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Effect of probiotic supplementation after laparoscopic sleeve gastrectomy on constipation and gastrointestinal quality of life

Laparoskopik sleeve gastrektomi sonrası probiyotik takviyesinin konstipasyon ve gastrointestinal yaşam kalitesi üzerine etkisi

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Abstract

Aim: In this study, we aimed to investigate the early effect of probiotic supplementation after Laparoscopic Sleeve Gastrectomy (LSG) on constipation and gastrointestinal quality of life compared to control group.

Methods: This study was a prospective, randomized clinical trial. Participants were recruited to Bariatriklab Obesity and Metabolic Surgery Center for LSG. All patients were divided into 2 groups as probiotic and control by using simple randomization. The probiotic group consumed Bifidobacterium animalis lactis BB-12 strain as a probiotic supplement during 6 weeks after LSG. Gastrointestinal Symptom Rating Scale (GSRS), Constipation Severity Instrument (CSI), Patient Assessment of Constipation Quality of Life Scale (PAC-QOL), Bristol Stool Form Scale (BSFS), Gastrointestinal Quality of Life Index (GIQLI) of the patients were recorded before LSG and at the 2nd, 4th, 6th weeks after LSG.

Results: The probiotic group had an average age of 37.00±8.92 years (18 female, 12 male), the control group had an average age of 41.03±11.29 years (23 female, 7 male). CSI (16.50 ± 14.76 vs. 31.37 ± 15.34), PAC-QOL (58.53 ± 12.59 vs 72.30 ± 19.70), GSRS (26.83 ± 9.14 vs. 37.93 ± 16.59) and total score mean were lower compared to the control group, GIQLI total score average (147.50 ± 11.79 vs 136.87 ± 18.98) was found higher ($p < 0.05$) in probiotic group.

Conclusions: Probiotic supplementationimproved the constipation and gastrointestinal quality of life in the early post LSG-period in the brobiotic group compared to the control group.

Keywords: Bariatric surgery, gastrointestinal quality of life, constipation, sleeve gastrectomy, probiotics.

Öz

Amaç: Bu çalışmada, Laparoskopik Sleeve Gastrektomi (LSG) sonrası probiyotik takviyesinin, konstipasyon ve gastrointestinal yaşam kalitesi üzerine erken dönem etkisinin araştırılması amaçlanmıştır.

Yöntemler: Bu çalışma, prospektif, randomize klinik çalışmadır. Katılımcıları Bariatriklab Obezite ve Metabolik Cerrahi Merkezi'ne LSG için başvuran bireyler oluşturmaktadır. Tüm hastalar, basit randomizasyon kullanılarak randomize örnekleme ile probiyotik ve kontrol olmak üzere 2 gruba ayrıldı. Probiyotik grubu, LSG sonrası 6 hafta boyunca probiyotik takviyesi olarak Bifidobacterium animalis lactis BB-12 suşunu kullandı. Hastaların, LSG öncesi ve sonrası 2.hafta, 4.hafta, 6.haftanın sonunda Gastrointestinal Semptom Derecelendirme Ölçeği (GSRS), Konstipasyon Ciddiyet Ölçeği (CSI), Konstipasyon Yaşam Kalitesi Ölçeği (PAC-QOL), Bristol Dışkı Formu Skalası (BSFS), Gastrointestinal Yaşam Kalitesi İndeksi (GIQLI) kaydedildi.

Bulgular: Probiyotik grubun yaş ortalaması 37,00±8,92 (18 kadın, 12 erkek), kontrol grubunun yaş ortalaması 41,03±11,29 (23 kadın, 7 erkek) idi. CSI (16,50 ± 14,76 ile 31,37 ± 15,34), PAC-QOL (58,53 ± 12,59 ile 72,30 ± 19,70), GSRS (26,83 ± 9,14 ile 37,93 ± 16,59) ve toplam puan ortalaması kontrol grubuna göre daha düşük, GIQLI toplam puan ortalaması (147,50 ± 11,79 ile 136,87 ± 18,98) daha yüksek bulundu ($p < 0,05$).

Sonuç: LSG sonrası erken dönemde probiyotik takviyesi alan grupta, kontrol grubuna kıyasla konstipasyon ve gastrointestinal yaşam kalitesinde iyileşmeler gözlenmiştir.

Anahtar Kelimeler: Bariatrik cerrahi, gastrointestinal yaşam kalitesi, konstipasyon, sleeve gastrektomi, probiyotik.

