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REVIEW

Alcohol Use After Bariatric Surgery: A Comprehensive Review of Current Knowledge and Research Gaps

Esin Er[1,2] | Cécile Flahault[2] | Anne-Marie Etienne[1]

[1]Research Unit for a life-Course perspective on Health & Education – RUCHE, Faculty of Psychology, Speech and Language Therapy and Educational Sciences, University of Liège, Liège, Belgium | [2]Laboratoire de Psychopathologie et Processus de Santé, Université Paris Cité, Paris, France

Correspondence: Esin Er (esin.er@uliege.be)

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ABSTRACT

In recent years, there has been increased research on alcohol consumption following bariatric surgery. This review aimed to synthesise existing quantitative research on this topic and identify knowledge gaps in the literature. A comprehensive search was performed across Medline, PsychInfo and Scopus. Studies involving human participants who underwent bariatric surgery and reporting postoperative alcohol consumption were considered. A total of 88 studies were included. Overall, most longitudinal studies found an increased prevalence of problematic alcohol consumption (PAC) post-surgery. Risk factors for postoperative PAC remain poorly understood. Explanatory hypotheses include addiction transfer theory, changes in alcohol pharmacokinetics, and increased rewarding effects of alcohol postoperatively. While the addiction transfer theory lacks empirical support, further research is needed to understand how alterations in alcohol metabolism may lead to problematic consumption in some cases. We found only one study on alcohol's rewarding effects post-surgery. Regarding the consequences of PAC, body weight seems unaffected while alcohol-related hospitalizations, liver disease and mortality post-surgery are all increased. Few studies referred to interventions aiming to prevent or treat PAC postoperatively. In conclusion, while the increase in PAC prevalence after bariatric surgery is well documented, substantial knowledge gaps remain regarding its risk factors, underlying mechanisms, potential consequences and the development of prevention and treatment strategies.

1 | Introduction

Worldwide, 890 million people struggle with obesity [1]. Bariatric surgery is an efficient treatment to induce sustainable weight loss [2, 3]. Each year, over 500,000 bariatric interventions are performed globally [4]. Sleeve gastrectomy (SG) is the most performed surgical procedure, followed by Roux-en-Y gastric bypass (RYGB) [4, 5]. Other procedures exist, but they have been abandoned (e.g., vertical banded gastroplasty) or are rarely performed (e.g., adjustable gastric banding, biliopancreatic diversion and duodenal switch) [6].

SG involves the removal of approximately 75% of the stomach, resulting in a narrow, tube-shaped gastric structure. RYGB entails the creation of a small gastric pouch in the upper portion of the stomach and rerouting of the small intestine to this new pouch, thereby bypassing a substantial segment of the stomach and the proximal small intestine [7, 8]. While RYGB combines gastric restriction with some degree of malabsorption, SG is primarily considered a restrictive procedure. Beyond mechanical restriction (and, for RYGB, some degree of malabsorption), both procedures promote weight loss through a complex interplay of mechanisms, including sustained reductions in appetite,

enhanced satiety mediated by gut-derived hormones, neurohormonal adaptations in gut–brain signalling, and metabolic changes involving bile acid metabolism, gut microbiota composition and energy expenditure [7, 8].

In addition to the physical health issues associated with obesity (e.g., diabetes, hypertension, sleep apnea, etc.), candidates for bariatric surgery present a high prevalence of lifetime (between 37% and 81%) and current (up to 60%) psychological disorders. The most common disorders include anxiety, mood disorders and eating disorders [9–11].

Recent studies and literature reviews indicate that many patients experience improvements in mental health and quality of life following surgery. However, some mental health problems may persist, recur, or emerge over time postoperatively [12–14]. Over the past two decades, substantial research has focused on patients' alcohol consumption after surgery.

Alcohol is the most widely consumed psychoactive substance in the world and is associated with over 200 diseases, injuries and health conditions [1, 15–17]. Numerous studies with large sample sizes have shown that patients who have undergone surgery are at a higher risk of developing problematic alcohol use [18, 19]. Given the growing body of research in this area, the present research aimed to provide a comprehensive overview of previous quantitative studies on alcohol consumption following bariatric surgery. Rather than concentrating on a single aspect (e.g., prevalence alone), this review seeks to present a detailed overview of the available evidence regarding postoperative alcohol use, determining which areas have been thoroughly researched, identifying gaps in the literature and highlighting where further investigation is needed.

2 | Methods

2.1 | Eligibility Criteria

This review focused on studies including human participants who underwent bariatric surgery, without restriction on the type of surgical procedure. All patterns of alcohol consumption were considered, ranging from alcohol use, high-risk and harmful drinking to alcohol abuse, dependence and alcohol use disorder (AUD). Only quantitative studies written in English or French were included.

Studies involving adolescents (as defined by the original study authors) or animals were excluded, as well as any type of research other than a primary quantitative study (e.g., literature review, commentary, qualitative study). Additionally, studies not written in English or French, those that focused only on surgical candidates, and research that addressed postoperative alcohol use without any details on preoperative consumption were also excluded. Lastly, studies focusing on substance use in general without specific information on alcohol consumption were not considered.

2.2 | Search Strategy

A search was conducted on Medline (Ovid), PsychInfo (Ovid) and Scopus (Elsevier) in February 2024 to identify studies that explored bariatric patients' alcohol consumption postoperatively. All search strategies were constructed with the support of an information specialist with experience in information synthesis. Examples of employed keywords included 'bariatric surg*', 'gastric bypass*', 'bilio pancreatic diversion*', 'duodenal switch', 'sleeve', 'weight loss surg*', 'alcohol*', 'drink*', 'drunk*', 'substance abus*'. There was no limitation on the publication date. The detailed search strategies are available in File S1.

2.3 | Selection Process

The various citations identified following database searching were uploaded to Covidence (Veritas Health Innovation). Duplicates were removed. In this non-systematic review, the title and abstract of all remaining references were screened by one reviewer. The process was performed twice to minimise the risk of missing relevant studies. All potentially relevant studies were read in full text against the eligibility criteria. Reasons for excluding papers after full-text reading were reported in the review. Finally, the reference lists of the included articles were examined to find additional references. The results of the search and the study inclusion process were illustrated in a Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram [20].

2.4 | Data Extraction and Classification

General information from all included studies was extracted, including citation details, data regarding the country, study design, participants, alcohol consumption measures and main results.

Included studies' results were synthesised qualitatively into five main sections: (1) prevalence of alcohol use and problematic consumption; (2) risk factors for alcohol use and problematic consumption; (3) explanatory hypotheses underlying increased consumption; (4) potential effects of alcohol consumption after surgery and (5) intervention strategies.

3 | Results

3.1 | Included Studies

The search across various databases led to the identification of 4933 references. Two additional references were found by examining articles' reference lists. After removing duplicates ($n = 1407$), the title and abstract of 3528 references were analysed. A total of 134 references were retained for full-text review. Ultimately, 88 studies were included. Reasons for excluding articles at the full-text reading stage are documented in File S2. Figure 1 represents the results of the study search and inclusion process in the form of a PRISMA flow diagram [20].

3.2 | Prevalence of Alcohol Use and Problematic Consumption

Forty studies provided data on the prevalence or risk of alcohol use and problematic drinking after surgery (see Table 1).

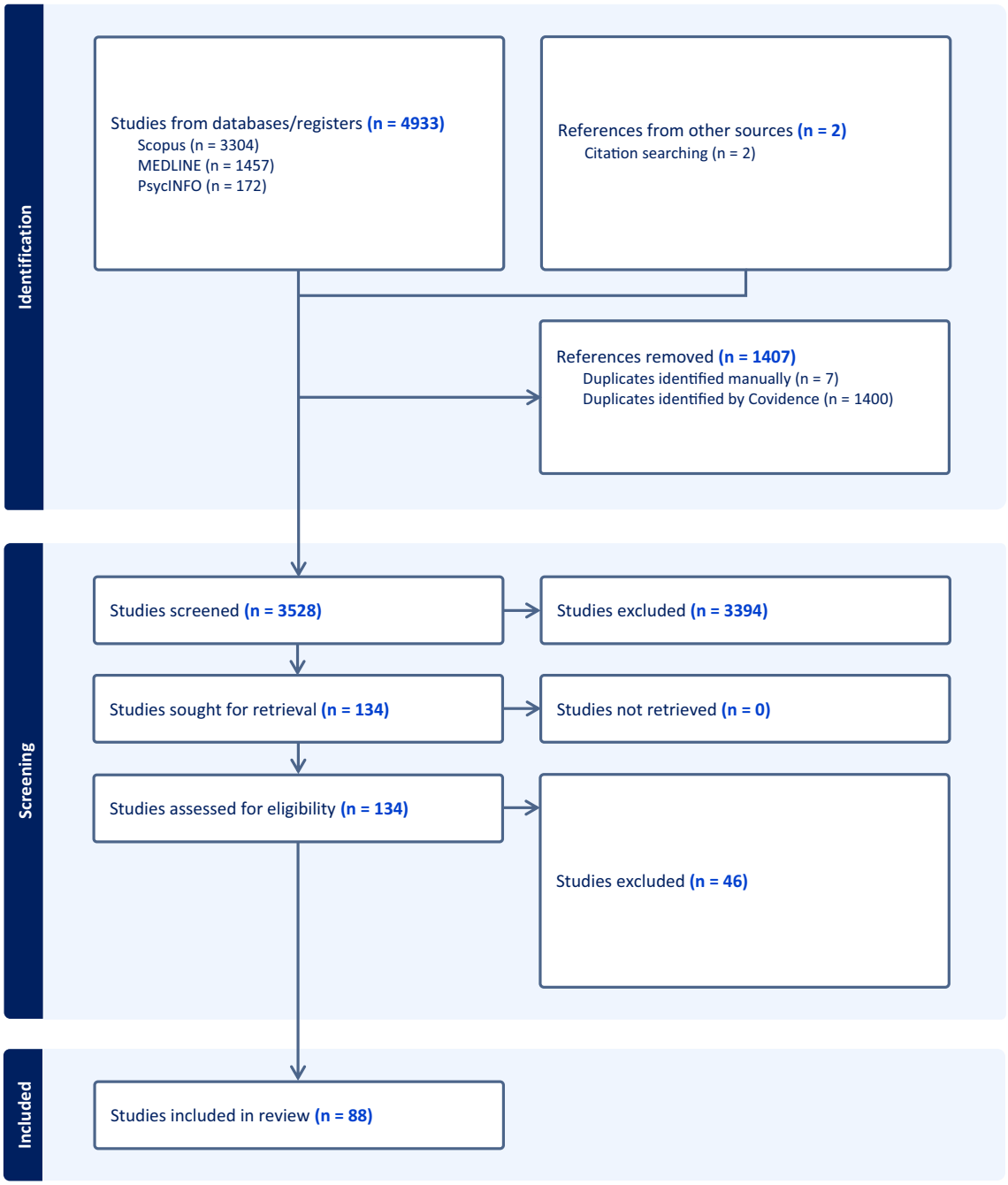

FIGURE 1 | Detailed literature review flow diagram.

For clarity, the results were synthesised separately for cross-sectional and longitudinal studies.

3.2.1 | Cross-Sectional Studies

Fourteen cross-sectional studies were identified. Ten examined alcohol consumption at a specific time point after bariatric surgery, while four studies investigated the prevalence of individuals with a bariatric surgery history in substance abuse treatment settings.

3.2.1.1 | Prevalence at a Specific Postoperative Time Point. These studies were published between 2001 and 2022 and were conducted in the United States ($n = 8$), Norway ($n = 1$) and Belgium ($n = 1$). Most involved relatively small sample sizes (23 to 564 participants), with participants who had undergone surgery between less than a year and 15 years earlier. Response rates ranged from 11.1% to 78%, with one study not reporting this information. Six studies used validated instruments (e.g., standardised questionnaires or structured interviews) to assess postoperative alcohol consumption, and four relied on non-validated tools. Preoperative alcohol use was generally assessed through retrospective self-reports or extracted from preoperative psychological evaluations. Some studies relied on participants' subjective assessment of changes in their alcohol use over time. One study compared operated individuals' alcohol use with that of a control group 7 years after bariatric surgery [21–30].

TABLE 1 | Studies on the prevalence of alcohol consumption and problematic drinking after bariatric surgery.

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Mitchell et al. [24] USA	Cross-sectional	a. 78 participants b. 83% female c. 56.8 years (from 31 to 77) d. RYGB e. 13 to 15 years f. 78% g. NA	– Preoperative information collected via medical records or retrospective report – AUDIT, interview	– Preoperatively, 12.8% reported alcohol abuse or dependence vs. 7.7% after surgery. – Increase in the alcohol abuse rate after bariatric surgery (from 2.6% before to 5.1% after surgery), but decrease in the alcohol dependence rate (from 10.3% before to 2.6% after surgery).
Buffington [21] USA	Cross-sectional	a. 318 participants from multiple countries b. 93.7% female c. Not reported for the whole sample, but 49.4% between 36 and 50 years d. 97.4% with RYGB e. Not reported for the whole sample, but 84% had been operated at least 1 year before. f. NA g. NA	– Non validated questions on alcohol sensitivity and postoperative alcohol use	– Occasional or regular alcohol use among 83% of the participants since surgery. – 84% of regular consumers (i.e., drinking one or more alcoholic beverages weekly) reported being more sensitive to alcohol's effects after compared to before surgery. – 44% reported feeling alcohol's effects after only a few sips of alcohol and 45% after one alcoholic beverage. – 29% described longer effects of alcohol postoperatively while 52% reported that alcohol's effects lasted for a shorter period of time compared to before surgery. – 28.4% reported difficulty controlling their alcohol use after surgery vs. 4.5% preoperatively.
Ertelt et al. [22] USA	Cross-sectional	a. 70 participants b. 85.5% female c. 49.9 years (SD = 9.2) d. RYGB e. 6–10 years f. 28% (70 of 250 individuals who were sent an email) g. NA	– Questionnaire developed for the study	– No significant change in the AUD prevalence from before to after surgery. Before surgery, alcohol dependence in 7.1% ($n = 5$) and abuse in 1.4% ($n = 1$) of the participants. After surgery, dependence in 8.6% ($n = 6$) of participants and abuse in 1.4% ($n = 1$). Of these participants, 5.7% ($n = 4$) had alcohol dependence that persisted post-surgery. One participant (1.4%) continued to experience alcohol abuse. One individual (1.4%) with alcohol dependence before surgery reported no longer suffering from it after surgery. Two participants (2.9%, aged 64 and 40) developed alcohol dependence after surgery, despite having no prior issues with alcohol. – 5.8% ($n = 4$) reported they either started drinking or increased their consumption following surgery. 22.9% ($n = 16$) reported their consumption had decreased after surgery and 67.1% ($n = 47$) reported no impact of surgery on their consumption. – 54.3% reported a change in their response to alcohol after surgery: 34.3% reported they became intoxicated more quickly, and 20.0% reported intoxication effect occurred after consuming smaller amounts than before surgery.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Suzuki et al. [27] USA	Cross-sectional	a. 51 participants b. 86.3% female c. 51.3 years (SD = 8.7) d. 45.1% with AGB and 54.9% with RYGB e. 43.4 months (SD = 6.8) f. 11.1% (51 participants out of the 460 individuals who received an email) g. NA	– AUDIT-C – Structured Clinical Interview for the DSM-IV Non-Patient Edition – Data from the preoperative psychiatric evaluations	– 35.3% ($n = 18$) of participants with a history of AUD before surgery vs. postoperative prevalence of 11.8% ($n = 6$). No cases of AUD at the time of preoperative assessment. – 83.3% of participants with AUD had a history of AUD preoperatively. – All individuals with postoperative AUD had undergone RYGB. – No association between lifetime or current binge eating disorder and postoperative AUD. – No relationship between weight loss and postoperative AUD.
Saules et al. [33] USA	Cross-sectional	a. 7199 individuals admitted to a substance abuse treatment program + comparison of 54 patients with surgery and 54 control patients b. 70.4% female in both groups c. 44.7 years (SD = 9.2) in the bariatric and 44.5 years (SD = 9) in the control group d. RYGB e. See main results f. NA g. NA	– Patients' medical records	– 2 to 6% of patients admitted had a history of bariatric surgery. – Significantly more women in the bariatric compared to the control group. – Patients with surgery were more often diagnosed with alcohol withdrawal, in addition to alcohol dependence than non-bariatric patients. – Greater minimum (16.3 ± 8.5 vs. 11.0 ± 5.9) and maximum (19.1 ± 8.6 vs. 15.0 ± 6.4) quantity of drinks per drinking day among bariatric vs. control patients with alcohol dependence. – Patients with surgery were more likely to seek treatment for alcohol, alcohol plus drug, and benzodiazepine-related problems compared with control participants who more often sought treatment for opiate abuse and polydrug use. – Among alcohol users, 61.9% already suffered from heavy alcohol use before surgery. – Average time from surgery to substance abuse treatment admission was 5.4 years (SD = 3.2).
Odom et al. [28] USA	Cross-sectional	a. 203 participants b. 85% female c. 50.6 years (SD = 9.8) d. RYGB e. 28.1 months (SD = 18.9) f. 24.9% (questionnaire sent to 1117 patients, 278 responses received, and 203 retained for final analyses) g. NA	– Questions developed for the study	– 30.1% ($n = 83$) reported their alcohol consumption had not changed from before to after surgery. 41.7% ($n = 115$) reported they had never consumed alcohol before or after surgery. 19.1% ($n = 53$) reported their alcohol use had decreased and 9.1% ($n = 25$) reported an increase in their alcohol consumption after surgery. – Nearly 10% of participants reported someone had expressed concern about their consumption. – Concerns about alcohol or drug use after surgery were a predictor of significant weight regain.

