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Relationship between Alcohol Use and Weight Loss after Bariatric Procedure

DANIEL TIMOFTE¹, ANCA PANTEA STOIAN², RAZVAN HAINAROSIE^{3, 4}, CAMELIA DIACONU^{3, 5}, DIANA BULGARU ILIESCU¹, BOGDAN CIUNTU¹, NICULAE IORDACHE³, ALEKSANDR NEIMARK^{6*}

¹«Gr. T. Popa» University of Medicine and Pharmacy, Department of General Surgery, 16 Universitatii Street, 700115 Iasi, Romania; ²University of Medicine and Pharmacy «Carol Davila», Diabetes, Nutrition and Metabolic Disease Department, Bucharest, Romania, Eroii Sanitari No. 8; ³University of Medicine and Pharmacy «Carol Davila» Bucharest, Romania, Eroii Sanitari No. 8 4 «Prof. Dr. D. Hociota» Institute of Phonoaudiology and Functional ENT Surgery, 21st Mihail Cioranu Street, Bucharest, Romania; ⁴Internal Medicine Clinic, Floreasca Clinical Emergency Hospital, 8 Floreasca Avenue, Bucharest, Romania; ⁵Almazov National Medical Research Centre, Saint-Petersburg, Russia, Akkuratova 2

Goal of our study is to determine the effect of laparoscopic sleeve gastrectomy (LSG) on alcohol use after surgery. **Materials and methods.** 90 patients (44 men and 46 women), residents of Romania after LSG. The patients were divided into two groups according to the estimates obtained from the AUDIT test (Alcohol Abuse Disruption Test). These patients were examined prior to surgery and 12 months after LSG. **Results.** Before surgery: 5 (5.5%) patients reported alcohol abuse (AUDIT score of 8 or higher), and 85 patients did not report alcohol abuse (AUDIT scores below 8). 3 patients reported, 12 months after surgery, for persistent alcohol abuse, which they not reported before surgery. 12 months after surgery, the amount of alcohol abuse has changed. The number of patients reporting alcohol abuse increased from 5 (5.5%) to 18 (20%). Thus, with regard to the effect of bariatric surgery on the level of alcohol use, our results showed that 2/5 (40%) of patients who reported alcohol abuse before the operation reduced its consumption to the level of the group without the risk of alcohol abuse. At the same time, 15 (17.6%) patients from the group where there was no risk, 12 months after surgery, increased their level of alcohol intake. **Conclusion.** Bariatric surgery may pose a potential risk of increased alcohol use. In addition, the increase in alcohol consumption after surgery can be explained by the ability to satisfy with alcohol, significantly reduced consumption of previously preferred products with a rich taste.

Keywords: obesity, bariatric surgery, laparoscopic sleeve gastrectomy, alcoholism, alcohol abuse.

Obesity is a multi-factorial disease that is developing in epidemic proportions nationally and internationally [1, 2]. Furthermore, obesity is now declared the most chronic health problem in the Western societies [3]. For example in the United States, according to the available medical data, nearly 39 million adults in the U.S. met the criteria for a diagnosis of obesity. In order to have a medical diagnosis of obesity, one individual must have a Body Mass Index (BMI) score of 30 or more [4]. In addition, a significant increase in the number of overweight and obese adult population can be observed. For example, in the United States obese percentage is increasing from 44% to 61% in the last ten years [5]. Furthermore, the prevalence of obesity is also increasing, doubling from 13% to 27% [6].

The evidence proving the efficacy of bariatric procedures is numerous [7–9]. The challenges in achieving weight loss via diet and/or exercise only in patients who have a busy life style, have made this surgical procedure an increasingly used treatment against obesity. The results presented in the literature are encouraging. Patients receiving bariatric surgery have significant reductions in food intake, lose large amounts of body fat and this fat loss also results in beneficial effects on weight-associated health problems [10].