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Introduction

In recent studies, Laparoscopic sleeve gastrectomy (LSG) is recognized as one of the standard approach of bariatric surgery [1]. LSG surgery aims to restrict the volume of food taken without affecting nutrient absorption and reduces the feeling of hunger [2]. LSG has become more preferred surgical treatment of obesity alone or combination with other bariatric surgical methods [3]. Gastrointestinal (GI) symptoms might be seen after bariatric surgery, and these symptoms are associated with impaired quality of life [4]. In addition, these symptoms may be observed by physiological differences in the digestive system due to anatomical changes after surgery [5]. Furthermore, GI quality of life score was lower in morbidly obese individuals than non-obese individuals [6]. For instance, one of the symptoms is the constipation which was seen after bariatric surgery ranges between 7-39%. The constipation is observed after bariatric surgery due to the taken of post-operative dehydration, calcium, iron, vitamin and mineral supplements [7].

In addition to that, the probiotics are used as a treatment method which provides benefits in patients with constipation. The probiotics are considered that as a treatment of constipation and previous study showed the differences in gut microbiota between healthy individuals and patients with chronic constipation [8]. "Bifidobacterium animalis subsp. lactis BB-12" is the broadest investigated probiotics on the market. Some human studies show that Bifidobacterium animalis subsp. lactis BB-12 is efficient in improving constipation, modulating intestinal flora. For example, it was invetigated that Bifidobacterium animalis subsp. lactis BB-12 is demonstrated a significant improvement in young adults and the elderly population compared to placebo treatment on the frequency of defecation [9]. Few studies investigated the effectiveness of probiotic supplementation after bariatric surgery in decreasing lactose intolerance, better digestion of proteins, increase in vitamin and mineral bioavailability, but studies on the effectiveness of probiotics in GI symptoms after LSG are not sufficient and require more research [10]. The purpose of our study is to investigate the early effect of probiotic supplementation after LSG on constipation and gastrointestinal quality of life compared to control group.

Material and methods

Study population

This study is a prospective clinical trial. Power analysis was conducted and satisfied (80%). 80% power analysis, 30 patients in probiotic and 30 patients in control group, 60 patients in total, were participated the study from Bariatriklab Obesity and Metabolic Surgery Center. The remaining 60 patients were divided into 2 groups by random sampling using simple randomization. Participants were randomly allocated to the probiotic group or the control group as 30 participants for each (simple allocation using www.random.org). The inclusion criteria were the age of 18-65, BMI $\geq$40 kg/m^2 or BMI $\geq$35 kg/m^2 and having at least one comorbid disease related to obesity, following a regular dietitian control for at least 6 weeks after LSG were included the study.

The exclusion criteria were; under the age of 18 and over the age of 65, pregnant women or who are in breastfeeding, not have constipation treatment at least a month, LSG pre-with a history of antibiotic use over the last six months, at least three months use of laxatives probiotic, prebiotic supplements, patients are not eligible for surgery by the surgeon or patients who undergone different bariatric surgical procedures, patients who are not on regular dietitian follow-up for at least 6 weeks after LSG and individuals with BMI <35 kg/m^2. This study was endorsed suitable for medical ethics with the 2017/13/51 decision no and date 03.08.2017 by Acibadem Mehmet Ali Aydinlar University and Acibadem Health Organizations Medical Research Ethics Board (ATADEK). All participants provided written consent in accordance with the declaration of Helsinki. The principal researcher received the consent forms from the volunteers who agreed to participate in the study.

Patients' characteristics

Before LSG procedure, patient's demographic information was recorded such as age, gender, number of births, educational status, employment status and exercise habits.

Data collection and questionnaires

In this study, the scales to evaluate patients' status were used; Gastrointestinal Symptom Rating Scale (GSRS), Constipation Severity Instrument (CSI), Constipation Quality of Life Scale (PAC-QOL), Bristol Stool Form Scale (BSFS), Gastrointestinal Quality of Life Index (GIQLI). In addition, participants' information forms were applied, 24-hour dietary recall and anthropometric measurements were taken. All scales and measurements were applied face-to-face by the researcher at pre-op and the end of the 2nd, 4th, 6th week after the surgery.