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TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
King et al. [38] USA	Prospective cohort study (2 years)	a. 1945 participants b. 78.8% female c. 47 years (median) d. 69.9% with RYGB, 25.2% with AGB. e. NA f. 4476 individuals approached for participation, but 2458 who finally underwent surgery, 1945 (79%) included in analyses. g. 79% (1945 out of 2458 participants completed pre- and postoperative assessments at 1 and/or 2 year).	– AUDIT: participants considered as having an AUD if they had a score ≥ 8 or if they reported alcohol dependence symptoms or alcohol-related harm.	– No significant difference in the AUD prevalence from before to 1 year after surgery (7.6% before and 7.3% 1 year after surgery). – Significant increase in the AUD prevalence 2 years after surgery (7.6% before to 9.6% 2 years after surgery). – Increase in the AUD rate following RYGB (i.e., 7.0% preoperatively, 7.9% 1 year postoperatively and 10.7% 2 years postoperatively), but not AGB (i.e., 9.3% preoperatively, 5.6% 1 year postoperatively and 7.0% 2 years postoperatively). – Preoperative predictors of postoperative AUD: male gender, younger age, smoking, regular alcohol consumption, AUD, recreational drug use, lower belonging interpersonal social support. – Postoperative predictors of AUD: lower score on the SF-36 mental component, smoking, recreational drug use, and treatment for psychiatric or emotional problems. – No relationship between percentage weight loss and postoperative AUD.
Fogger and McGuinness [32] USA	Cross-sectional	a. 173 nurses suffering from addiction in a state-monitoring program. b. Data provided only for the subgroup who had undergone surgery: 96% female c. Not reported d. Not reported e. Not reported f. 45% (questionnaire sent to 382 patients, 173 responses) g. NA	– Questions developed for the study	– History of bariatric surgery among 25 (14%) of the participants, of whom 24 were women. – Higher percentage of alcohol use among participants with a history of bariatric surgery compared to those without (24% vs. 19%). – Among those with a history of bariatric surgery, 17 (68%) reported having developed addiction after surgery.
Conason et al. [37] USA	Prospective cohort study (2 years)	a. 155 participants b. 85.2% female c. 40 years (SD = 11) d. 64.5% with RYGB and 35.5% with AGB e. NA f. Not reported (participants recruited from a preoperative information session at a bariatric surgery center, no information about the number of patients approached to participate) g. 24% at 2 year follow-up	– Questionnaire developed for the study	– Significant decrease in alcohol consumption frequency from before to 1 and 3 months after RYGB. – Significant increase in alcohol consumption frequency 2 years after RYGB compared to baseline. – No change in consumption frequency among individuals with AGB. – No significant interaction between preoperative binge eating disorder and postoperative alcohol use frequency.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Wiedemann et al. [34] USA	Cross-sectional	a. 4658 individuals admitted to a substance abuse treatment program between 2009 and 2011 + Interview and questionnaires with 56 individuals with a history of bariatric surgery b. 71.4% female c. 44.8 years (SD = 9.49) d. 90.6% with RYGB e. Not reported f. 129 patients with surgery identified. 56 (43.4%) recruited to complete an interview. 51/56 (91.1%) completed the questionnaire for the present study g. NA	– Participants' medical records – Questionnaires, including AUDIT-Revised, and additional questions developed for the study. – Semi-structured interview developed for the study	– Among the 4658 individuals, 2.8% ($n = 129$) had a history of bariatric surgery. – More women in the group with vs. the group without surgery (72.6% vs. 34.5%). – Surgical group significantly older than the group without surgery (45.43 years vs. 39.28). – Significantly more diagnoses of AUD in the bariatric vs. the control group (68.8% vs. 54.6%). – Among patients with AUD, 88.9% with surgery received treatment for alcohol withdrawal, compared with 70.1% of patients without surgery. – Among the 56 patients with bariatric surgery history, 60% were new-onset cases and 40% already had a SUD preoperatively. – Patients with SUD prior to surgery reported having been sober, on average, for 9.18 years (SD = 8.37) before surgery. – Patients with SUD preoperatively reported using more types of substances than new-onset cases and reported more often a binge eating disorder before surgery.
Svensson et al. [39] Sweden	Prospective cohort study (up to 22 years)	a. 2010 individuals who underwent surgery and 2037 control participants with obesity b. 70.9% female in the VBG group, 69.1% in the banding group and 71.3% in the RYGB group c. 37–60 years d. 68% with VBG, 19% with banding and 13% with RYGB e. NA f. Not reported g. 87% at 2 years, 71% at 10 years, 52% at 15 years, 50% at 20 years	– Average alcohol intake in grams per day (at least medium risk alcohol use if > 40 g in men and 20 g in women) – A question developed for the study to assess alcohol problems – Medical records for alcohol abuse diagnosis	– No significant difference between the bariatric and the control group at baseline for mean alcohol consumption, prevalence of at least medium risk drinking, self-reported alcohol problems, and the proportion of participants reporting any alcohol consumption. – Increased risk of at least moderate-risk drinking (adjHR = 2.69, $p < 0.001$), self-reported alcohol problems (adjHR = 5.91, $p < 0.001$) and alcohol abuse diagnosis (adjusted hazard ratio [adjHR] = 4.97, $p < 0.001$), among participants with RYGB vs. control participants. – No significant differences between participants with banding and control participants on alcohol-related outcomes. – Preoperative predictors of postoperative alcohol abuse diagnosis: male gender, smoking, and alcohol consumption. – No relationship between preoperative BMI and age and postoperative alcohol abuse diagnosis.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Lent et al. [52] USA	Prospective cohort study (2 years)	a. 155 participants b. 80.6% female c. 50.1 years (SD = 11.3) d. RYGB e. NA f. Not reported g. 899 patients recruited, of whom 345 (38%) completed the postoperative survey and 155 (17.2%) answered at least one question on alcohol consumption both pre- and postoperatively	– Questionnaire developed for the study, 3 consumption categories: (1) none, (2) low (1–4 drinks) and (3) high (≥ 5 drinks) consumption on typical drinking occasions	– Decreased prevalence of alcohol users from before to after surgery (72.3% before vs. 63.2% after surgery). – Before surgery, 43 participants did not consume alcohol. Of these, 10 (23.2%) started drinking postoperatively. – 24 of the 112 participants (21.4%) consuming alcohol before surgery stopped drinking postoperatively. – Positive association between preoperative alcohol quantity and postoperative consumption. – Older age associated with decreased risk of postoperative alcohol consumption, while younger age was associated with higher risk. – Association between higher preoperative BMI and increased risk of high alcohol consumption after surgery. – No relationship between weight loss and pre- or postoperative alcohol consumption.
Wee et al. [56] USA	Prospective cohort study (2 years)	a. 541 participants b. 76% female c. 43.9 years (SD = not reported) d. 55% with RYGB, 44% with AGB, 1% with SG/ other. e. NA f. 70% g. 541 participants who underwent surgery, 375 (69%) completed the interview at 1 year and 328 (63%) at 2 year.	– Interview – Modified version of the AUDIT-C and AUDIT items	– Among those who completed the questionnaire at one year, no change in the prevalence of high-risk alcohol drinking from before to after surgery (17% before and 13% after surgery). – Among those who completed the questionnaire at two years, no change in the prevalence of high-risk alcohol drinking from before to after surgery (15% at baseline vs. 13% at two years after surgery). – At one and two years postoperatively, more than half of the participants who reported high-risk alcohol consumption at baseline no longer reported it, but this difference was not significant. – 7% and 6% of the participants who did not report high-risk drinking before surgery reported high-risk consumption 1 and 2 years after surgery, respectively.
Alfonsson et al. [58] Sweden	Prospective cohort study (one1 year)	a. 129 participants b. 78% female c. 42.8 years (SD = 10.52) d. RYGB e. NA f. 72.8% (177 patients were approached and complete data from 129 participants were obtained) g. 100%	– AUDIT: score > 8 and 6 as an indicator of risk consumption in men and women, respectively; score > 16 indicating alcohol disturbance	– Significant decrease in AUDIT scores after surgery (3.31 before vs. 2.42 after surgery). Gender-specific analyses showed a decrease in AUDIT scores among women, but not men. – Before surgery, 18 participants presented risk consumption. After surgery, only seven participants reported risk consumption and three participants presented alcohol disturbance (no information regarding the statistical significance of these changes). – Relationship between ADHD symptoms and postoperative alcohol consumption. – No relationship between pre- or postoperative AUDIT scores and weight loss.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Tae et al. [54] Brazil	Prospective cohort study (6 months)	a. 32 participants b. 100% female c. 41 years (SD = 11.6) d. Not reported e. NA f. Not reported g. 71.9% (32 participants at baseline and 23 at the end of the study)	– Non validated tool (not described)	– No significant difference in the prevalence of alcohol consumers from before to after bariatric surgery (12 participants before vs. 6 participants after surgery).
Mitchell et al. [55] USA	Prospective cohort study (3 years)	a. 201 participants b. 62% female c. 48 years (median) d. RYGB e. NA f. 324 participants approached, 234 accepted and 201 with complete responses g. 85.9% (33 out of 234 participants excluded due to incomplete 3 year data)	– Structured Clinical Interview for DSM-IV Axis I (SCID-I) – AUDIT (score ≥ 8)	– Based on SCID: AUD in 16 (8%) participants within 3 years after RYGB, of whom 9 (56.3%) had a history of AUD before surgery and 7 (43.8%) were new-onset cases. – SCID + AUDIT: postoperative AUD in 32 participants (18.4%), of whom 13 (40.6%) were new-onset cases. 7 (12.5%) had AUD the year before surgery and continued to have AUD after surgery. 12 (37.5%) did not have AUD the year before surgery but had a history of AUD and presented postoperative AUD. – Higher prevalence of mood disorders, particularly major depressive disorder, generalised anxiety disorder and binge eating disorder among individuals with postoperative AUD, before and after surgery. Higher prevalence of any anxiety disorder and panic disorder after surgery. – No significant difference between participants with and without addictive disorders in weight loss.
Cuellar-Barboza et al. [31] USA	Cross-sectional	a. 823 individuals admitted to an alcohol abuse treatment center + comparison of 41 with RYGB to 122 controls with obesity b. 70.7% women in the bariatric and 28.6% in the control group c. 46 years (SD = 1.3) in the bariatric and 47 years (SD = 0.66) in the control group d. RYGB e. Not reported f. NA g. NA	– Patients' medical records – Data extracted from the clinical notes – Pennsylvania Alcohol Craving Scale (PACS)	– Among the 823 individuals, 44 (5.3%) had a history of bariatric surgery, including 41 (4.9%) with a RYGB. – Significantly more women in the RYGB group than the control group (70.7% vs. 28.6%). – Participants with RYGB met AUD criteria at a younger age than those in the control group (19.1 years vs. 25 years). – No difference in craving scores between patients with and without surgery. – Fewer drinking days per week in the bariatric vs. the control group (4.7 vs. 5.5). – AUD already present before surgery among 39% of participants ($n = 16$). 17% ($n = 7$) reported they did not consume alcohol at all before surgery. – Patients with surgery reported having resumed alcohol use or started drinking approximately 1.42 years (SD = 0.24) after surgery. They met AUD criteria 3.1 years (SD = 0.51) and sought treatment 5.4 years (SD = 0.38) after surgery.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Burgos et al. [51] Portugal	Retrospective cohort study (2 years)	a. 276 participants b. 90.2% female c. 42 years (SD = 10.9) d. 32.6% with RYGB and 67.4% with AGB e. NA f. NA g. NA	– Non validated questions – Patients'electronic charts	– Decreased prevalence of alcohol users after surgery (24.2% before vs. 9.4% after surgery). Among individuals who did not consume alcohol before surgery, none started drinking after surgery. No increase in quantity or frequency of consumption after surgery. – Relationship between postoperative alcohol consumption and male gender, age ≥ 45 years and preoperative BMI < 40. – No difference between consumers and non-consumers in the prevalence of binge eating disorder before or after surgery. – No relationship between postoperative alcohol consumption and weight loss.
Spadola et al. [26] USA	Cross-sectional	a. 69 participants b. 75% female c. 26.5 years (SD = 5.5) d. 50.7% with RYGB, 40.6% with SG and 8.7% with AGB e. 19.9 months (SD = 13) f. 50% g. NA	– Structured Clinical Interview for DSM Disorders I—Research Version/Non-patient Edition – An alcohol use chart including several questions to assess alcohol use patterns (e.g., lifetime use or past-year use)	– 42% of participants reported drinking to intoxication in the past 30 days, with the majority reporting this occurring 2–4 times a month (17.4%). – 14.5% of the participants reported binge drinking in the past 30 days. – 15 participants (21.7%) had a history of alcohol abuse, of whom 4 (5.8%) also had a history of alcohol dependence. Three (4.2%) had developed the disorder after surgery, 12 had the disorder before surgery. The 12 participants who met the criteria for alcohol abuse before surgery no longer presented the disorder after surgery. – History of alcohol abuse and dependence before surgery as a predictor of an increased frequency of drinking days after surgery. – Age, time since surgery, RYGB, and preoperative history of an AUD were not significant predictors of binge drinking or drinking to intoxication postoperatively.
Vangoitsenhoven et al. [30] Belgium	Cross-sectional	a. 23 operated and 23 non-operated individuals, matched by gender, age and BMI b. 74% female in both group c. 49 years (median) in both groups d. RYGB e. 84.9 months (median) f. 58% (of the 40 patients who underwent RYGB in the center, 23 completed the questionnaires) g. NA	– AUDIT	– No significant difference between the bariatric and the control group regarding alcohol intake. Three individuals with a score > 8 in the bariatric and one in the control group (non-significant).