Another major health problem which is of major concern is the alcohol dependence. This term of alcohol dependence has now been replaced by the common definition of alcohol use disorder, according to the DSM-5 [11]. The alcohol use disorder is the leading causes of morbidity and mortality worldwide [12, 13]. Heavy, hazardous and harmful alcohol use may lead to several serious medical consequences, such as cardiovascular disease and liver cirrhosis, and represents a risk factor for several types of cancers [14–16]. Given these irrefutably evidence, any variable that may potentially lead to an increase risk of alcohol use disorder warrant serious consideration and should be thoroughly researched [17]. Among many other risk factors, bariatric procedures such as laparoscopic sleeve gastrectomy have recently been identified as a potential risk factor for alcohol use disorder. Thus, the main goal of our study was to identify how laparoscopic sleeve gastrectomy influences alcohol use post-surgery.

As mentioned before with citations, recent studies suggest that bariatric surgery may be associated with significant changes in alcohol drinking habits. Specifically, the majority of the studies suggest that it may lead to an increased alcohol use post-surgery. Given that both obesity and alcohol use disorder represent important public health problems, clarifying the relationship between bariatric sur-

Clinical characteristics of the patients at baseline. Data given are arithmetic mean values (\pm SD). BMI=body mass

	(1). No risk use group	(2). Hazardous and harmful use group	<i>p</i> value
Age (years)	39.9 (6.8)	44.4 (5.7)	0.164
Height (cm)	170.6 (9.3)	177.6 (9.2)	0.101
Weight (kg)	121.9 (15.1)	124.8 (20.5)	0.741
BMI (kg/m ²)	43.28 (6.4)	42.6 (1.8)	0.813

gery and potential later development of alcohol use disorder is vital.

Methods

90 patients (44 men and 46 women), all Romanians, who were hospitalized for laparoscopic sleeve gastrectomy surgery in the Surgery Service, «Sf. Spiridon» Clinical Emergency Hospital in Iasi (Romania) were recruited to be part of the experimental group. These patients were investigated before and 12 months after the laparoscopic sleeve gastrectomy. These patients were divided into two groups according to the scores obtained at the AUDIT test: No risk alcohol use and Hazardous and harmful alcohol use.

Alcohol Use Disorders Test (AUDIT)

The AUDIT was developed by the World Health Organization to identify persons whose alcohol consumption has become hazardous or harmful to their health. The AUDIT27 is a validated 10-item screening tool to assess alcohol use, including hazardous consumption. Participants reported «past 12-month» alcohol use including frequency/level of consumption. Scoring criteria for a hazardous and harmful use requires a total score ≥ 8 . The self-reported version of the test was used in this study. The AUDIT is easy to score. All the response scores should then be added and recorded in the box labeled «Total». Total scores of 8 or more are recommended as indicators of hazardous and harmful alcohol use, as well as possible alcohol dependence.

To maximize the reliability of responses, we assured patients that their responses would remain confidential.

BMI

Height and weight were measured using a standardized protocol and were used to calculate BMI (kg/m²). BMI was analyzed at baseline (before operation) and after 12 months postoperative among both groups.

All patients treated by surgical intervention were given the same kind of dietary advice and were recommended to take a daily oral supplement containing vitamins and minerals. To have a lower risk of complications with the weight-loss surgery, the bariatric surgery program recommended that the patients quit drinking alcohol or reduce alcohol use after the surgery.

All analyses were defined a priori. The results were given as arithmetic mean with SD. ANOVA was used for group comparisons. Tests were two-tailed and a *p* value

<0.05 was considered significant. The statistical analysis was performed using Windows 19.0 version of SPSS software (SPSS Inc., Chicago, IL, USA).