Gastrointestinal Symptom Rating Scale (GSRS):

It is a Likert scale consisting of 15 items to evaluate the symptoms frequently observed in GI symptoms developed by Revicki et al. (1998) and validity and reliability in Turkish version was performed by Turan and Asti (2011) [11]. The scale has five sub-dimensions for abdominal pain, reflux, diarrhea, indigestion, constipation. Higher scores from the scale indicate that symptoms are more severe, Cronbach alfa was found 0.82 for all items [12].

Constipation Severity Instrument (CSI):

This is a scale of 16 questions developed by Varma at al (2008) [13], conducted by Turkish validity and reliability Kaya and Turan (2011), used to determine the frequency, intensity and difficulty in defecation of individuals and to evaluate symptoms of constipation. It has three lower dimensions: obstructive defecation, colonic internia, pain. A high score from the scale indicates that the symptoms are serious, Cronbach alpha was determined between 0.92 and 0.93 [14].

Constipation Quality of Life Scale (PAC-QOL):

This is a scale consisting of 28 questions developed by Marquis et al. (2005), whose validity and reliability [15] in Turkish was carried out by Dedeli et al. (2007), including physical discomfort, psychosocial discomfort, worries and discomfort, satisfaction subscales in order to evaluate the impact of constipation on quality of life. It is considered that the quality of life of individuals who received high scores was negatively affected, and Cronbach alpha was defined 0.91 for all items [16].

Bristol Stool Form Scale (BSFS):

It divides fecal shapes into seven fecal types. Confirmed as a measure of bowel passage. According to BSFS, Type 1 and Type 2 express constipation, Type 3 and Type 4 express normal stool, Type 5, Type 6 and Type 7 express diarrhea [17].

Gastrointestinal Quality of Life Index (GIQLI):

GIQLI, developed by Eypasch et al. (1995), explores the patient's self-assessment over the last 2-week period. It contains 36 questions each with five response categories such core symptoms, physical items, psychological items, social items, disease-specific items [18]. Each question is scored from zero to four (0: worst, 4: best). The maximum score is shown 144 and the normal score range is shown between 118-126 and Cronbach alpha was figured out as between 0.76 and 0.86 [19].

Anthropometric Measurements

The Tanita Body Composition Analyser model SC-330 (Tanita Corp Tokyo, Japan) was used to measure the body composition (body fat ratio, body fat mass, and body muscle mass) of the patients [20].

The determination of the nutritional consumption status of patients

24-hour dietary recall was taken to evaluate the nutritional status of the patients before and 2nd week, 4th week and 6th week after LSG. The energy and nutrients taken from the daily diet were analyzed using the Computer-Assisted Nutrition Program developed for Turkey, the Nutrition Information Systems package program (BEBIS) (Version 7.1)" [21]. In the evaluation of the amount of fluid intake of the patients other than water, the liquids they specified in the nutrient consumption records (tea, coffee, protein shake etc.) as a consideration.

Probiotic Supplement

The probiotic group used live freeze-dried Bifidobacterium animalis lactis (BB-12) $1x10^9$ CFU as a probiotic supplement. Patients used this probiotic supplement for the first 6 weeks after discharging from LSG under the control of the dietitian. The supplement is in the form of a sachet, and it is recommended to be mixed with 1 cup of warm water twice a day in the morning and evening.

Statistical analysis

The SPSS 24.0 was used for statistical analysis. In the questionnaire applied, qualitative data were evaluated as number (S) and percentage (%). The arithmetic mean (x), standard deviation (SD), median, lower, and upper values were found in the data obtained from patients. Descriptive statistics for the data were given. Pearson Chi-square test and Fisher Exact test were used to compare qualitative data. Independent samples t-test and one-way ANOVA were used for group comparisons. The statistical p value was set at $p<0.05$ in the 95% of confidence interval.

Results

The average age of the probiotic group participating in the study was 37.00 ± 8.92 years, and the average age of the control group was 41.03 ± 11.29 years. There are 18 (60.0%) women and 12 (40%) men in the probiotic group, and there are 23 (76.7%) women and 7 (23.3%) men in the control group. There were no statistically significant differences in age, gender, number of births, marital status, educational status, labor status, and constipation problem parameters between probiotic and control groups before LSG ($P<0.05$) (Table 1).

There were no statistically significant differences between probiotic and control groups in terms of body weight, BMI, body fat weight, body fat percentage and body muscle mass before and after LSG ($p>0.05$) (Table 2).