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Kovacs et al. [19] Denmark	Retrospective cohort study (4.03 years)	a. 12 612 operated and 9839 control individuals with obesity b. 75.2% female in the bariatric and 87.4% in the control group c. 41.59 years (SD = 10.71) d. RYGB, AGB and other interventions (percentages not reported) e. NA f. NA g. NA	– Codes associated with alcohol misuse in national registers	– Increased risk of alcohol misuse among operated participants compared to control participants, controlling for age and gender (HR 3.91, 95% CI (2.94–5.18), $p < 0.001$). – Higher incidence rate of alcohol misuse 3 (4.08, CI (3–5.55), $p < 0.001$), 5 (4.30, CI (3.28–5.64), $p < 0.001$) and 7 (4.65, CI (3.46–6.27), $p < 0.001$) years after surgery compared to 3, 5 and 7 years before surgery. – No difference in the risk of alcohol misuse between individuals who had undergone RYGB and those who had undergone AGB.
Kanerva et al. [48] Sweden	Prospective cohort study (10 years)	a. 1695 participants b. 69.8% female c. 47.3 years (SD = 5.9) d. 15.5% with RYGB, 15.9% with banding and 68.6% with VBG e. NA f. Not reported g. 92.0%, 76.6%, and 73.3% at 2-, 6-, and 10-year follow-ups, respectively	– Alcohol consumption in grams per day	– At 10 years postoperatively, significant increase in alcohol consumption in men (+ 2.2 g of alcohol per day compared to baseline) and in women (+ 0.16 g of alcohol per day compared to baseline). – Individuals with RYGB presented a significantly higher increase over their initial consumption than those with the other two interventions (increase of 3.8 g per day compared to an increase of 1.1 g/day for those with a banding procedure and 0.5 g/day for those with a VBG). – Male gender and preoperative sedentary lifestyle associated with increased consumption after surgery.
King et al. [18] USA	Prospective cohort study (7 years)	a. 2003 participants b. 79.2% female c. 47 years (median) d. 74% with RYGB and 26% with AGB e. NA f. 85.3% (2348 individuals underwent RYGB or LAGB, 2003 completed baseline and postoperative assessments) g. 78%, 70%, 67%, 66%, 67% and 68% at years 1, 2, 3, 4, 5 and 7, respectively.	– AUDIT: participants considered as having an AUD if they had a score ≥ 8 or if they reported alcohol dependence symptoms or alcohol-related harm.	– Increased prevalence of AUD (from 6.6% to 16.4%), any alcohol consumption and regular consumption 7 years after RYGB. – Increase in any alcohol consumption and regular consumption (≥ twice weekly) after AGB. – 5-year cumulative incidence of AUD symptoms was 20.8% after RYGB and 11.3% after AGB. – Association between male gender, younger age, smoking, any alcohol consumption and regular consumption (compared with no consumption) before surgery and an increased risk of postoperative AUD. – Association between lower social support and an increased risk of postoperative AUD. – Association between higher risk of postoperative AUD and less improvement or worsening of mental health after surgery, getting divorced, initiation of smoking, initiation of regular drinking and initiation of illicit drug use after surgery. – Stopping regular alcohol use associated with a lower risk of postoperative AUD. – No relationship between postoperative AUD and binge eating or loss of control eating. – No relationship between AUD and weight loss.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Smith et al. [25] USA	Cross-sectional	a. 26 participants b. 84.6% female c. 43.65 years (SD = 10.52) d. RYGB or SG (percentages not reported) e. 1 to 4 years f. Not reported g. NA	– Mini International Neuropsychiatric Interview and Structured Interview for DSM-IV-TR Axis I Disorders Non-patient Edition – Questions developed for the study – Alcohol consumption calendar – AUDIT (> 8), MAST (> 5), DAST, HSA	– Alcohol abuse or dependence in 12 participants and lifetime history of these disorders in 12 participants. – 7 participants did not report a history of alcohol abuse or dependence before surgery, but presented current abuse or dependence. – One participant reported detoxification treatment prior to surgery while eight participants reported receiving treatment for alcohol use post-surgery. – First postoperative alcohol use occurred approximately 5 months after surgery. Heaviest use occurred on average at 71.05 weeks (SD = 58.66).
Walther et al. [46] Sweden	Prospective cohort study (2 years)	a. Three groups: (1) 133 individuals followed for 2 years after surgery; (2) 214 individuals followed for 1 year and (3) 323 individuals without surgery b. 64% female in group 1, 82% in group 2, and 50% in group 3 c. 47 years (SD = 8.9) in group 1, 42 years (SD = 11) in group 2, and 40 years (SD = 14) in group 3 d. RYGB e. NA f. Not reported g. 72% in group 1 (131 participants at 1 year and 96 at 2 years follow-up), data not reported for group 2.	– Phosphatidyletha-nol (PEth) biomarker: results < 0.05 interpreted as low or no consumption	– No significant difference in PEth results between baseline and one-year follow-up in group 1. Higher proportion of participants with PEth ≥ 0.05 at 2 years in group 1 compared to baseline and first-year results (17% at baseline, 21% at one-year and 26% at 2-year follow-up), but these rates were still lower than in the control group. In the control group, almost half of the participants (44%) had PEth result ≥ 0.05. – In the second group, significantly higher rate of participants with PEth ≥ 0.05 1 year after surgery compared to baseline (12% at baseline vs. 18% at one-year follow-up).
Coluzzi et al. [57] Italy	Prospective cohort study (1 year)	a. 142 participants b. 71.1% female c. 43.2 years (SD = 10.8) d. SG e. NA f. 81.1% (175 SG performed, 142 participants included) g. 100%	– AUDIT – Questions developed for the study	– 4.2% of participants with harmful consumption (score ≥ 8) at baseline vs. none 1 year after surgery. – Non-significant decrease in mean AUDIT scores after surgery (from 2.70 to 1.38). – No effect of gender or age on alcohol consumption 1 year after surgery.

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TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Ibrahim et al. [40] USA	Prospective cohort study (2 years)	a. 5724 participants b. 78.4% female c. 46.2 years (median) d. 82.4% with SG and 17.6% with RYGB e. NA f. Data from the Michigan Bariatric Surgery Collaborative registry, which includes nearly 95% of patients having surgery in the state of Michigan g. 24.1% (1381 completed the 2 years postoperative questionnaires)	– AUDIT-C: score ≥ 4 for men and ≥ 3 for women suggesting AUD	– Increased prevalence of AUD 2 years after RYGB (7.6% at baseline vs. 11.9% 2 years after surgery), and SG (10.1% at baseline vs. 14.4% 2 years after surgery). – No significant difference in the prevalence of AUD between patients with SG and RYGB before or after bariatric surgery. – Overall AUD prevalence, without distinction between operations, of 9.6% before surgery, 8.5% at 1 year and 14% at 2 years postoperatively. – Higher household income, lower educational level, any alcohol consumption, and AUD at baseline as risk factors for AUD after RYGB. Absence of baseline AUD and consumption, and higher educational level associated with lower risk of AUD after RYGB. – Baseline alcohol consumption and AUD as risk factors for post-SG AUD. Absence of AUD, alcohol consumption, and presence of a diagnosis of depression at baseline associated with lower risk of post-SG AUD.
Murray et al. [44] USA	Prospective cohort study (2 years)	a. 27 participants: 16 underwent surgery, 6 received a 3-month dietary intervention and 5 participants without treatment b. 93% female c. 32.7 years (SD = 7.6) d. 62.5% with RYGB, 37.5% with SG e. NA f. Not reported g. 49.1% (28 participants lost to follow-up)	– One question developed for the study to assess the number of drinks consumed per week	– No significant difference between the groups at baseline regarding alcohol consumption. No change in alcohol consumption from baseline to 4 months of follow-up in any group. Significant increase in alcohol consumption only in the bariatric surgery group 24 months after surgery. – Before surgery, 10 participants reported not drinking. 6 of them reported consuming alcohol once or twice a week 24 months after surgery. – No correlation between change in food addiction scores and change in alcohol consumption scores.
White et al. [50] USA	Prospective cohort study (7 years)	a. 1472 participants b. 79.9% female c. 46 years (median) d. RYGB e. NA f. 91.7% (of 4476 eligible individuals, 1738 gave consent and had a RYGB and 1593 completed preoperative questionnaires) g. 78%, 69%, 66%, 66%, 68% and 69% at years 1, 2, 3, 4, 5 and 7, respectively	– AUDIT	– Increase in the frequency of consumption and the average quantity of drinks per drinking day 7 years after surgery compared to baseline and the first postoperative year.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Maciejew-ski et al. [41] USA	Retrospective cohort study (8 years)	a. 2608 participants with surgery and 22 284 control participants b. 24.7% female in the bariatric and 22.8% in the control group c. 53.0 years (SD = 9.9) in the bariatric and 53.6 (SD = 9.9) in the control group d. 64.6% with SG and 35.4% with RYGB e. NA f. NA g. NA	– AUDIT-C: score ≥ 3 for women, ≥ 4 for men as indicating unhealthy alcohol use – Electronic health record	– Among individuals without problematic consumption at baseline, higher mean AUDIT-C scores after SG and RYGB compared to the control group. Higher scores observed at 5 and 8 years for the SG group (0.86 vs. 0.65 and 0.85 vs. 0.62, respectively) and at 3, 5 and 8 years postoperatively for the RYGB group (0.78 vs. 0.65; 0.92 vs. 0.64 and 0.94 vs. 0.62, respectively). – Among individuals without problematic consumption at baseline, higher prevalence of unhealthy alcohol use 8 years after SG and RYGB, compared to the control group: 7.9% in the SG group vs. 4.5% in the control group; 9.2% in the RYGB group vs. 4.4% in the control group. Decrease of the probability of no alcohol use 5 to 8 years after both procedures among patients with surgery vs. control patients. – Among patients with problematic consumption at baseline, increase in mean AUDIT-C scores only after RYGB compared to the control group at 5 and 8 years post-surgery (2.75 vs. 2.25 and 2.94 vs. 2.15, respectively). Higher prevalence of unhealthy alcohol use 8 years after surgery only in the RYGB group, compared to the control group (39.4% vs. 25.7%).
Strømmen et al. [35] Norway	Retrospective cohort study (3.4 years of follow-up for individuals with RYGB and 2.7 years for those with SG)	a. 10 208 participants b. 72.4% female c. 42.5 years (SD = 10.4) d. 80.3% with RYGB and 19.7% with SG e. NA f. NA g. NA	– Codes associated with alcohol-related diagnoses (e.g., mental and behavioural disorders due to alcohol, alcoholic gastritis)	– Before surgery, 67 individuals with an alcohol-related diagnosis. After surgery, 202 individuals with an alcohol-related diagnosis. – Incidence rate of alcohol-related diagnoses of 6.36 per 1000 person-years after RYGB and 4.54 after SG. – No difference in the risks of alcohol-related diagnoses between individuals who underwent SG and RYGB. – Higher frequency of alcohol-related diagnoses in men over 40 years compared to women of the same age. – Higher frequency of alcohol-related diagnoses among women under 26 years compared to older women.
Bond et al. [53] USA	Prospective cohort study (1 year)	a. 71 participants b. 88.7% female c. 44.5 years (SD = 11.2) d. 74.6% with SG and 25.4% with RYGB e. NA f. Not reported g. 62% (71 participants at baseline and 44 at 1 year post-surgery)	– Smartphone-based ecological momentary assessment	– No change in the prevalence of alcohol consumption from before to after surgery.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Strømmen et al. [29] Norway	Cross-sectional	a. 546 participants b. 80% female c. 40.4 years (SD = 9) d. RYGB e. 141 months (SD = 19) f. 58.7% (546 participants out of 959 invited) g. NA	– Questions developed for the study or taken from other questionnaires	– 8.8% ($n = 48$) of participants reported drinking more often after surgery, while 26% ($n = 142$) reported having stopped drinking, drinking less or less frequently since surgery. – Compared to women, men drank more and more often.
Bramming et al. [45] /Denmark	Retrospective cohort study (6.9 years)	a. Two groups: (1) 13430 operated individuals; (2) 21021 control individuals with obesity b. 77.4% female in the bariatric and 58% in the control group c. 40.3 years (SD = 9.8) in the bariatric and 45.9 years (SD = 11.6) in the control group d. 95% with RYGB e. NA f. NA g. NA	– Codes associated with alcohol-related diagnoses, registration on alcohol associated treatment register or a registration of a pick-up of medication prescribed for AUD	– 6 to 7 times higher risk of AUD in patients with surgery compared to control participants. Increased risk from the first year after surgery [HR: 2.77 (95% CI: 1.39–5.53)], risk continuing to increase over time after surgery. Highest risk level occurring after 5 years [HR: 12.1 (95% CI: 7.79–18.7)]. Risk present for men and women. – 7 times higher risk of AUD 5 years after compared to 5 years before surgery [HR: 7.7 (95% CI: 6.17–9.79)]. – Decrease in the risk with higher age. No effect of preoperative BMI or socioeconomic status (level of income and education) on the risk of postoperative AUD. – Higher risk in individuals who have undergone RYGB compared to those who have had another procedure.
Şen et al. [42] /Turkey	Prospective cohort study (1–6 years)	a. 183 participants: (1) 102 followed 1–3 years after surgery; (2) 81 followed 4–6 years after surgery b. 63.7% female in the first and 61.7% in the second group c. 39.7 years (SD = 11) in the first and 39.6 years (SD = 10.2) in the second group d. SG e. NA f. Not reported g. Not reported	– AUDIT	– Significant reduction in mean AUDIT scores in the first 3 years after SG (mean score of 2.79 before vs. 2.27 after SG). – Significant increase in mean AUDIT scores between 4 and 6 years postoperatively (mean score of 3.06 before vs. 4.04 after SG). – Higher increase in the risk among individuals with moderate-risk consumption before surgery compared to those with low-risk consumption preoperatively.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Miller-Matero et al. [23] USA	Cross-sectional	a. 564 participants b. 84.2% female c. 45.7 years (SD = 7.8) d. 67% with SG and 33% with RYGB e. Participants operated <1 year, 1–2 years, 2–3 years, or 3–4 years ago f. 39.2% (no details reported) g. NA	– AUDIT-C – Participants' medical records – Pre-surgical psychological evaluations	– Before surgery, 2.5% ($n = 14$) reported engaging in risky drinking. – 57.5% participants reported consuming alcohol since surgery. – Among those with current alcohol consumption, 16.1% presented hazardous drinking. – 93.6% ($n = 44$) participants with postoperative hazardous drinking did not report preoperative risky drinking. – Prevalence of hazardous drinking was higher among participants 3–4 years post-surgery (33.3%) compared to those less than 1-year post-surgery (2%). – No significant difference between SG and RYGB regarding hazardous drinking rates (16.3% and 15.7%, respectively)
Siikaluoma et al. [47] Sweden	Retrospective cohort study (2 years)	a. 410 participants b. 73.3% female c. 40.2 years (SD = 12.4) d. 70.5% with RYGB and 29.5% with SG e. NA f. NA g. NA	– Phosphatidyletha-nol (PEth) biomarker: PEth results above 0.30 μmol/L indicating alcohol overconsumption – Results collected from medical records	– Increased prevalence of alcohol overconsumption from before to after bariatric surgery (3% before, 6.8% 1 year and 8.3% 2 years after surgery). Significant difference at each measurement time compared to baseline. – No significant difference between SG and RYGB in the prevalence of alcohol overconsumption. – Male gender, older age, previous AUD and hypertension at baseline as risk factors for postoperative overconsumption. – No relationship between smoking, preoperative depression and postoperative overconsumption.
Wong et al. [43] USA	Prospective cohort study (1 year)	a. 97 participants b. 72.2% female c. 45.2 years (SD = 11.8) d. SG e. NA f. 57.1% (of 194 eligible patients, 113 completed the baseline interview) g. 89% (97 out of 109 participants who finally underwent surgery)	– Modified version of the AUDIT-C: score ≥ 4 in men and ≥ 3 in women indicating high-risk drinking – Modified version of the AUDIT – Interview	– Significant increase in the prevalence of high-risk drinking from 13.4% before to 22.7% one year after SG. – 16 participants without high-risk drinking at baseline reported high-risk drinking after surgery. – 7 out of 13 participants with high-risk drinking at baseline no longer presented high-risk drinking after surgery. – Lower cognitive restraint scores before surgery in new high-risk drinkers.