Results

Baseline Data

At baseline, before patients underwent laparoscopic sleeve gastrectomy surgery, there were no statistically significant differences between the 2 groups of patients (the group who reported a no risk alcohol use and the group with a hazardous and harmful alcohol use level), regarding age, height, weight or BMI (Table). In addition, before the operation, the reported alcohol consumption was the following: 5 (5.5%) patients reported a hazardous and harmful alcohol use (an AUDIT score of 8 or higher) and 85 patients reported no risk in their alcohol use (AUDIT scores lower than 8). Furthermore, 3 patients reported 12 months after the operation the same hazardous and harmful alcohol use that they reported before the laparoscopic sleeve gastrectomy. None of the patients in this study had any complications during the surgical performance or during the 1-year follow-up period (fig. 1).

At 12 months after the operation the reported alcohol use had changed. The number of patients who reported a hazardous and harmful alcohol use increased from 5 (5.5%) to 18 (20%). Thus, regarding the effect of bariatric surgery on the alcohol drinking level our results showed that 2/5 (40%) patients who reported hazardous and harmful alcohol use before surgery reduced their consumption to a no risk level after the operation. However, 15 (17.6%) patients from the no risk level group increased their reported alcohol use level over the cut-off point of the AUDIT test to a hazardous and harmful level 12 months after the operation. The rest of the 72 patients maintained their no risk alcohol consumption reported before the operation.

When we analyzed the reported alcohol use at 12 months after the operation (no risk level compared to a hazardous and harmful level) effect on the outcome of the operation (measured by the BMI), a significant effect was found $p=0.010$. This effect was significant in the sense that patients who reported a hazardous and harmful use of alcohol had lower BMI (mean of 27.3 kg/m²) when compared to those who reported a no risk use (mean of 30.8 kg/m²) (fig. 2).

To analyze if the patients who increased or decreased their alcohol use level had a significant different BMI after



Fig. 1. Comparing BMI (kg/m^2) at baseline for the No Risk alcohol use level group and the Hazardous and harmful use level group.

Data at 12 months follow up.

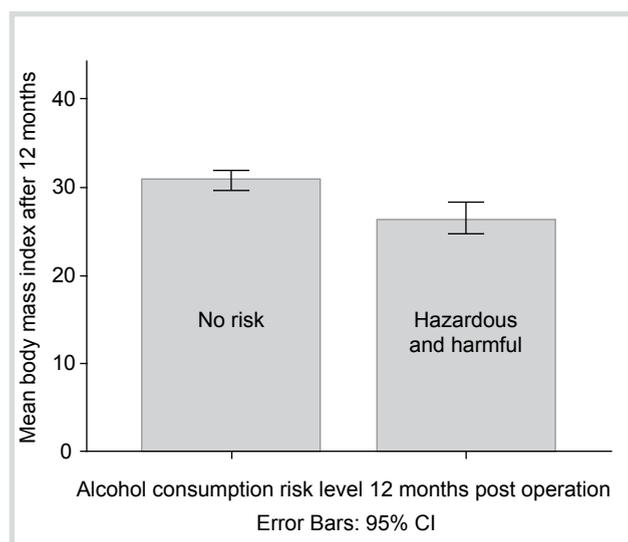


Fig. 2. Comparing BMI (kg/m^2) at 1 year after the operation for the No Risk alcohol use level group and the Hazardous and harmful use level group.

1 year, we created two other distinct groups and ran another analysis: Group 3 — Patients who decreased their alcohol use from hazardous and harmful to a no risk level; and Group 4 — Patients who increased their alcohol use level from no risk to a hazardous and harmful use. The results were the following: a significant difference was observed between the 3 groups regarding the BMI 12 months after the operation ($p=0.002$). Furthermore, the post hoc tests results showed that the patients who decreased their alcohol use from a hazardous and harmful level to a no risk level after the laparoscopic sleeve gastrectomy showed a significant higher BMI when compared with each of the other groups:

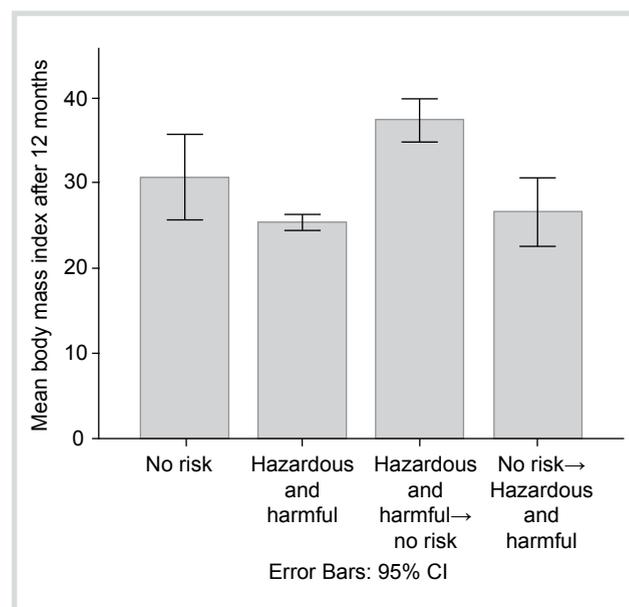


Fig. 3. Comparing BMI (kg/m^2) at 1 year after the operation for the No Risk alcohol use level group, the Hazardous and harmful use level group, the hazardous and harmful who decreased to no risk use group and the no risk group who increased to a hazardous and harmful alcohol use group.

$p=0.05$ when compared with the no risk use group, $p=0.007$ when compared with hazardous and harmful use group and $p=0.003$ when compared with the group formed by patients who increased their alcohol use from no risk to hazardous and harmful use. Interestingly, the last formed group, the group of patients who increased their alcohol use level from no risk to a hazardous and harmful use had a significantly lower BMI than the no risk level group ($p=0.004$) and also a significantly lower BMI than the previous group, formed by patients who decreased their alcohol use from hazardous and harmful to a no risk level ($p=0.003$). The only non-significant difference was found between the group of patients who increased their alcohol use level from no risk to a hazardous and harmful use and the group who reported hazardous and harmful alcohol use before and 12 months after the operation ($p=0.690$) (fig. 3).

Discussion

Most of the published literature on the role of bariatric surgery in alcohol use suggests that bariatric surgery patients, especially after laparoscopic sleeve gastrectomy, may be at risk of alcohol use problems. The American Society for Metabolic and Bariatric Surgery guidelines recommend that high risk patients (for example those with a history of substance abuse, regular alcohol use pre-surgery) abstain from alcohol use after gastric bypass given the altered metabolism of alcohol after surgery.

In our study we wanted to test the hypothesis according to which bariatric surgery, laparoscopic sleeve gastrec-

tomy more specific, can influence the reported alcohol use level. We measured the alcohol use level using the self-reported version of the AUDIT test before the operation and 12 months after the procedure. We created two distinct groups according to the scores obtained by the participants. Group one was formed by patients with no risk use level. Meaning the participants in this group scored 8 or lower on the AUDIT scale. The second group was formed by patients who scored above 8 on the alcohol use scale, meaning they had a hazardous and harmful use of alcohol. The results showed that the bariatric procedure as an independent variable changed the alcohol use status of 17 patients (18.8%). Two patients (2.2%) reduced their reported alcohol consumption from a hazardous and harmful level to a no risk level. The concerning results were those that showed that 15 patients (16.6%) increased their alcohol use from a no risk use to a hazardous and harmful level.

The other important hypothesis we wanted to test was that in which the alcohol use level could influence the weight lost 12 months post the operation. More specific we measured the BMI differences between patients with different levels of alcohol use. It is important to mention that the groups were similar regarding age, gender, weight, height and BMI before the operation.

The results showed that patients who consumed a hazardous and harmful level of alcohol 12 months after the procedure had a lower BMI (27.3 kg/m²) than those who consumed a no risk level of alcohol (30.8 kg/m²). Furthermore, in order to measure how increasing or decreasing the alcohol level use may influence the weight loss after the bariatric, we created two more groups: one formed by patients who decreased their alcohol use from a hazardous and harmful level to a no risk use and another formed by patients who increased their alcohol consumption from a no risk level to a hazardous and harmful one. The results showed that patients who increased their alcohol use 12 months post-surgery had a significantly lower BMI (26.5 kg/m²) compared with patients who kept their alcohol use to a no risk level (30.6 kg/m²) and with patients who decreased their alcohol use (37.3 kg/m²). In fact, this last group of patients had the higher BMI, significantly higher than any other group.