When the distribution of stool characteristics of patients in the probiotic and control groups compared to BSFS was examined, the rate of constipation was observed lower in patients in the probiotic group compared to the control group, and the rate of normal defecation and diarrhea was observed higher. These results were statistically significant ($p <0.05$) (Figure 1 and 2).
GSRS diarrhea subscale mean score of patients in the probiotic group at post-op 4th week, GSRS indigestion subscale mean post-op at 6th week, GSRS constipation sub-mean score post-op at 2nd week, GSRS total score average post-op 2nd week and post-op 6th week were observed statistically significantly lower compared to the control group ($p <0.05$) (Table 3).

Table 1. Distribution of patients by pre-LSG socio-demographic characteristics.

Parameter		Probiotic Group (n=30)		Control Group (n=30)		
		n	%	n	%	p
Age (year)	9-18	1	3.3	7	11.7	χ^2 =5.281
	0-39	17	28.3	14	23.3	p=0.152
	40-49	6	10	5	8.3	
	50 and above	6	10	4	6.7	
Gender	Female	18	60.0	23	76.7	χ^2=1.926
	Male	12	40.0	7	23.3	p=0.133
Number of births	0	7	38.9	6	26.1	χ^2=7.309
	1	8	44.4	4	17.4	p=0.120
	2	2	11.1	8	34.8	
	3	1	5.6	4	17.4	
	4	0	0.0	1	4.3	
Marital status	Single	12	40.0	6	20.0	χ^2=2.857
	Married	18	60.0	24	80.0	p=0.079
Education level	Education	1	3.3	0	0.0	χ^2=6.687
	Primary school graduate	0	0.0	4	13.3	p=0.153
	Secondary school graduate	0	0.0	1	3.3	
	High school graduate	6	20.0	7	23.3	
	College/University graduate	23	76.7	18	60.0	
Employment status	Employed	24	80.0	22	73.3	χ^2=0.373
	Unemployed	6	20.0	8	26.7	p=0.381
Smoking	Yes	12	40.0	9	30.0	χ^2=0.659
	No	18	60.0	21	70.0	p=0.294
Alcohol consumption	Yes	21	70.0	12	40.0	χ^2=5.455
	No	9	30.0	18	60.0	p=0.018
Constipation problems	Yes	16	53.3	18	60.0	χ^2=0.271
			4			p=0.397
	No	14	46.7	12	40.0	
Regular exercise activity	Yes	2	6.7	1	3.3	NA
	No	28	93.3	29	96.7	

NA: not applicable.

The CSI obstructive defecation subscale mean score of patients in the probiotic group were post-op 2nd week and post-op 6th week, the CSI colonic inertia dimension mean scores were post-op 2nd week, post-op 4th week and post-op at 6th week, CSI pain subscale mean scores pre-op, post-op at 2nd week and post-op at 6th week, CSI total score averages pre-op, post-op 2nd week and post-op 6th week were found significantly lower compared to the control group ($p <0.05$) (Table 4). PAC-QOL physical discomfort subscale mean scores of patients in the probiotic group pre-op, post-op 2nd week and post-op 6th week, PAC-QOL psychosocial discomfort subscale mean scores pre-op, post-op 4th week, post-op 6th week, PAC-QOL worries, and discomfort subscale mean scores pre-op, post-op 2nd week, post-op 4th week, post-op 6th week, PAC-QOL total score averages pre-op, post-op 4th week, post-op 6th week were observed lower than the control group ($p <0.05$) (Table 5).

GIQLI core symptoms sub-mean score average of the probiotic group was post-op at 6th week, GIQLI disease-specific items sub-dimension mean scores pre-op, post-op at 2nd week and post-op at 6th week and GIQLI total score average post-op 6th week compared to the control group were observed statistically significantly higher ($p <0.05$) (Table 6).

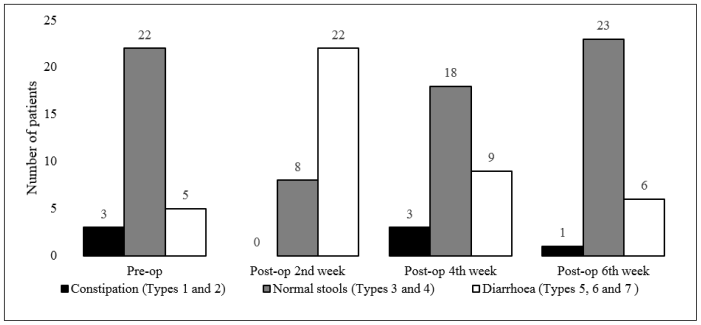

Figure 1. Distribution of fecal characteristics of probiotic group according to Bristol Stool Form Scale.