(Continues)

TABLE 1 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Svensson et al. [49] Sweden	Retrospective cohort study (3.9 years)	a. 28 204 participants with bariatric surgery, 40 827 control participants with obesity and a control group without obesity for each of these two groups: 55903 and 80 800 control participants, respectively b. 75.5% female in the RYGB group, 68.5% in the group with obesity, 75.5% in control group 1 and 68.6% in control group 2. c. 40.8 years (SD = 10.4) in the bariatric group and control group 1, 43.2 years (SD = 11.8) in the group with obesity and 43.1 years (SD = 11.7) in control group 2. d. RYGB e. NA f. NA g. NA	– Codes associated with alcohol-related disorders	– 4 to 5 times higher risk of alcohol-related disorders in patients who underwent surgery compared to individuals without obesity. – 3 to 4 times higher risk of alcohol-related disorders in individuals who underwent surgery compared to individuals suffering from obesity. – Higher risk in men compared to women.
Butt et al. [36] USA	Retrospective cohort study (2 years)	a. Three cohorts: (1) 2523 individuals with bariatric surgery, (2) 876720 individuals with obesity or overweight, (3) 3532989 control participants b. 76.9% female in the SG group, 78.1% in the RYGB group, 71% in the banding group, 53% in the group with obesity and 51% in the control group c. 47 years (SD = 12) in the SG group, 48 years (SD = 11) in the RYGB group, 50 years (SD = 15) in the banding group, 56 years (SD = 17) in the group with obesity and 54 years (SD = 18) in the control group. d. 61.20% with SG, 25.84% with RYGB and 12.96% with banding e. NA f. NA g. NA	– Codes associated with AUD	– Patients who underwent RYGB presented higher risk of developing de novo AUD compared with control participants from the general population (OR: 1.36 [1.16, 1.59]). – Individuals who underwent SG presented a lower risk of developing AUD compared with control participants from the general population (OR: 0.88 [0.79, 0.99]). – Compared with individuals with obesity, SG was associated with a lower risk of de novo AUD (OR: 0.72 [0.64, 0.80]); and individuals who underwent RYGB did not differ from individuals with obesity in the risk of AUD (1.10 [0.94, 1.29]). – AGB was not associated with an increased or reduced risk of AUD compared with individuals with obesity or overweight (1.00 [0.78, 1.28]) or control participants (1.23 [0.96, 1.57]).

Abbreviations: ADHD, attention-deficit/hyperactivity disorder; AGB, adjustable gastric banding; AUD, alcohol use disorder; AUDIT, alcohol use disorders identification test; AUDIT-C, alcohol use disorders identification test-consumption; BMI, body mass index; DAST, drug abuse screening test; HAS, hangover and sensitivity to alcohol questionnaire; MAST, Michigan alcohol screening test; NA, not applicable; RYGB, Roux-en-Y gastric bypass; SF-36, medical outcomes study 36-item short-form health survey; SG, sleeve gastrectomy; SUD, substance use disorder; VGB, vertical banded gastroplasty.

Probably due to substantial methodological heterogeneity—including variations in study aims, measurement tools, definitions of consumption and problematic use, surgical procedures, and sample sizes—these studies yielded divergent results. However, two patterns emerged more frequently.

First, across all studies that examined patients' perceptions of changes in their alcohol use since surgery, most participants reported maintaining the same level of consumption, while others reported either an increase or a decrease. Depending on the studies, 5.8%–9.1% of participants felt their alcohol consumption had increased and 19.1%–26% considered it had decreased since surgery [22, 28, 29]. Second, in several studies, it appeared that some participants who struggled with problematic alcohol use prior to surgery no longer faced these issues afterward, while others developed problematic use post-surgery despite not having had such problems before the operation [22, 23, 25–27]. Studies estimated that between 2.9% and 26.9% of their participants had initiated problematic use after surgery [22, 23, 25–27].

These results should nonetheless be interpreted with caution. Relying on patients' subjective perceptions or retrospective reports of their preoperative alcohol use may introduce recall bias. In studies using data from pre-surgical psychological assessments, alcohol consumption may have been underreported, as candidates might have minimised problematic drinking to avoid risking their eligibility for surgery. Moreover, some of these studies involved small sample sizes or low or unmentioned response rates [22, 26, 27, 30], raising concerns about selection bias—non-responders maybe those facing greater postoperative difficulties.

3.2.1.2 | Prevalence of Individuals With a Bariatric Surgery History in Substance Abuse Treatment Settings. These studies ($n = 4$) were published between 2010 and 2015 and were conducted in the United States. Three analysed medical records from addiction treatment centers, with sample sizes ranging from 823 to 7199 participants, to determine the proportion of patients with prior bariatric surgery. The fourth one surveyed nurses ($n = 173$) in an addiction treatment program to assess how many had undergone surgery [31–34].

These studies indicated an overrepresentation of patients with bariatric surgery in substance abuse treatment programs [31–34]. Depending on studies, 2%–14% of admitted patients had a history of bariatric surgery. This rate was rather between 2% and 6% when considering only studies with the largest sample sizes [31, 33, 34]. Compared to individuals without a surgical history, those with prior surgery were more likely to be women and were more frequently admitted for alcohol-related problems [31–34]. Additionally, between 38% and 68% of these patients reported they had developed the disorder postoperatively.

The main limitation of these studies was that prior bariatric surgery was not systematically documented in medical records, potentially leading to underestimation of prevalence. Furthermore, whether a patient's disorder was new-onset or a relapse post-surgery was based on self-report.

3.2.2 | Longitudinal Studies

Twenty six longitudinal studies were identified. Sixteen indicated an increase in alcohol consumption, prevalence or risk of problematic drinking after surgery. Eight described either a decrease, stability, or heterogeneous trajectories of alcohol use postoperatively. Two additional studies held a particular status: one did not assess changes in alcohol use from before to after surgery but compared rates of alcohol-related diagnoses following SG versus RYGB [35]; the other specifically focused on new cases of postoperative AUD and yielded mixed results [36]. These two studies were presented in the subsection on increased alcohol use but were not counted among the 16 studies indicating an overall rise in consumption.

3.2.2.1 | Increased Consumption and Problematic Use. These studies were published between 2012 and 2023 and were conducted in the United States ($n = 8$), Sweden ($n = 5$), Denmark ($n = 2$) and Turkey ($n = 1$). With the exception of one study, all assessed alcohol consumption 2 years or more after surgery. Eleven studies were prospective, and five were retrospective cohort studies. Sample sizes ranged from 27 to 5724 participants in prospective studies, and from 410 to 28 204 in retrospective ones. Retention rates in prospective studies varied from 24% to 89%, with one study not reporting this information. Seven studies used the AUDIT, AUDIT-C, or a modified version of these questionnaires to assess alcohol use. Two studies employed objective measures, two used non-validated tools, one measured alcohol consumption in grams per day, three relied on alcohol-related codes in national patient registries, and one combined multiple methods [18, 19, 37–50].

Earlier studies primarily focused on RYGB and non-adjustable or adjustable gastric banding (AGB) [37–39]. Of these, two included large samples with high retention rates. In a study involving 1945 participants, King et al. [38] found no significant change in AUD prevalence 1 year after surgery compared to baseline. However, 2 years post-surgery, AUD prevalence increased from 7.6% to 9.6%. The change was observed only in patients with RYGB, but not in those with AGB. Svensson et al. [39] followed 2010 patients for up to 20 years and compared them to a non-operated control group with obesity. They found that those with RYGB were nearly three times more likely to report at least moderate-risk drinking, six times more likely to report alcohol-related problems, and almost five times more likely to receive a diagnosis of alcohol abuse. No significant differences were observed between participants with a banding procedure and controls on alcohol-related outcomes.

More recent research also investigated SG and indicated that this procedure was associated with a heightened risk of problematic drinking as well [40–43]. Two of these studies involved large samples followed for at least 2 years after surgery and used validated alcohol use measures. Ibrahim et al. [40] reported that AUD prevalence rose 2 years after both RYGB (from 7.6% at baseline to 11.9% post-surgery) and SG (from 10.1% at baseline to 14.4% post-surgery). There was no significant difference in AUD prevalence between the two procedures at 2 years post-surgery. Maciejewski et al. [41] evaluated alcohol consumption among participants who had undergone bariatric surgery ($n = 2608$) and control participants. Among

patients without preoperative unhealthy alcohol use, they observed a higher rate of problematic drinking after both SG and RYGB compared to control patients (7.9% in the SG group vs. 4.5% in controls; 9.2% in the RYGB group vs. 4.4% in controls at 8 years post-surgery). Another study, while not assessing change from pre- to post-surgery, compared rates of alcohol-related diagnoses between SG and RYGB and found no significant difference between the two procedures approximately 3 years after surgery [35].

Most studies indicated that problematic drinking tends to emerge around 2 years after surgery [18, 37, 38, 40, 44]. However, some recent studies suggested that alcohol consumption and problematic drinking may already be increasing 1 year postoperatively. Wong et al. [43] found that the prevalence of high-risk drinking rose from 13.4% before SG to 22.7% 1 year later. Bramming et al. [45] noted a two-fold increased risk of AUD as early as 1 year after surgery compared to non-operated control participants. Walther et al. [46] used phosphatidylethanol (PEth), a sensitive and specific biomarker for alcohol, to assess consumption in three groups: (1) patients followed for 2 years after RYGB, (2) patients followed for 1 year after RYGB and (3) a control group without surgery. In the first group, no significant differences in PEth results were observed between baseline and 1 year post-surgery; however, a higher proportion of participants had a PEth level ≥ 0.05 at 2 years compared to baseline. In the second group, a significantly higher proportion of participants exhibited PEth levels ≥ 0.05 1 year after surgery. Using the same biomarker in a sample of 410 individuals, Siikaluoma et al. [47] noted an increase in overconsumption rates as early as 1 year postoperatively (3% before vs. 6.8% one year after).

Several studies examined alcohol consumption beyond 2 or 3 years after surgery, with some including a control group [18, 19, 39, 41, 42, 45, 48–50]. Most of these studies provided data on the long-term evolution of problematic consumption post-RYGB, but only two focused on SG [41, 42]. Two key insights emerged from this research.

First, the risk of problematic drinking appeared to be approximately 2–7 times higher after surgery—particularly after RYGB—compared to pre-surgery or non-operated individuals [18, 19, 39, 41, 45, 49]. For instance, in a recent retrospective cohort study, Svensson et al. [49] compared over 28 000 operated patients to individuals with obesity ($n = 40{,}827$) and without obesity ($n = 55{,}903$). They found that patients with surgery had a four to five times higher risk of alcohol-related disorders than those without obesity, and three to four times higher risk than those with obesity but no surgery. Kovacs et al. [19] also compared a large cohort of operated individuals with a control group suffering from obesity. Patients with surgery had an almost fourfold increased risk of alcohol misuse compared to control participants. In addition, they were four times more likely to suffer from alcohol misuse 3, 5 and 7 years after surgery compared to 3, 5 and 7 years before surgery.

Second, these studies suggested the prevalence of problematic alcohol use tends to increase over time following surgery [18, 42, 45]. For instance, King et al. [18] found that AUD prevalence rose from 6.6% before to 16.4% 7 years after RYGB, with a five-year cumulative incidence of AUD of 20.8%. These percentages were higher than those found in their earlier study [38], which suggested that the AUD prevalence rises with time after surgery. Bramming et al. [45] reinforced this finding in a study involving 430 participants with surgery compared to 21 021 controls with obesity. They found that operated patients were seven times more likely to have AUD 5 years post-surgery compared to 5 years prior to surgery. Furthermore, they were six to seven times more likely to have AUD than control participants, with the risk escalating over time and reaching its highest level after 5 years following the procedure.

Given their longitudinal design, these studies offer more robust insights into the evolution of alcohol consumption compared to cross-sectional studies. While some are limited by small sample sizes, low or unreported retention rates, or the use of non-validated measures [37, 43, 44], several include large cohorts, extended follow-up periods, and reliable assessment tools. Collectively, they provide convincing evidence indicating an increase in postoperative problematic drinking.

However, few longitudinal studies in this subsection clearly distinguished between patients who relapsed after surgery and those who developed de novo problematic drinking. Some examined alcohol use in the years preceding surgery or excluded participants who had experienced problematic drinking within a specific preoperative timeframe (e.g., in 5 years before surgery) [18, 41, 45]. Yet, *lifetime* history of problematic use was rarely assessed, making it difficult to determine whether postoperative cases represented new-onset problems or relapses of past issues. To our knowledge, only Kovacs et al. [19] excluded patients with a preoperative lifetime history of psychiatric disorder or psychiatric contact from their sample when comparing operated individuals to non-operated ones. Recently, Butt et al. [36] analysed the incidence of new cases of problematic use up to 2 years following surgery. They found a higher rate after RYGB compared to the general population, but not compared to individuals with obesity. SG was associated with a lower incidence than both comparison groups. A key limitation of this research was its reliance on clinically diagnosed cases, which excluded individuals who developed the disorder but did not receive a formal diagnosis.