The results of our study results while it should raise serious concerns about alcohol use after bariatric surgery are not surprising. The majority of the clinical data suggests that bariatric surgery represents a potential risk for increased alcohol use. Furthermore, studies with rigorous experimental plans and large samples showed consistent evidence that bariatric procedures can increase alcohol use and risk of alcohol-related problems [16, 18]. In addition, a survey with 318 bariatric surgery patients presented even more concerning results compared with the results of our study. This study showed that approximately 83% of the participants consumed alcohol after surgery. Furthermore, a total of 28.4 percent of the sample reporting difficulties controlling their alcohol use, compared with 4.5 percent before surgery. Additionally, 84 percent

of those who consumed alcohol after surgery reported an increase in sensitivity to effects of alcohol [19]. Another study based on administrative medical data compared patients who underwent bariatric procedures to matched obese patients who did not undergo a bariatric surgery. The results of this study showed that both groups, formed of 54 patients each, were equally likely to have a diagnosis of alcohol dependence; however, bariatric patients were significantly more likely to have a diagnosis of alcohol withdrawal and to report larger amounts of alcohol consumed per drinking day [20].

In contrast to our results, other studies failed to prove any connection between alcohol consumption and bariatric surgery's outcome. In a study on 119 patients who underwent a bariatric procedure, no significant association was found between alcohol use and weight loss at 1-year post surgery [21]. However, consistent with our results, some retrospective studies suggest that a history of alcohol use may be associated with stronger weight loss following bariatric procedures [22, 23]. In addition, a survey-based study found that alcohol use level may represent an independent predictor of weight regain post bariatric surgery [24]. The data available suggests it is still unclear whether alcohol use is a factor that contributes to weight loss after bariatric surgery.

These contradictory results could be explained by the fact that different bariatric procedures may alter alcohol metabolism in distinct ways. Research has shown that individuals present a heightened subjective sensitivity to alcohol following bariatric surgery [25, 26]. Furthermore, alcohol administration studies have generally shown altered pharmacokinetics of alcohol following Roux-en-Y Gastric Bypass, mixed results following sleeve gastrectomy and no change following gastric banding.

In addition, another study investigating alcohol metabolism following a Roux-en-Y Gastric Bypass showed that the pharmacokinetic parameters of alcohol were altered [27]. A cross-sectional comparison of blood alcohol concentrations between 12 post Roux-en-Y Gastric Bypass patients and 12 controls matched on BMI and age showed that the time to maximum blood alcohol concentration was shorter in the Roux-en-Y Gastric Bypass group [28, 29].

A simple explanation on why patients present an altered alcohol metabolism after these procedures states that these changes likely result from the dramatic anatomical and physiological changes that result from Roux-en-Y Gastric Bypass or sleeve gastrectomy. These surgical procedures reduce the available gastric surface area, and therefore a decrease in the availability of the metabolic enzyme gastric alcohol dehydrogenase is likely, which is normally responsible for a significant amount of alcohol metabolism [30–32]. In addition, studies have shown that the gastric emptying rate of liquids is also accelerated by Roux-en-Y Gastric Bypass and sleeve gastrectomy [31, 32]. This may favor alcohol to reach the jejunum rapidly after ingestion where it is fast absorbed. In addition to that, the body weight reduction present after bariatric surgeries will alter the

gram-per-kilogram dose of a fixed amount of alcohol given before and after surgery [33]. Therefore, the higher the milligram-per-kilogram dose ingested, the longer it would be expected to take to return to baseline. Whether the pharmacokinetic changes that follow Roux-en-Y Gastric Bypass account for some of the increased risk of alcohol use disorders following surgery is unclear. Theoretically, higher and more rapid blood alcohol concentration achievement may be more reinforcing to patients, and additional research is needed to explore this area. However, animal models contradict this theory. Studies on rats showed that rats who underwent Roux-en-Y Gastric Bypass worked harder to receive alcohol compared with control rats, suggesting that more complex neurobiological mechanisms are involved in alcohol reward system [34].