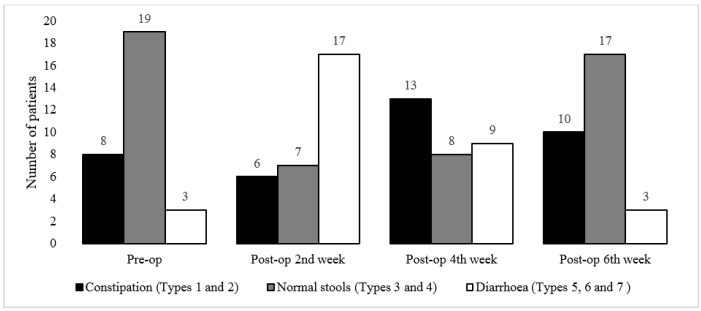

Figure 2. Distribution of fecal characteristics of control group according to Bristol Stool Form Scale.

Discussion

Our study is one of the first examining the effect of probiotic supplementation after LSG on constipation and GI quality of life. Disordered bowel habit is observed in patients after bariatric surgery and this may affect the quality of life of the patients negatively. Obesity is associated with disordered bowel habit but the effects of bariatric surgery on bowel habits are not well studied and unclear. In the previous study conducted by Afshar et al., more than a quarter of patients who were on 6-month follow-up after bariatric surgery had constipation [22]. Meanwhile, the study performed by Menenakos et al. [23] 1-year follow-up after LSG for the treatment of morbid obese patients, 15% of patients developed constipation and 3% anal fistula. Moreover, a study showed that a significant increase in GI symptoms such as swelling, diarrhea, increased feeling of satiety and constipation after bariatric surgery were observed [24].

Table 2. Anthropometric measurements of patients before and after LSG.

		Probiotic Group (n=30)	Control Group (n=30)	p
Weight (kg)	pre-op	121.44± 27.64	114.18 ± 21.31	0.250
	post-op 2nd week	111.63 ± 29.00	106.19 ± 20.58	0.400
	post-op 4th week	109.31 ± 24.82	101.85 ± 20.08	0.200
	post-op 6th week	105.27 ± 24.40	97.12 ± 20.73	0.160
BMI (kg/m^2)	pre-op	42.10 ± 6.62	41.27 ± 5.64	0.600
	post-op 2nd week	38.89 ± 4.68	38.36 ± 5.31	0.680
	post-op 4th week	37.41 ± 4.70	36.92 ± 5.61	0.710
	post-op 6th week	36.03 ± 4.70	35.12 ± 5.67	0.500
Body fat mass (kg)	pre-op	54.22 ± 16.73	53.07 ± 15.22	0.780
	post-op 2nd week	50.45 ± 13.82	48.75 ± 14.99	0.650
	post-op 4th week	45.10 ± 12.87	44.39 ± 15.78	0.850
	post-op 6th week	42.09 ± 12.19	40.58 ± 14.70	0.660
Body fat ratio (%)	pre-op	44.64 ± 7.60	46.08 ± 5.20	0.390
	post-op 2nd week	44.19 ± 6.43	45.41 ± 5.98	0.440
	post-op 4th week	41.21 ± 7.57	42.81 ± 7.22	0.400
	post-op 6th week	39.96 ± 7.77	41.05 ± 7.41	0.570
Body muscle mass (kg)	pre-op	62.91 ± 16.62	58.05 ± 9.17	0.160
	post-op 2nd week	60.06 ± 14.76	54.61 ± 9.08	0.090
	post-op 4th week	60.99 ± 16.36	54.84 ± 9.42	0.080
	post-op 6th week	59.97 ± 16.68	53.68 ± 9.60	0.080

All values are mean ± standard deviation

Bariatric surgery has a significant impact on food intake, defecation stereotypes, and metabolism. It was reported that no changes were found on constipation and prevalence of anal incontinence after 6-month of LSG. In addition, it was emphasized the weight loss after bariatric surgery could be associated with recovery of the constipation symptoms [25].