3.2.2.2 | Decreased, Stable or Varying Trajectories of Alcohol Use and Problematic Drinking After Surgery. Eight studies reported either no change or a decrease in alcohol consumption following bariatric surgery, and/or highlighted heterogeneous trajectories of alcohol use postoperatively. These studies were published between 2013 and 2021 and were conducted in the United States ($n = 4$), Brazil ($n = 1$), Portugal ($n = 1$), Sweden ($n = 1$) and Italy ($n = 1$). Except for one study, all were prospective cohort studies. Retention rates in prospective studies ranged from 17.2% to 100%. Three studies used validated alcohol consumption measures (i.e., AUDIT or structured clinical interviews), one used a modified version of the AUDIT-C, three relied on non-validated tools, and one employed smartphone-based ecological momentary assessment.

Compared with research indicating an increased risk of problematic drinking post-surgery, these studies featured smaller sample sizes (23–375 participants). Half had a follow-up period

of < 2 years, and only two specifically focused on problematic alcohol use. In contrast, studies showing an increase in alcohol use mainly examined problematic drinking patterns and followed patients for at least 2 years most of the time [18, 40, 41].

Of the eight studies, four examined the prevalence of alcohol users before and after surgery [51–54]. Two reported a decrease [51, 52], and two found no significant changes [53, 54]. Notably, two of these studies included fewer than 50 participants followed for 6 months and 1 year postoperatively [53, 54]. Furthermore, despite showing an overall decline in drinking prevalence, one study reported that 10 of the 43 preoperative non-drinkers (23.2%) started drinking after surgery, while 24 of the 112 preoperative drinkers (21.4%) stopped drinking postoperatively [52]. However, in this latter study, only 155 of the 899 recruited patients answered a question on alcohol use before and after surgery, raising concerns about selection bias.

Two studies examined the prevalence of problematic drinking [55, 56]. Wee et al. [56] found no significant overall change in the prevalence of high-risk drinking at 1 and 2 years postoperatively compared to baseline. However, shifts at the individual level were observed: although some participants who reported high-risk drinking before surgery no longer did so after, new-onset cases were also registered. Mitchell et al. [55] similarly highlighted heterogeneous trajectories over a three-year follow-up, reporting both remission of preoperative problematic drinking and new postoperative onset, rather than a uniform change in prevalence across the sample.

Finally, two studies examined changes in AUDIT scores after surgery. Coluzzi et al. found no significant change in median AUDIT scores 1 year after SG ($n = 142$) [57]. In contrast, Alfonsson et al. [58] observed a significant decrease in mean AUDIT scores 1 year after RYGB ($n = 129$). In this study, while 18 participants presented risk consumption preoperatively, only seven reported such consumption after surgery, and three presented alcohol disturbance.

Overall, although some of these studies found no change or a decrease in alcohol use following surgery, several highlighted variability in individual trajectories of alcohol use post-bariatric surgery. This variability mirrors patterns observed in some cross-sectional studies [22, 25, 26] and even in some longitudinal studies showing an overall increase [38, 43]. However, given the methodological limitations of some of these studies—such as small sample sizes, low response rates and short follow-up durations—their findings should be interpreted cautiously. Moreover, their less frequent focus on problematic alcohol consumption limits direct comparison with the studies described in the previous section.

3.3 | Risk Factors for Alcohol Use and Problematic Consumption

Risk factors for postoperative alcohol use and problematic drinking have been underexplored, often appearing as a secondary objective in research. Most of the relevant studies were discussed in the previous section, with only five additional studies (see Table 2) providing data on this specific topic. Overall, three risk factor categories were identified: sociodemographic factors, factors related to pre- and postoperative substance use habits, and psychosocial factors.

3.3.1 | Sociodemographic Risk Factors

Male gender and being younger were identified as risk factors for post-surgical alcohol use and problematic drinking in several studies [18, 29, 38, 39, 45, 47–49, 59]. Three studies did not find a relationship between postoperative AUD and income and educational level [18, 38, 45] whereas one study found that a higher income level and a lower educational level were risk factors for AUD after RYGB [40]. The role of race or ethnicity has rarely been examined, but available findings suggest no relationship with postoperative AUD [18, 38]. Finally, getting divorced *after* surgery was reported to increase the risk of AUD [18].

3.3.2 | Pre- and Postoperative Substance Use Habits

Several preoperative substance use behaviours—such as any alcohol consumption (vs. no alcohol consumption), regular drinking habits (i.e., ≥ 2 times/week), AUD, recreational drug use, and smoking—appeared as predictors of higher alcohol use (i.e., AUDIT scores or drinking frequency) and problematic drinking (i.e., AUD) after surgery [18, 26, 27, 38–40, 42, 47, 59].

Similarly, initiating regular drinking (vs. remaining a non-regular consumer), smoking (vs. remaining a non-smoker), or using illicit drugs (vs. continuing no use) *after surgery* was associated with a higher risk of developing AUD [18, 38]. In contrast, no alcohol consumption at baseline (i.e., no drinking in the 12 months prior to surgery) or stopping regular drinking postoperatively appeared as protective factors against post-surgical AUD [18, 40].

3.3.3 | Psychosocial Risk Factors

Research regarding psychosocial risk factors has produced inconclusive findings. A few studies identified associations between some preoperative eating behaviours (i.e., emotional eating, binge eating, lower levels of cognitive restraint, and purging episodes) and postoperative alcohol use and problematic drinking [43, 55, 59, 60]. However, most found no significant relationship between these behaviours and postoperative alcohol use patterns [18, 27, 37, 38, 44, 51, 61–63].

Two studies showed that higher depression levels or a history of depression prior to surgery were associated with increased consumption after surgery [55, 59]. Two others found no significant relationship between preoperative depressive symptoms and postoperative problematic use [38, 47]. One study suggested that baseline depression might be a protective factor against post-SG AUD [40].

Additional psychosocial variables have been explored in a limited number of studies. One study found a higher prevalence of alcohol

TABLE 2 | Additional studies on risk factors for problematic use after bariatric surgery.

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Macias and Leal [60] Spain	Cross-sectional	a. 140 participants: (1) 25 with binge eating disorder before surgery, and (2) 115 without the disorder b. 60% female in the first and 82.6% in the second group c. 36.46 years (SD = 11.72) in the first and 44.61 years (SD = 9.92) in the second group d. VBG e. 18 months f. Not reported g. NA	– Millon Clinical Multiaxial Inventory-II – Binge Eating Scale – Three-factor Eating Questionnaire	– More symptoms of alcohol dependence in the group with binge eating vs. the group without binge eating at baseline ($M = 39.28$; SD = 27.70 vs. $M = 12.46$; SD = 18.71).
Freire et al. [63] Brazil	Retrospective cohort study (12 years)	a. 46 participants b. 71.7% female c. 41.4 years (SD = 10.5) d. RYGB e. NA f. 46% (46 out of 100 patients who underwent surgery during a specific period in a Brazilian hospital) g. See above	– AUDIT – Questionnaire on Eating and Weight Patterns-Revised	– No cases of AUD before RYGB. – 10 (21.7%) participants met AUD criteria 12 years after surgery (AUDIT score ≥ 20) and 4 (6.5%) had a risk for alcohol abuse (score ≥ 6 for women, score ≥ 8 for men). – No association between binge eating disorder before surgery and AUD after RYGB. Among the 10 participants who developed AUD after surgery, only 4 had binge eating disorder preoperatively.
Chiappetta et al. [61] Germany	Prospective cohort study (2 years)	a. 113 participants b. 68% female c. 44.2 years (SD = 9.9) d. 60.18% with SG and 39.82% with RYGB. e. NA f. 94.2% (120 enrolled participants, seven excluded because of a lack of consent or surgical procedure not performed) g. 44% (50 participants at 2 years post-surgery vs. 113 at baseline)	– AUDIT – Yale Food Addiction Scale	– Significant decrease in the prevalence of food addiction from before to 2 years after surgery (69% before vs. 10% after). – No significant increase in the rate of addiction to alcohol, tobacco, drugs, internet or physical activity.

(Continues)

TABLE 2 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Dickhut et al. [62] Germany	Prospective cohort study (1 year)	a. 125 participants: (1) 49 (39.2%) with preoperative food addiction; (2) 76 (60.8%) without preoperative food addiction. b. 83.2% female c. 44.7 years (SD = 7) d. Not reported e. NA f. Not reported g. 66.5% (of 188 operated patients, 125 included in final analyses)	– AUDIT – Yale Food Addiction Scale 2.0	– Decrease in food addiction scores from before to after bariatric surgery. – No increase or emergence of other addictive behaviours (including problematic alcohol use, internet-use disorder, buying-shopping disorder, hypersexual disorder, and exercise dependence) after surgery in the group with or without food addiction preoperatively.
Marek et al. [66] USA	Cross-sectional	a. 161 participants b. 72.4% female c. 57.3 years (SD = 10.5) d. 74.8% with RYGB and 22.4% with SG e. 6 years (SD = 0.69) f. 11.6% (1382 individuals invited to participate, 168 accepted, 161 included with a valid protocol) g. NA	– AUDIT – Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF)	– Positive relationship between postoperative scores on the Stress/Worry, Anxiety, Behaviour-Restricting Fears and Substance abuse scales of the MMPI-2-RF and AUDIT scores ($r = 0.19$; $r = 0.16$; $r = 0.18$ and $r = 0.45$ respectively).
Miller-Matero et al. [59] USA	Cross-sectional	a. 567 participants b. 83.9% female c. 45.73 years (SD = 10.33) d. 67% with SG and 33% with RYGB e. Not mentioned. Patients operated between 2014 and 2017. f. 39.2% (no additional details) g. NA	– Data from the preoperative psychological assessment – AUDIT-C – Emotional Eating Scale	– Younger age and preoperative alcohol consumption as predictors of postoperative alcohol consumption and hazardous drinking. – Higher levels of depressive symptoms, emotional eating (i.e., eating in response to depression), and a history of purging before surgery as predictors of postoperative binge drinking (defined as consuming six or more drinks in a sitting).

(Continues)

TABLE 2 | (Continued)

Authors/ Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Aizpuru et al. [64] USA	Retrospective cohort study (2 years)	a. 71 participants with either bipolar disorder or schizoaffective disorder and a control group of 142 operated participants b. 90.1% female in both groups c. 51.6 years (SD = 12.39) in the bariatric group and 57.5 years (SD = 12) in the control group d. 70.4% with RYGB, 26.8% with SG and 2.8% with a duodenal switch e. NA f. NA g. NA	– Participants' medical records	– More participants in the bipolar/schizoaffective disorder (BSD) group presented with alcohol use (7/71) compared to those operated on without such disorders (3/142).
Marek et al. [65] USA	Cross-sectional	a. 163 participants b. 69.3% female c. 57.3 years (SD = 10.4) d. 74.8% with RYGB, 22.1% with SG, and 3.1% with another type of procedure, such as duodenal switch e. 6 years (SD = 0.69) f. 11.8% (1382 individuals invited to participate, 168 accepted, 163 included with a valid protocol) g. NA	– Minnesota Multiphasic Personality Inventory—3 – AUDIT	– Positive relationship between postoperative anxiety (Anxiety-Related Experiences scale) and postoperative AUDIT scores ($r = 0.48$). – Positive relationship ($r = 0.29$) between postoperative scores on the Disconstraint scale and AUDIT scores.

Abbreviations: AUD, alcohol use disorder; AUDIT, alcohol use disorders identification test; AUDIT-C, alcohol use disorders identification test-consumption; RYGB, Roux-en-Y Gastric Bypass; SG, sleeve gastrectomy; VGB, vertical banded gastroplasty.

use among patients diagnosed with bipolar or schizoaffective disorder compared to control participants after surgery, although no details were provided regarding the quantity or frequency of alcohol use [64]. Another reported higher postoperative AUDIT scores among individuals with attention-deficit/hyperactivity disorder (ADHD) compared to those without the disorder [58]. Three studies indicated that both pre- and postoperative anxiety symptoms and anxiety disorders may be linked to higher postoperative AUDIT scores and greater AUD risk [55, 65, 66]. Finally, lack of preoperative social support, lower postoperative mental health scores (as measured by the SF-36 mental component score), less improvement or worsening in mental health after surgery, and the need for psychiatric or emotional treatment following surgery appeared as predictors of postoperative AUD in two studies [18, 38]. Importantly, all these findings came from only seven studies and therefore require replication in future research [18, 38, 55, 58, 64–66].

3.4 | Explanatory Hypotheses Underlying Increased Consumption

Three mechanisms have been proposed to explain problematic alcohol use after surgery. The third mechanism was less explored in this review (focused exclusively on human studies) because it was mainly derived from animal research.

3.4.1 | Addiction Transfer Theory

The first explanatory hypothesis, the addiction transfer theory, posits that individuals who develop problematic alcohol use following surgery may have previously struggled with an addictive relationship with food. After surgery, these patients may shift their addiction from food to alcohol due to the restrictions imposed by the procedure on the types and quantities of food they can eat [37, 43, 61, 62].

This theory implies that eating disorders, such as binge eating disorder, and particularly 'food addiction', should be predictors of problematic drinking after surgery. However, as mentioned in the previous section, except for a few studies [43, 55, 59, 60], research indicates no significant relationship between preoperative eating behaviours, including food addiction, and postoperative alcohol consumption [18, 27, 37, 38, 44, 51, 61–63].

3.4.2 | Changes in Alcohol Pharmacokinetics

The second explanatory hypothesis related to the changes in alcohol pharmacokinetics following surgery. Such changes have been suggested in some previous research [21, 22] but have been more specifically studied in 12 studies (see Table 3). Published between 2002 and 2022, these studies were conducted in the United States ($n=9$), Sweden ($n=1$), Italy ($n=1$) and Chile ($n=1$). Sample sizes varied between five and 55 operated individuals. All of them measured alcohol concentration through breath and/or blood tests after participants consumed a certain amount of alcohol (either fixed or adjusted for body weight). In 10 of them, these measurements were taken either before and after surgery or in a group of operated individuals compared to a control group [67–78].

All the studies on RYGB using either a pre–post design or a comparison with controls consistently found that patients who have undergone this procedure reached peak alcohol levels faster and that these peak levels were significantly higher post-surgery compared to pre-surgery or control groups (up to two or three times higher depending on the study) [67, 69–72, 74]. Some studies also found that patients with RYGB took longer to return to zero alcohol levels after drinking [70, 74].

Among the six studies focused on SG [67, 68, 75–78], five used a pre–post design or compared alcohol pharmacokinetics after SG with a control group [67, 75–78]. Of these, three found that this procedure, similar to RYGB but to a lesser degree, was also associated with higher and faster peak alcohol levels compared to pre-surgery or control groups [67, 75, 76]. Research has shown no impact of AGB on alcohol pharmacokinetics [77].

