among others. The use of fully validated psychometric tools is encouraged.

## Conclusions

This study found that there are significant gaps in knowledge and attitudes about the use of antidiabetic drugs as weight loss agents among adults in Riyadh, Saudi Arabia. While respondents often mentioned drugs that have gained popularity, such as Ozempic and Mounjaro, as well as side effects related to the gastrointestinal system, it was not always clear to them which drugs are indicated or which serious side effects have not gained attention in popular discussions. Exploratory analyses identified potential sociodemographic and clinical correlates of knowledge, attitudes, and medication use, including gender, occupation, chronic disease status, and knowledge and attitude scores. Information was usually acquired from family and friends, social networks, and medical professionals. These findings should be regarded as hypothesis-generating and require confirmation in larger, probability-based studies specifically powered to evaluate these associations.

Patient counseling should accompany the initiation of pharmacological therapy for weight management. Healthcare professionals should explain which medications are specifically indicated for obesity management and clarify how these differ from glucose-lowering agents that are not intended for this purpose, including Amaryl. Counseling should also address realistic treatment outcomes and possible adverse effects to support informed and appropriate medication use. Future studies should use longitudinal designs to examine changes in GLP-1 RA use over time, weight regain after treatment discontinuation, and the temporal relationship between health literacy and medication adherence.

## Additional Information

### Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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## Disclosures

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