It is thought that probiotics can alter the changing intestinal microbiota and increase intestinal motility in patients with constipation, as well as regulate the lumen environment by increasing the end products of bacterial fermentation and reducing the luminal ph [26]. Probiotics are increasingly used in the treatment of constipation, and Bifidobacterium is among the most widely used probiotic strains [8]. For instance, In a meta-analysis performed by Dimidi et al. [27], it was demonstrated that Bifidobacterium lactis strains, microbiological microorganisms, improved the intestinal transit time, stool frequency and consistency. In addition, performed by Chen et al. [5] reported that probiotics may improve GI symptoms and quality of life after bariatric surgery. In our study, PAC-QOL total score averages of the control group were statistically higher than probiotic group in the 4th week of post-op and 6th week of post-op. Likewise, In the randomized placebo control study performed by Kommers et al. [28], it was reported that the PAC-QOL satisfaction subscale score of the experimental group who received 15 days of probiotic supplementation was higher than the control group. In our study, we reported that the PAC-QOL satisfaction subscale score of the probiotic group was higher than the control group, but there was no statistically significant difference.

Table 3. Comparison of GSRS scores before and after LSG of patients in probiotic and control groups.

		Probiotic Group (n=30)	Control Group(n=30)	p
Diarrhea	pre-op	6.73 ± 4.62	6.77 ± 4.02	0.970
	post-op 2nd week	6.17 ± 3.15	6.93 ± 3.29	0.360
	post-op 4th week	4.17 ± 1.93	5.53 ± 2.90	0.030
	post-op 6th week	4.37 ± 2.28	5.10 ± 2.91	0.280
Indigestion	pre-op	9.53 ± 5.63	12.03±6.74	0.120
	post-op 2nd week	7.47 ± 3.73	8.90 ± 5.42	0.230
	post-op 4th week	7.57 ± 3.13	9.47 ± 5.67	0.110
	post-op 6th week	7.20 ± 3.76	10.03 ± 6.00	0.030
Constipation	pre-op	6.87 ± 4.79	9.53 ± 6.53	0.070
	post-op 2nd week	5.73 ± 2.65	8.47 ± 4.97	0.010
	post-op 4th week	8.37 ± 5.12	10.10 ± 5.60	0.210
	post-op 6th week	6.80 ± 3.60	11.77 ± 6.02	<0.001
Abdominal pain	pre-op	6.20 ± 3.00	7.87 ± 3.64	0.050
	post-op 2nd week	5.20 ± 1.67	6.30 ± 4.33	0.200
	post-op 4th week	5.63 ± 2.77	6.10 ± 4.37	0.620
	post-op 6th week	5.30 ± 2.34	6.77 ± 4.89	0.140
Reflux	pre-op	4.73 ± 3.45	5.27 ± 3.46	0.550
	post-op 2nd week	3.13 ± 1.68	4.13 ± 2.98	0.110
	post-op 4th week	3.27 ± 1.91	3.77 ± 2.81	0.420
	post-op 6th week	3.17 ± 1.91	4.27 ± 2.94	0.090
GSRS total score	pre-op	34.07±15.89	41.47±19.11	0.100
	post-op 2nd week	27.70 ± 8.84	34.73 ± 15.32	0.030
	post-op 4th week	29.00±9.37	34.97±14.54	0.060
	post-op 6th week	26.83± 9.14	37.93 ± 16.59	<0.001

All values are mean ± standard deviation.
GSRS: Gastrointestinal Symptom Rating Scale, GSRS Cronbach Alpha (pre-op, post-op 2nd week, post-op 4th week, post-op 6th week) = 0.903-0.858-0.831-0.872.

Obesity is associated with impaired gut microbiota and lack of micro nutrition. The weight loss after the bariatric surgery is associated with recovery of the comorbidity of obesity and changes of the function of the microbiota in the gut. The balance in the gut microbiota after bariatric surgery could not be remained. The imbalance of gut microbiota could be due to the adverse consequences of the weight loss and lack of nutrition. Therefore, it is considered that the probiotics could be used as tool to provide improved balance for gut microbiota [29]. In a

study performed by Wildt et al. [30] patients with chronic constipation were given probiotics, a mixture of Lactobacillus acidophilus strain LA-5 and Bifidobacterium animalis subsp lactis BB-12, as probiotics for 12 weeks. They found differences in the probiotic group with improved symptoms and stool consistency. This suggests that probiotic supplementation may have a therapeutic effect on constipation. Also, in the study conducted by Eskesen et al. [9], the mean defecation frequency of patients who used B. lactis BB-12 for 4 weeks for constipation treatment was significantly higher than placebo for all weeks. Our results also indicated that CSI total score were found significantly lower than the control group in the post-op 2nd week and in post-op 6th week of the probiotic group.