3.4.3 | Changes in the Reinforcing Effects of Alcohol

The final explanatory hypothesis regarded alcohol's reinforcing effects. Most research in this area has been conducted on animal models. Only one study was found that evaluated alcohol's reinforcing effects in humans after RYGB [69]. Engel et al. [69] asked participants to consume a dose of alcohol. They then performed blood tests to analyse alcohol pharmacokinetics and administered a questionnaire to investigate subjective rewarding effects of alcohol. Their results on alcohol pharmacokinetics aligned with previous studies, revealing that peak alcohol concentration was higher and time to peak concentration was shorter after RYGB compared to before. Regarding alcohol's rewarding effects, participants reported greater reinforcement from alcohol post-surgery, and the time to reach maximum reward was shorter. Additionally, the study identified a significant positive association between reward and blood alcohol concentrations, and this was stronger post-surgery.

Alongside increased reinforcing properties, one study suggested that some individuals may experience reduced sedative effects from alcohol after surgery. Acevedo et al. [68] found that one-third of patients with RYGB and SG in their study reported experiencing almost no sedative effects from alcohol. This 'relative insensitivity to the sedative effects of alcohol' may lead some patients to drink more to achieve those effects, thereby increasing the risk of AUD [68, p. 6].

3.5 | Potential Effects of Alcohol Consumption After Surgery

The possible impacts of alcohol consumption after surgery were examined, focusing on four areas: weight loss, alcohol-related hospitalizations, liver disease and mortality.

3.5.1 | Alcohol Consumption and Weight Loss After Bariatric Surgery

Thirteen studies (see Tables 1 and 4) examined the association between postoperative alcohol consumption and weight-related outcomes (e.g., weight loss, percentage of excess weight loss,

TABLE 3 | Studies on the pharmacokinetics of alcohol after surgery.

Authors/Country	Surgical procedure	Sample	Alcohol concentration measure	Fixed or adjusted alcohol dose?	Main results
Klockhoff et al. [71] Sweden	RYGB	12 women who underwent surgery at least 3 years ago, and 12 control women matched for BMI and age	Blood test	Adjusted	– Participants with RYGB reached peak blood alcohol concentration faster (10 vs. 30 min). – RYGB group had a higher peak blood alcohol concentration than the control group (0.74 $g\,l^{-1}$ vs. 0.58 $g\,l^{-1}$).
Hagedorn et al. [70] USA	RYGB	19 individuals who underwent surgery an average 2 years ago and 17 control participants	Breath test	Fixed	– Peak breath alcohol level of 0.05% for control participants vs. 0.08% for participants with RYGB. – Time to reach a breath alcohol level of 0 was higher for the RYGB group compared with the control group (108 min vs. 72 min).
Maluenda et al. [76] Chile	SG	12 individuals before and 2.3 months (median) after SG	Breath test	Adjusted	– Higher peak breath alcohol levels after surgery compared to before surgery (2.02 g/L vs. 0.87 g/L). – Longer time needed to reach a breath alcohol level of 0 after surgery (204 min vs. 177.4 min).
Woodard et al. [74] USA	RYGB	19 operated individuals before surgery, and at 3 and 6 months after surgery	Breath test	Fixed	– Higher peak breath alcohol concentration at 6 and 3 months than before surgery (0.024% before surgery, 0.059% at 3 and 0.088% at 6 months post-surgery). – Longer time needed to reach a breath alcohol level of 0 six months after surgery compared to before surgery (49 min before and 88 min at 6 months).
Changchien et al. [77] USA	SG and AGB	9 individuals with AGB and 7 with SG; before surgery and at 3 and 6 months post-surgery	Breath test	Fixed	– No significant changes in peak breath alcohol level or time to sober from before to 3 and 6 months after SG or AGB.
Steffen et al. [73] USA	RYGB	5 women who underwent surgery 18 to 60 months ago	Blood test	Adjusted	– Higher peak blood alcohol concentrations than reported in previous studies (138.4 mg/dL). – Participants reached peak blood alcohol concentrations faster than reported in previous studies (5.4 min).

(Continues)

TABLE 3 | (Continued)

Authors/Country	Surgical procedure	Sample	Alcohol concentration measure	Fixed or adjusted alcohol dose?	Main results
Gallo et al. [78] USA	SG	10 individuals before, 3 months and 12 months post-surgery	Breath test	Fixed	– Peak breath alcohol concentration occurring 20 min after ingestion. – No significant difference in peak breath alcohol level from before to 3 and 12 months after surgery (0.059 before, 0.068 at 3 and 0.047 at 12 month post-surgery). – No significant difference in time to reach a breath alcohol level of 0 from before to after bariatric surgery (70 min before, 95 min at 3 months, and 57 min at 12 months post-surgery).
Pepino et al. [72] USA	RYGB	8 women who underwent surgery 1 to 5 years ago and 9 women awaiting surgery + additional tests with 5 participants of the group awaiting surgery on average 9.7 months after their operation.	Blood tests	Adjusted	– Participants reached peak blood alcohol concentrations faster after surgery compared to before (35.6 min vs. 15 min). – Higher peak blood alcohol concentrations after surgery compared to before (1.10 vs. 0.60 g/L). – Similar results observed in participants from the waiting group after they had undergone surgery themselves.
Acevedo et al. [67] USA	SG and RYGB	11 women who underwent SG, 8 women who had RYGB 1 to 5 years ago, and 9 women awaiting surgery	Blood and breath tests	Adjusted	– Faster increase in blood alcohol concentration among participants with surgery (15 min after RYGB, 18.7 min after SG and 35.6 min for the control group). – Higher peak blood alcohol concentrations in participants with surgery compared to the control group (1.53 g/L/h after RYGB, 1.42 g/L/h after SG and 0.97 g/L/h in the control group). – Breath tests underestimated blood alcohol concentration.
Acevedo et al. [68] USA	RYGB, SG and AGB	16 individuals with RYGB, 28 with SG and 11 with AGB	Blood test	Adjusted	– Faster peak blood alcohol concentrations among patients who underwent RYGB and SG compared to AGB (1.15 g/L after RYGB and 1.03 g/L after SG vs. 0.67 g/L after AGB). – Higher peak blood alcohol concentration among patients who underwent RYGB and SG compared to AGB (15.4 min after RYGB, 18.9 min after SG and 35 min after AGB). – One third of women reported experiencing almost no alcohol-related sedative effects.

(Continues)

TABLE 3 | (Continued)

Authors/Country	Surgical procedure	Sample	Alcohol concentration measure	Fixed or adjusted alcohol dose?	Main results
Iossa et al. [75] Italy	SG	30 individuals before and 6 and 12 months after surgery	Blood test	Adjusted	– Participants reached peak blood alcohol concentration after 15 min. – Higher peak blood alcohol concentration at 15 min after surgery compared to before (0.26 g/L vs. 0.17 g/L). – Return to a blood alcohol concentration of 0 in 90 min. – Significant increase in urinary metabolite levels after surgery.
Engel et al. [69] USA	RYGB	34 participants before and 1 year after surgery	Blood tests	Adjusted	– Maximum reported reward was higher postoperatively compared to preoperatively (57.14 vs. 46.37). Time to maximum reward was shorter postoperatively compared to preoperatively (15.29 min vs. 27.35 min). – Peak blood alcohol concentration was higher (0.1010 mg/mL vs. 0.0646 mg/mL) and time to peak blood alcohol concentration was shorter (6.80 min vs. 42.60 min) after surgery compared to before surgery. – Significant positive association between reward and blood alcohol concentration. This relationship was stronger after surgery compared to before surgery

Abbreviations: AGB, adjustable gastric banding. BMI, body mass index; RYGB, Roux-en-Y gastric bypass; SG, sleeve gastrectomy.

TABLE 4 | Additional studies on the relationship between alcohol consumption and weight loss after bariatric surgery.

Authors/Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Cornicelli et al. [79] Italy	Cross-sectional	a. 60 participants b. 73.3% female c. not reported d. biliopancreatic diversion e. 24–72 months after surgery f. Not reported g. NA	– Questions developed for the study	– Positive association between postoperative alcohol consumption and current postoperative weight.
Yanos et al. [81] USA	Cross-sectional	a. 97 participants b. 77.3% female c. 56.1 years (SD = 11.3) d. RYGB e. 8.8 years (SD = 3.7) f. Not reported g. NA	– AUDIT	– Postoperative alcohol abuse associated with the likelihood of significant weight regain post-surgery.
Reid et al. [80] Canada	Cross-sectional	a. 10 individuals who maintained weight loss and 17 who significantly regained weight after surgery b. 89% female c. 53.2 years (SD = 8.3) among those who regained weight and 54.4 years (SD = 7.6) among those who maintained weight loss d. RYGB e. 12.2 years (SD = 3.7 years) f. Not reported g. NA	– Alcohol consumed in grams per day over 3 days	– Participants who regained weight consumed more alcohol than those who maintained weight loss (18.5 vs. 2.6 g/day).
Nicanor-Carreón et al. [82] USA	Cross-sectional	a. 36 participants b. 100% female c. 42.9 years (SD = 9.5) d. 83% with SG (83%) and 17% with RYGB e. 2 to 10 years f. 32.4% (111 women initially invited to participate) g. NA	– AUDIT-C	– 31/36 participants reported consuming alcohol. Of these, 17 (55%) presented hazardous drinking. – No significant association between hazardous drinking and weight regain. However, when comparing patients with lower vs. higher weight regain, those in the lower regain group showed a trend toward a higher prevalence of hazardous drinking (68% vs. 33%, $p = 0.06$).

(Continues)

TABLE 4 | (Continued)

Authors/Country	Research design	Sample (a. sample size, b. gender, c. age, d. surgical procedure, e. time since surgery, only for cross-sectional studies, f. baseline response rate, g. retention rate)	Alcohol consumption measures	Main results
Romagna et al. [83] Brazil	Cross-sectional	a. 94 participants b. 87.2% female c. 42 years (SD = 9) d. 85.1% with RYGB and 14.9% with SG e. 6.1 years (SD = 4) f. Not reported g. NA	– AUDIT	– No difference in alcohol consumption and problematic drinking between individuals with a high ratio of weight regain and those with a low ratio of weight regain since surgery.

Abbreviations: AUDIT-C, alcohol use disorders identification test-consumption; RYGB, Roux-en-Y gastric bypass; SG, sleeve gastrectomy.

weight regain). These studies were published between 2010 and 2023 and were conducted in the United States ($n=8$), Sweden ($n=1$), Portugal ($n=1$), Italy ($n=1$), Canada ($n=1$) and Brazil ($n=1$). Six were longitudinal, and seven were cross-sectional; only two of the longitudinal studies followed participants for more than 2 years after surgery. Sample sizes varied widely in the longitudinal studies (129–2003 participants), whereas cross-sectional studies generally involved small samples (27–97 participants), with one exception ($n=203$). Eight studies used validated measures to assess alcohol use (e.g., AUDIT or structured clinical interviews), four relied on non-validated tools and one quantified alcohol intake in grams per day [18, 27, 38, 51, 52, 55, 58, 79–83].

A subset of these studies ($n=8$) specifically examined the relationship between alcohol use or problematic drinking (e.g., AUD) and postoperative weight loss, which was variably defined across studies (e.g., percentage total weight loss, maximum weight loss achieved, total weight loss, percentage excess weight loss, percent excess–BMI loss) [18, 27, 38, 51, 52, 55, 58, 79]. With the exception of one cross-sectional study [79], findings did not support a significant association between alcohol consumption (i.e., quantity consumed or AUDIT scores) or AUD and weight outcomes following surgery [18, 27, 38, 51, 52, 55, 58].

Results were more mixed among studies on weight regain [28, 80–83]. One study found that individuals who had regained a significant amount of weight after surgery consumed more alcohol than those who had maintained their postoperative weight [80]. Two others reported that problematic alcohol use or concerns regarding alcohol or drug use post-surgery were associated with weight regain [28, 81]. One study observed a non-significant trend suggesting that women with lower weight regain were more likely to engage in hazardous drinking compared with those with greater regain ($p=0.06$) [82]. In contrast, one study found no significant differences in AUDIT scores and problematic drinking patterns between individuals with high versus low postoperative weight regain [83].

These findings should be considered with caution due to important methodological limitations. The absence of an observed relationship between alcohol use and weight loss came from one cross-sectional and six longitudinal studies; however, most of the longitudinal studies had follow-up periods of 'only' 1 or 2 years. This is noteworthy, as substantial weight regain after bariatric surgery typically occurs 2 years after reaching nadir weight [84]. As a result, potential negative effects of alcohol use on weight outcomes may not be detectable in studies with shorter follow-up durations. Moreover, except for one study, studies focusing on weight regain relied on small samples and were all cross-sectional, which limits the robustness and generalizability of the results.

3.5.2 | Alcohol-Related Hospitalizations After Bariatric Surgery

Six studies examined hospital admissions related to alcohol use following bariatric surgery, with one of them also assessing emergency department encounters. Published between 2013 and 2023, these studies were conducted in the United States

($n=2$), Sweden ($n=2$), Denmark ($n=1$) and France ($n=1$). All were retrospective cohort studies. Two studies focused solely on hospitalisation rates among patients who had undergone surgery, whereas the other four compared alcohol-related hospitalisation rates between operated patients and a control group (i.e., individuals with obesity or from the general population). Sample sizes ranged from 1449 to 16 755 operated individuals [85–90].

These studies reported a high prevalence or an increased risk of hospitalizations for problematic alcohol use postoperatively (see Table 5). The risk appeared to be higher for patients who underwent RYGB compared to those who had restrictive procedures [85–90]. For instance, Gribsholt et al. [87] examined hospital admission rates among individuals who underwent RYGB between 2006 and 2010, compared to an age- and gender-matched control group. Prior to surgery, those who had RYGB exhibited a lower risk of hospital admission for alcohol abuse than control participants. However, after surgery, the admission rate due to alcohol abuse increased significantly, with individuals who underwent RYGB being twice as likely to be hospitalised for alcohol abuse compared to control participants. Similarly, Mahmud et al. [88] compared a group of veterans who underwent bariatric surgery with a group that received a traditional weight loss intervention on AUD-related hospitalizations. Results indicated that RYGB was associated with an increased risk of AUD-related hospitalizations compared to SG and the traditional weight loss program. Participants who had SG did not show a difference in hospitalization risk compared to the control group.

3.5.3 | Alcohol-Related Liver Disease After Surgery and Patient Characteristics at Diagnosis or Transplantation

Eleven studies provided data on the link between bariatric surgery and alcohol-related liver disease. Published between 2019 and 2023, these studies were conducted in the United States ($n=11$) and Belgium ($n=3$). All were retrospective cohort studies, involving between 158 and over 500,000 operated individuals [91–101].

Three of these studies investigated whether bariatric surgery was associated with increased risk of alcohol-related liver disease [91–93] (see Table 5). They not only confirmed previous findings of increased problematic alcohol consumption (especially after RYGB) but also emphasised a rise in alcohol-related liver disease during the postoperative period. Specifically, RYGB was associated with a heightened risk of the disease, whereas SG and AGB were linked to a reduced risk [93]. For instance, Mellinger et al. [93] studied three cohorts: individuals operated before 2008, between 2008 and 2016 and individuals with obesity. Women who had surgery before 2008 had a two-fold increased risk of alcohol-related cirrhosis compared to controls. Men also faced increased risk but to a lesser extent than women. Conversely, the 2008–2016 cohort exhibited a lower risk of alcohol-related cirrhosis (only for patients with SG and AGB). These results suggested that bariatric surgery lowers the short-term risk of alcohol-related cirrhosis but may increase the long-term risk, especially in women. The short-term benefit likely results from weight loss, while the long-term risk may stem from increased alcohol misuse and the slow development of cirrhosis after problematic drinking begins [93]. Similarly, Kim et al. [92] found that RYGB was associated with a two- to three-fold increased risk of alcoholic hepatitis, alcohol abuse and alcohol poisoning compared to controls with non-bariatric abdominal surgery. AGB was associated with decreased risks, and no significant differences were observed in individual alcohol-related outcomes for SG versus controls.