A possible explanation on why the patients who consumed more alcohol lost more weight in our sample may be linked with the phenomenon that has been commonly referred to in the literature as ‘cross addiction’ and ‘addiction transfer’. This theory suggests that overeating may compete with alcohol for brain reward sites. In this way, alcohol abuse may hijack existing reward pathways leaving less space for binge eating [35]. The addiction transfer model in a post bariatric group suggests that the key behavior of interest (binge eating) has been replaced with a different behavior (alcohol consumption), because of the patients’ inability to eat large amounts of food. This lack of ability to eat a large volume of food in one sitting therefore reduces the patients’ ability to regulate their emotions through this mechanism and theoretically leads them to find a new behavior that can serve this purpose. However, this theory has not been completely developed or validated and could stand as future directions to research. Furthermore, the exact mechanisms through

which the addiction transfer model may operate should be studied and explained.

Also, in the present context we could introduce the importance of oxidative stress in this context, especially considering our previous experience in this area of research, where we previously demonstrated the importance of alcohol consumption in diabetes and its relations with the oxidative stress status [36], as well as the importance of the oxidative in the chronicity and alcohol-related withdrawal [37].

Our data has certain limitations. As with most psychosocial domains of interest, the alcohol assessment is influenced by the limits of self-report. Although our research group recommends toxicology screening and a review of records, patients who are motivated to undergo bariatric surgery might be reluctant to reveal their substance abuse disorder.

Conclusions

In summary, the results of our study are consistent with the majority of the clinical literature and support the notion that bariatric surgery may represent a potential risk for increased alcohol use. Furthermore, it seems that the increase in alcohol consumption post-surgery may be explained by the higher alcohol reward substituting for reduced reward from previously highly-preferred, rich food items. The implementation of more careful screening tests, a better pre-operative preparation could help reduce the risk of alcohol use disorder after the bariatric procedure. In addition, social factors should also be considered, as they may play an important role in increasing alcohol beverages consumption after the operation in this at risk population.

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The authors:

Daniel Timofte — «Gr. T. Popa» University of Medicine and Pharmacy, Department of General Surgery, 16 Universitatii Street, 700115 Iasi, Romania

Anca Pantea Stoian — University of Medicine and Pharmacy «Carol Davila», Diabetes, Nutrition and Metabolic Disease Department, Bucharest, Romania, Eroii Sanitari, 8

Razvan Hainarosie — «Prof. Dr. D. Hociota» Institute of Phonoaudiology and Functional ENT Surgery, 21st Mihail Cioranu Street, Bucharest, Romania

Camelia Diaconu — Internal Medicine Clinic, Floreasca Clinical Emergency Hospital, 8 Floreasca Avenue, Bucharest, Romania

Diana Bulgaru Iliescu — «Gr. T. Popa» University of Medicine and Pharmacy, Department of General Surgery, 16 Universitatii Street, 700115 Iasi, Romania

Bogdan Ciuntu — «Gr. T. Popa» University of Medicine and Pharmacy, Department of General Surgery, 16 Universitatii Street, 700115 Iasi, Romania

Niculae Iordache — University of Medicine and Pharmacy «Carol Davila», Diabetes, Nutrition and Metabolic Disease Department, Bucharest, Romania, Eroii Sanitari, 8

Aleksandr Neimark — Leading Researcher, Almazov National Medical Research Centre, Saint-Petersburg, Russia, Akkuratova 2; e-mail: sas_spb@mail.ru; <https://orcid.org/0000-0003-4925-0126>