Six studies explored characteristics of individuals with a history of bariatric surgery when they presented with alcohol-related liver disease ($n=4$) or for liver transplantation ($n=2$) in comparison with individuals without such a history [94–99] (see Table 5). Patients with surgery tended to present more severe forms of alcohol-related liver disease [94–97, 99], to be younger [95–98] and were more often women [94–98]. For example, Van Melkebeke et al. [98] found that operated patients (mainly RYGB cases) were 8 years younger than non-operated patients at presentation with severe alcoholic hepatitis, suggesting accelerated disease progression [98]. They were also more often women, which may reflect the higher prevalence of women among operated patients, and women are more likely to develop alcohol-related liver disease in the context of AUD [98]. Lefere et al. [96] observed that patients with prior bariatric surgery listed for liver transplantation due to alcohol-related cirrhosis were younger and exhibited more severe hepatic decompensation compared to those without such a history. Onghena et al. [97] found that operated patients with severe alcohol-related liver disease were more often female and were younger than patients without a surgery history. Interestingly, patients with surgery had lower weekly alcohol consumption and had been drinking for a shorter duration than patients without surgery.

Except for one study [94], these studies found no significant differences in mortality or survival rates associated with these diseases or post-transplantation between patients with and without a bariatric surgery history [95–99]. However, bariatric surgery appeared as a risk factor for readmission 30 and 90 days after hospitalization for alcoholic hepatitis in three studies [94, 100, 101].

3.5.4 | Mortality

Three studies provided data on alcohol consumption and mortality after bariatric surgery (see Table 5). Published between 2013 and 2023, two were conducted in the United States and one in Brazil [88, 102, 103].

One retrospective cohort study, based on data from over 6000 operated patients, assessed the relationship between AUDIT-C scores and mortality [88]. This study showed that increased alcohol use after RYGB attenuated the beneficial effects of surgery on mortality, and beyond a certain threshold of alcohol intake (i.e., AUDIT-C scores ≥ 8), these benefits were lost [88].

The other two were prospective cohort studies analysing mortality rates and causes of death among operated patients in the years following surgery. Both reported a high rate of alcohol-related mortality post-surgery. In a sample of 2458

TABLE 5 | Bariatric surgery and alcohol-related hospitalizations, liver diseases and mortality.

Authors/Country	Research design	Sample (a. sample size, b. gender, c. age, d. retention rate, only for prospective cohort studies)	Main results
Diniz et al. [103] Brazil	Prospective cohort study (5.1 years)	a. 248 individuals followed 1 to 12 years after RYGB b. 75% female c. 39.7 years (SD = 10.6)	– Nine deaths (5 women), including two due to alcoholic cirrhosis and two related to suicide. One of the patients who died of cirrhosis did not report alcohol use before surgery. – Deaths occurred on average 5.6 years (SD = 2.6) after surgery. – The mean age at death was 48.3 years (SD = 8.4)
Ostlund et al. [89] Sweden	Retrospective cohort study (8.6 years)	a. 4161 individuals with RYGB and 6954 with VBG or gastric banding b. 75% female in the group with RYGB and 78% in the group with restrictive surgery c. 40.2 years (SD = 10.1) in the group with RYGB and 40 years (SD = 10.4) in the group with restrictive surgery	– No difference between patients with RYGB and those with a restrictive procedure in inpatient treatment of alcohol abuse before surgery. – After surgery, 2-fold increased risk of inpatient care for alcohol abuse in the RYGB group compared with the group with a restrictive intervention (hazard ratio, 2.3; 95% CI: 1.7–3.2).
Backman et al. [85] Sweden	Retrospective cohort study (1–4 years)	a. 2 cohorts: (1) 16755 individuals with RYGB and 167 550 individuals from the general population, matched by age and gender. (2) A cohort of 3139 individuals with RYGB and for whom data were available 1 year before and 4 years after surgery and 31 390 individuals from the general population. b. 75.9% female in both cohorts c. (1) in both groups: 44.9% between 18 and 39 years, 31.6% between 40 and 49 years and 23.5% ≥ 50 years. (2) in both groups: 47.8% between 18 and 39 years, 32% between 40 and 49 years and 20.3% ≥ 50 years.	– In women who underwent RYGB, higher risk of inpatient care for AUD before surgery compared to control participants. Before surgery, men with RYGB had a significantly lower risk of inpatient care for AUD compared to control participants. – After surgery, both men and women with RYGB presented higher risk of inpatient care for AUD compared to the control group. Significantly increased risk of inpatient care related to AUD after surgery only seen in men. – Before surgery, no difference between the bariatric and control group regarding prescription of medications for AUD. Increase in the proportion of individuals who had drugs prescribed for AUD compared with the control patients after surgery. Increase in the percentage of individuals treated for AUD after surgery (0.4% before vs. 2.6% after RYGB vs. 0.2 to 0.3% in the control group).
Gribsholt et al. [87] Denmark	Retrospective cohort study (4.2 years)	a. 9985 individuals who had undergone RYGB between 2006 and 2010 and 247 375 control individuals matched by gender and age b. 78% female in both groups c. 40.2 years (median) in both groups	– Increase in hospital admissions due to alcohol abuse after RYGB – Before surgery, patients who underwent RYGB had a lower risk of admission for alcohol abuse compared to control participants [RR = 0.59 (95% CI; 0.39–0.88)]. – After surgery, individuals who underwent RYGB had a two-fold increased risk of hospital admission for alcohol abuse compared to control participants (RR = 2.17 [95% CI; 1.72–2.72]).
Garg et al. [101] USA	Retrospective cohort study (30 days)	a. 61 750 admissions for alcoholic hepatitis, with 23.9% readmission within 30 days b. 39.4% female c. 41% between 18 and 44 years; 53.8% between 45 and 64 years; 5.1% between 65 and 84 years and 0.1% ≥ 85 years	– History of bariatric surgery as a risk factor for readmission 30 days after hospitalisation for alcoholic hepatitis (OR, 1.59; 95% CI, 1.23–2.05).

(Continues)

TABLE 5 | (Continued)

Authors/Country	Research design	Sample (a. sample size, b. gender, c. age, d. retention rate, only for prospective cohort studies)	Main results
Thereaux et al. [90] France	Retrospective cohort study (6.8 years)	a. 8966 individuals with bariatric surgery (55% with RYGB and 45% with SG) and 8966 control individuals, matched for age, gender, BMI category, antidiabetic and insulin therapy at baseline. b. 82% female in both groups c. 40.4 years (SD = 11.3) in the group with surgery and 40.9 years (SD = 11.4%) in the control group.	– Individuals who had undergone RYGB (not those who had SG) had an almost two-fold increased risk of inpatient care for alcohol dependence compared to the control group (IRR 1.8 [95% CI 1.1–2.8], $p = 0.0124$).
White et al. [102] USA	Prospective cohort study (6.6 years)	a. 2458 individuals with surgery (72% with RYGB; 24.8% with AGB, 2.4% with SG and 0.77% with biliopancreatic diversion with duodenal switch) b. 78.6% female c. 46 years (median)	– 10 deaths related to drug or alcohol use: 8 related to overdose (including one from alcohol) and 2 caused by alcoholic liver disease. – Deaths occurring only after RYGB. – 7 out of 10 deceased patients were women. – The observed drug- or alcohol-related mortality rate was significantly higher than that expected in the general population (SMR = 2.10, 95% CI = 1.01–3.86, $p = 0.03$). – Deaths occurring approximately 4.8 years (median, range = 2.8–7) after bariatric surgery. Specifically, deaths related to alcoholic liver disease occurred 5.4 and 6.9 years post-surgery. – Median age of 50 years at death.
Adejumo et al. [100] USA	Retrospective cohort study (90 days)	a. 4917 and 7890 readmitted patients in 30 and 90 days after alcoholic hepatitis- related hospitalisation b. 42.8% female in the group readmitted in 30 days and 42.1% in the group readmitted in 90 days c. 46.9 years (SD = 10.7) in the group readmitted in 30 days and 46.6 years (SD = 10.8) in the group readmitted in 90 days	– History of bariatric surgery as a predictor of readmissions 30 and 90 days after hospitalisation for alcoholic hepatitis.
Lefere et al. [96] Belgium	Retrospective cohort study (6.6 years)	a. 188 patients listed for transplantation due to alcoholic liver disease b. See results c. See results	– Among the 188 patients, 11 had a history of bariatric surgery (6 with RYGB, 4 with biliopancreatic diversion with duodenal switch, and 1 with AGB). – More women in the bariatric group than in the non-surgery group (72.7% vs. 22%). – Patients with a history of bariatric surgery were younger (median age 45 years vs. 60 years) and presented more severe decompensation at the time of listing (MELD score 26 vs. 17) compared to those without a history of surgery. – Cirrhosis diagnosed after a median of 7.4 years (range 6.2–9.7 years) post-bariatric surgery. – There was no significant difference in post-transplant complications and survival rates 3 years post-transplant between the surgical and the control group (80% in the group with surgery vs. 82.2% in the non-surgical group).

(Continues)

TABLE 5 | (Continued)

Authors/Country	Research design	Sample (a. sample size, b. gender, c. age, d. retention rate, only for prospective cohort studies)	Main results
Fipps et al. [95] USA	Retrospective cohort study (up to 5 years post-transplantation)	a. 1416 individuals who underwent liver transplantation due to alcohol-related liver disease b. 17.7% female c. 56 years (median)	– 18 participants (1.3%) had a history of bariatric surgery prior to transplantation. – Half of those with a history of bariatric surgery were women. – Out of the 18 participants, 16 (88.9%) had undergone RYGB and two had AGB. – Median time between surgery and liver transplantation was 9 years. – Bariatric patients had a higher level of severity of liver disease (i.e., higher MELD score) compared with control participants. – Bariatric patients were younger than control patients at the time of liver transplantation (median age of 50 vs. 57 years). – No significant difference in mortality rates between bariatric and control patients 1 and 5 years post-transplantation.
Foley et al. [86] USA	Retrospective cohort study (mean follow-up duration not reported)	a. 1449 individuals who underwent RYGB b. 84% female c. 40.7 years (median)	– 93 (6.4%) had been admitted to the hospital or had presented to emergency room at least once for psychiatric or substance use-related reasons after surgery. – Of all hospitalizations or emergency room visits for psychiatric reasons, 42.4% were due to alcohol-related problems. – On average, hospitalizations or emergency room visits due to alcohol-related problems occurred 5.8 years (SD = 3.61) after surgery.
Mellinger et al. [93] USA	Retrospective cohort study (3.7 years)	a. Three groups: (1) 194130 individuals who underwent surgery between 2008 and 2016, (2) 209090 individuals who underwent surgery before 2008, and (3) a control group of individuals suffering from obesity b. 61.3% female c. 44.1 years (SD = not reported)	– Increased risk of alcohol misuse after surgery in both cohorts (before 2008 and after 2008). – Lower risk of alcohol-related cirrhosis after SG and AGB compared with RYGB. – Among those operated before 2008, operated women had a two-fold increased risk of alcohol-related cirrhosis (HR 2.1, 95% confidence interval 1.79–2.41) compared with women without bariatric surgery. Increased risk of alcohol-related cirrhosis after surgery in men as well, but to a lesser extent than in women (HR 1.3, 95% confidence interval 1.07–1.61). – In the 2008 to 2016 cohort, reduced risk of alcohol-related cirrhosis among patients who underwent SG or AGB (0.40; $p < 0.001$ and 0.43, – $p = 0.02$ respectively), but not among those who underwent RYGB.
Kim et al. [92] USA	Retrospective cohort study (2.8 years)	a. Four groups: (1) 24550 individuals with RYGB, (2) 7783 with SG, (3) 16664 with AGB and (4) a control group of 238 429 patients who underwent non-bariatric abdominal surgery (i.e., cholecystectomy) b. 78.9% female in the group with RYGB, 80.5% in the group with SG, 79.7% in the group with AGB and 75.4% in the control group c. Median age of 45 years in the group with RYGB and AGB, 44 years in the group with SG and 46 years in the control group	– Patients with RYGB had an increased risk of any de novo alcohol-related diagnosis compared with the control group (adjusted hazard ratio (AHR) = 1.51, 95% CI 1.40–1.62). AGB (AHR 0.55, 95% CI 0.48–0.63) and SG (AHR 0.77, 95% CI 0.64–0.91) were associated with a reduced risk of any de novo alcohol-related diagnosis compared with the control group. – RYGB associated with a higher risk of alcoholic hepatitis (AHR 1.98, 95% CI 1.17–3.33), alcohol abuse (AHR 2.05, 95% CI 1.88–2.24), alcohol dependence (AHR 1.39, 95% CI 1.22–1.57), and poisoning (3.14, CI 1.80–5.49) compared to the control group. AGB associated with reduced risk of alcohol abuse (AHR 0.56, 95% CI 0.46–0.67, $p < 0.001$), alcohol dependence (AHR 0.58, 95% CI 0.46–0.73, $p < 0.001$), alcoholic hepatitis (AHR 0.32, 95% CI 0.13–0.77, $p = 0.01$) and alcoholic cirrhosis (AHR 0.41, 95% CI 0.23–0.74, $p = 0.003$). No significant differences between SG and control group for individual alcohol-related outcomes.

(Continues)

TABLE 5 | (Continued)

Authors/Country	Research design	Sample (a. sample size, b. gender, c. age, d. retention rate, only for prospective cohort studies)	Main results
Mahmud et al. [88] USA	Retrospective cohort study (5 years)	a. Four groups: (1) 1854 veterans with RYGB, (2) 4211 veterans with SG, (3) 265 veterans with AGB and (4) 1364 veterans who followed a traditional weight loss program ('MOVE!') b. 30.2% female in the group with RYGB, 33.1% in the group with SG, 24.9% in the group with gastric banding and 13.9% in the MOVE! Group c. Median age of 53 years in the group with RYGB, 52 years in the group with SG, 55 years in the group with banding and 59 years in the MOVE! group.	– At baseline, patients with RYGB had the lowest AUDIT-C scores. – RYGB was associated with an increased risk of AUD-related hospitalisation compared with participants with SG (HR, 1.98; 95% CI, 1.55–2.53; $p < 0.001$) and participants in the MOVE! program (hazard ratio [HR], 1.70; 95% CI, 1.20–2.41; $p = 0.003$). – No significant difference between participants with SG and those in the MOVE! program regarding the risk of AUD-related hospitalisation (HR, 0.76; 95% CI, 0.56–1.03; $p = 0.08$). – SG and RYGB were associated with a reduced mortality risk compared with the MOVE! program. – Reduction of the beneficial effects of RYGB on mortality as AUDIT-C scores increase (phenomenon not observed among participants with SG).
Van Melkebeke et al. [98] Belgium	Retrospective cohort study (12.2 months)	a. 158 participants with severe alcoholic hepatitis b. See main results c. See main results	– 28 patients (17.8%) with a history of bariatric surgery (85.8% with RYGB, 10.7% with biliopancreatic diversion and 3.6% with AGB). – Patients with surgery were younger than control patients at diagnosis of severe alcoholic hepatitis (44.3 years ±8.1 vs. 52.4 years ±10.3), were more often female (70% vs. 38.5%), had a higher BMI (29.7 ± 4.9 vs. 26.6 ± 5), and a higher grade of steatosis on liver biopsy than patients without a history of bariatric surgery. – No difference in disease severity between the two groups, response to corticosteroid treatment and survival rate at 28 days, 90 days and 1 year. – Mean time between operation and presentation with severe alcoholic hepatitis of 8.8 years (SD = 4).
Alvarado-Tapias et al. [91] USA	Retrospective cohort study (mean follow-up duration not reported)	a. 537 757 individuals with a history of bariatric surgery (46.88% with RYGB, 33.76% with SG, 10.66% with AGB, and 8.69% with other types of operation) and 537 757 who underwent non-bariatric abdominal surgery (i.e., appendectomy and cholecystectomy). b. 73.3% female in the group with surgery and 72.3% in the group with non-bariatric abdominal surgery c. 48.78 (SD = 15) in the group with bariatric surgery and 51.51 (SD = 18) in the group with non-bariatric abdominal surgery	– Nearly two-fold increased risk of AUD in patients with bariatric surgery compared with control participants (odds ratio [OR]: 1.90; 95% CI: 1.85–1.95). – Higher risk of cirrhosis (OR, 1.39; 95% CI: 1.37–1.42) and alcohol-related liver disease (OR: 1.29; 95% CI: 1.22–1.37) in the bariatric group compared with the control group.

(Continues)

TABLE 5 | (Continued)

Authors/Country	Research design	Sample (a. sample size, b. gender, c. age, d. retention rate, only for prospective cohort studies)	Main results
Anugwom et al. [94] USA	Retrospective cohort study (3.6 years)	a. 2634 adults discharged from hospital with alcoholic hepatitis, without history of cirrhosis b. 83% female in the group with surgery and 35.6% in the group without surgery c. 47.5 years (median) in both groups	– 153 patients (5.8%) with a history of RYGB. – 83% of women in the RYGB group vs. 35.6% in the control group. – Higher severity of liver disease among patients with surgery vs. control patients. – No difference between the RYGB group and the control group regarding the inpatient mortality rate (2.6% vs. 2.7%). – Higher mortality rate after hospital discharge in the RYGB group (31.4%) vs. in the control group (24%). – Higher 30-day readmission rate in the bariatric group (20.3%) vs. the control group (11.7%). – Higher rate of development of cirrhosis after hospital discharge in the RYGB group (37.5%) vs. the control group (20.9%).
Onghena et al. [97] Belgium	Retrospective cohort study (mean follow-up duration note specified, participants included between 1 January 2018 and 31 December 2022 and followed up until death, lost to follow- up, or until 31 December 2022)	a. 299 patients hospitalised for severe alcohol-related liver disease b. See results c. See results	– 39 (13%) patients had a history of bariatric surgery, RYGB in 25 participants (64.1%). – More women among those with a history of bariatric surgery than those without (76.9% vs. 29.2%). – Patients with a history of bariatric surgery were significantly younger than those without (median age 45 vs. 57 years). – No difference between bariatric and non-bariatric patients in survival rate (61.5% vs. 58.1%), but a history of bariatric surgery and older age at diagnosis were associated with a significantly lower rate of transplant-free survival. – Lower quantities of alcohol consumed per week in the bariatric vs. the control group and shorter duration of use in patients with vs. those without a history of bariatric surgery.
Yarra et al. [99] USA	Retrospective cohort study (mean follow-up duration note specified)	a. 10 168 individuals admitted for alcohol-associated cirrhosis, including 2542 with a history of RYGB b. 75% female c. 49 years (SD = 10.7)	– Higher prevalence of concomitant alcoholic hepatitis (18.8% vs. 17%), hepatic encephalopathy (31% vs. 25%), and infection (28% vs. 24%) among individuals with a history of RYGB compared with controls. – No difference between the two groups regarding inpatient mortality rate.

Abbreviations: AGB, adjustable gastric banding; AUD, alcohol use disorder; AUDIT-C, alcohol use disorders identification test-consumption; MELD, model for end-stage liver disease; RYGB, Roux-en-Y gastric bypass; SG, sleeve gastrectomy; VGB, vertical banded gastroplasty.

participants, White et al. [102] found a significantly higher rate of drug- and alcohol-related deaths in the bariatric group compared to the expected mortality rate in the general population. When they restricted their sample to only patients who had undergone RYGB, the risk was even higher, as deaths occurred only among those who had this specific procedure. Notably, the increased risk was observed only in women. Diniz et al. [103] conducted a prospective cohort study including 246 individuals followed for 1–12 years after RYGB. Of the nine deaths recorded, two (22.2%) were related to alcoholic cirrhosis.

3.6 | Intervention Strategies

Only four studies were found on interventions aiming to detect, prevent, or treat problematic alcohol use postoperatively. Two studies concerned alcohol use screening. The first study evaluated the AuTomaTed Alcohol misuse INterventions (ATTAIN), a new web-based tool for alcohol screening with follow-up for positive results. Compared to usual care, ATTAIN identified more cases of unhealthy alcohol use in patients with bariatric surgery, both pre- and postoperatively [104]. The second study compared the self-reported AUDIT-C with an objective biomarker of alcohol use (phosphatidylethanol, PEth). In this study, 25 out of 139 participants had a positive PEth test, yet most (82.6%) denied recent alcohol use, and 61.5% of those with moderate to heavy PEth values were not detected by elevated AUDIT-C scores. These findings suggest that, while the AUDIT-C is useful due to its rapid administration and strong validation across diverse populations, incorporating objective measures such as PEth into the preoperative evaluation process may improve the detection of risky drinking patterns [105].

One study examined the effectiveness of a 90-min group intervention on patients' understanding of the effects of substance use after surgery and their motivation to abstain from substances postoperatively. Results indicated that following the intervention, patients demonstrated an enhanced knowledge of the negative health effects of postoperative substance abuse. Additionally, there was a decrease in the number of patients who reported an intention to use substances after surgery [106].

However, another study highlighted that psychoeducation alone before surgery may be insufficient to prevent alcohol-related issues afterward. Miller-Matero et al. [107] focused their research on patients who had received preoperative information about alcohol and investigated their postoperative alcohol consumption. They found that 93.1% of participants recalled having been informed about the risks of alcohol before surgery, but more than one-third did not remember the nature of this risk. Moreover, there was no difference in the prevalence of consumers between those who remembered the effects of surgery on alcohol metabolism and those who did not.

4 | Discussion

This review aimed to provide a comprehensive overview of quantitative studies examining the relationship between bariatric surgery and alcohol consumption.

Much of the existing research has addressed the prevalence of alcohol use and problematic drinking after surgery. Overall, longitudinal evidence indicates an increase in problematic drinking rates following bariatric surgery. Although some studies identified changes as early as 1 year postoperatively, the majority found that increases emerged only after two or more years, underscoring the importance of long-term follow-up (≥ 2 years) when examining postoperative drinking patterns. A smaller number of studies reported no change or a decrease in alcohol consumption following surgery. However, these studies often had follow-up periods shorter than 2 years, small sample sizes, and did not focus on problematic drinking behaviours.

Beyond these overall trends, several cross-sectional and longitudinal studies demonstrated that postoperative trajectories of alcohol use are heterogeneous. Four potential trajectories were identified: (1) no problematic use before and after surgery; (2) problematic use before and after surgery; (3) remission of problematic drinking following surgery and (4) development of postoperative problematic alcohol use. The last trajectory is particularly concerning, as it indicates that some individuals may develop alcohol-related issues postoperatively despite having no prior history. Unfortunately, despite the high volume of prevalence studies, it remains unclear how many patients develop new problematic drinking behaviours compared to those who relapse following surgery. Most data on this topic are from cross-sectional studies. Only a few longitudinal studies have examined patients' lifetime history of problematic drinking before surgery. Without detailed lifetime assessments, it remains difficult to determine whether the patients identified as having problematic drinking in these studies are new-onset cases or those who relapse after surgery.

Prevalence studies have also shown an overrepresentation of patients with a history of bariatric surgery in substance abuse treatment settings. All of these studies were conducted in the United States, raising the possibility that socioeconomic factors may partly explain this pattern, as both access to bariatric surgery and to addiction treatment are closely tied to financial resources and health insurance coverage in that country. This overrepresentation could therefore reflect, at least in part, a selection bias—patients who can afford surgery and subsequently seek treatment may be disproportionately represented in such samples. However, a recent Norwegian study also reported a high prevalence of prior bariatric surgery among consecutively enrolled patients in residential treatment for AUD (6.6% compared to 0.84% in the general population), suggesting that this phenomenon is not unique to the United States and may not be solely attributable to socioeconomic disparities [108].

The literature on risk factors for increased alcohol use after surgery remains limited. Sociodemographic risk factors such as male gender and younger age have been identified in several studies. However, little is known about the influence of other factors including socioeconomic status or race and ethnicity, despite their well-documented associations with alcohol use in non-bariatric populations [109, 110]. In contrast, substance use patterns before and after surgery have been consistently associated with postoperative alcohol use and problematic drinking:

any alcohol or drug use prior to surgery, whether problematic or not, appears to increase the risk of postoperative misuse, as does initiating such consumption after surgery. Findings regarding psychological risk factors are less clear. Most research in this area has focused on the role of eating behaviours and depression and yielded inconclusive results, thus highlighting the need for further investigation. Moreover, although some evidence suggests that certain individuals reduce their alcohol consumption after surgery, the factors associated with this decrease have yet to be explored.

As regards the mechanisms underlying an increase in problematic drinking postoperatively, three hypotheses have been proposed. The first, the addiction transfer theory, has received limited empirical support.

The second relates to alterations in alcohol pharmacokinetics after RYGB and SG. These changes have been well-documented, with several physiological factors potentially contributing to them. One factor may be a significant reduction in alcohol dehydrogenase activity due to the surgical bypass or removal of a substantial portion of the stomach, which leads to less effective first-pass alcohol metabolism. Another factor may involve the accelerated gastric emptying after SG and RYGB, which leads to an increased absorption of alcohol into the jejunum, resulting in more pronounced and rapid effects of alcohol postoperatively [67, 70, 71, 111, 112]. These pharmacokinetic changes might contribute to increased postoperative alcohol use [113]. However, the degree to which they really influence postoperative alcohol behaviour has not yet been evaluated. Moreover, one qualitative study suggests that alcohol's enhanced effects post-surgery might also lead some individuals to reduce their consumption postoperatively [114]. Therefore, further research is needed to clarify how these changes influence drinking behaviour. In any case, and importantly, this altered alcohol metabolism implies that even unchanged or seemingly moderate alcohol consumption post-surgery may carry greater risks of alcohol-related harm than before. This underscores the need to establish new guidelines defining what constitutes risky drinking in postoperative patients.

The final hypothesis suggests that alcohol's reinforcing effects may increase after surgery, but only one study involving a human sample confirmed it [69]. Factors contributing to this increase may include changes in alcohol pharmacokinetics [69, 115, 116] and alterations in the brain's reward system. Individuals with severe obesity have reduced activation in brain reward centers, which could lead them to overeating [117, 118]. Some data suggest that surgery, particularly RYGB, may restore dopamine signaling in these brain areas, and result in increased reward sensitivity [119–121]. This improved neural sensitivity to reinforcing stimuli might lead to an increase or initiation of alcohol use in some individuals postoperatively [113, 120]. Post-surgical hormonal changes, particularly in ghrelin (a hormone known to regulate appetite, but also involved in alcohol-related problems), could be a mechanism underlying this restoration of the reward system [69, 113, 119].

The consequences of problematic alcohol use post-surgery are an expanding area of research. In this review, consequences regarding weight loss, alcohol-related hospitalizations, liver disease and mortality were presented.

Regarding weight loss, most studies showed no significant relationship between postoperative alcohol use and weight outcomes. However, most of these studies were cross-sectional or did not examine the impact of alcohol consumption on weight outcomes beyond 2 years. In contrast, several studies highlighted an increase in alcohol-related hospitalizations following surgery. An increase in alcohol-related liver disease was also emphasised. Therefore, it seems that, while the majority of patients experience improvements in liver function post-surgery [122], a significant number develop severe liver disease due to their alcohol intake. Notably, these individuals tend to have undergone RYGB, are generally younger than non-operated individuals, and are more often female. Moreover, despite the well-documented benefits of surgery on mortality [123, 124], some research suggests that increased alcohol use after surgery may diminish these positive effects, and alcohol-related mortality appears to be higher among individuals who have undergone surgery.

Lastly, this review highlighted that there are few studies on alcohol use prevention and treatment postoperatively, underscoring a significant gap in the literature.

It is important to note that most of these findings are based on studies conducted in the United States ($n = 55$) and Europe. No studies were identified from African, Middle Eastern, or Asian countries, including those where alcohol consumption is known to be relatively prevalent (e.g., Japan, China). The only exception is the study by Şen et al. [42] which was conducted in Turkey—a predominantly Muslim country where alcohol consumption, although not prohibited, is relatively uncommon. Interestingly, that study also observed an increase in AUDIT scores during the years following surgery.

The reasons behind this geographic disparity are unclear, but are likely multifactorial. These may include the high obesity and bariatric surgery rates in the U.S., Latin America and some European countries, as well as the limited financial and research infrastructure in some low- and middle-income countries. In countries where alcohol use is minimal, taboo, or legally restricted (e.g., Iran), the topic may also be less relevant to study or more difficult to investigate.

Further research is needed to understand how postoperative alcohol consumption evolves across different countries, as alcohol-related behaviours are strongly influenced by cultural, social and genetic factors [109, 110, 125]. Consequently, findings from existing studies may not be directly generalizable to other populations.

In conclusion, research has established that patients who undergo bariatric surgery face a higher risk of problematic alcohol use. Future studies should move beyond this finding to focus on the mechanisms underlying this phenomenon, as well as the psychosocial risk factors for postoperative problematic use. Understanding the mechanisms and risk factors behind these changes is crucial for developing effective interventions. More research is also needed on the effects of postoperative alcohol consumption, as an increasing body of evidence suggests that alcohol consumption postoperatively may lead to severe negative consequences, potentially with lower levels of alcohol. Lastly, this review highlights that a significant number of patients also

reduce their consumption after surgery. Future studies should examine this aspect to identify factors that may promote reduced postoperative alcohol use.

Author Contributions

Esin Er conducted the study selection, data extraction and synthesis, all under the supervision of Anne-Marie Etienne, who thoroughly analysed each stage of the review process. Cécile Flahault and Anne-Marie Etienne reviewed these analyses and provided methodological guidance. Esin Er was responsible for writing the article. Cécile Flahault and Anne-Marie Etienne reviewed the manuscript.

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Disclosure

The authors have nothing to report.

Ethics Statement

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** cob70048-sup-0001-Supinfo.pdf.