Table 4. Comparison of CSI scores before and after LSG of patients in probiotic and control groups.

		Probiotic Group (n=30)	Control Group (n=30)	p
Obstructive defecation	pre-op	9.60 ± 7.93	14.10 ± 9.60	0.053
	post-op 2nd week	8.20 ± 6.39	13.83 ± 8.73	0.006
	post-op 4th week	11.73 ± 7.83	13.43 ± 8.45	0.422
	post-op 6th week	9.07 ± 7.51	15.97 ± 7.70	0.001
Colonic inertia	pre-op	8.40 ± 7.38	10.67 ± 7.71	0.250
	post-op 2nd week	5.90 ± 5.60	11.10 ± 6.45	0.001
	post-op 4th week	7.67 ± 6.24	11.37 ± 5.39	0.017
	post-op 6th week	6.00 ± 6.07	11.80 ± 5.79	<0.001
Pain	pre-op	0.83 ± 1.76	3.67 ± 4.69	0.004
	post-op 2nd week	1.17 ± 2.09	3.63 ± 4.51	0.010
	post-op 4th week	2.23 ± 2.80	3.43 ± 4.67	0.233
	post-op 6th week	1.43 ± 2.62	3.60 ± 4.50	0.027
CSI total score	pre-op	18.83 ± 14.54	28.43 ± 20.43	0.041
	post-op 2nd week	15.27 ± 11.84	28.57 ± 18.30	0.002
	post-op 4th week	21.63 ± 14.75	28.23 ± 15.47	0.096
	post-op 6th week	16.50 ± 14.76	31.37 ± 15.34	<0.001

All values are mean ± standard deviation.
CSI: Constipation Severity Instrument, CSI Cronbach Alpha (pre-op, post-op 2nd week, post-op 4th week, post-op 6th week) = 0.934-0.937-0.874-0.879

GI complaints are common in morbidly obese individuals and this may affect GI quality of life. A significant decrease in GIQLI scale can be observed after bariatric surgery. This is thought to be caused by changes in the intestinal microbiota of obese individuals and the development of GI symptoms. In a study performed by Yu et al. [31], a significant deterioration in GI symptoms was detected in the seriously obese patient group using the GIQLI scale. Also, in a study performed by Ignat et al. [32] found that GIQLI score after LSG as 90, 113, 114, 113 in the pre-op and post-op 1st, 2nd, 3rd and 5th years, respectively. To compare with our results, GIQLI total score mean was observed statistically lower in probiotic group in post-op 6th week compared to control group score mean. However, no study was observed with GIQLI in the early post-LSG period in the literature.

There are several limitations in our study. First, our study was placebo-controlled and not double-blind. Also, another limitation for our study is small sample size. The duration of the follow up of the study is short compared to other studies.

Table 5. Comparison of PAC-QOL scores before and after LSG of patients in probiotic and control groups.

		Probiotic Group (n=30)	Control Group (n=30)	p
Physical discomfort	pre-op	7.96 ± 3.65	10.70 ± 4.48	0.012
	post-op 2nd week	6.40 ± 2.32	9.00 ± 4.57	0.008
	post-op 4th week	7.83 ± 3.29	9.30 ± 4.15	0.135
	post-op 6th week	7.80 ± 3.07	10.53 ± 4.69	0.010
Psychosocial discomfort	pre-op	13.13 ± 5.15	16.46± 6.99	0.040
	post-op 2nd week	14.66 ± 6.40	15.50 ± 7.62	0.648
	post-op 4th week	12.76 ± 4.41	17.00 ± 7.12	0.008
	post-op 6th week	12.63 ± 3.96	17.96 ± 7.58	0.001
Worries and discomfort	pre-op	21.70 ± 8.89	27.46 ± 12.24	0.041
	post-op 2nd week	18.13 ± 6.43	25.53 ± 10.41	0.019
	post-op 4th week	20.43 ± 6.97	25.13 ± 10.54	0.046
	post-op 6th week	19.67 ± 8.20	26.63 ± 10.74	0.006
Satisfaction	pre-op	16.43 ± 3.61	17.33 ± 3.46	0.329
	post-op 2nd week	17.06 ± 3.87	16.40 ± 4.14	0.522
	post-op 4th week	18.26 ± 2.84	17.43 ± 3.80	0.341
	post-op 6th week	18.43 ± 2.29	17.16 ± 3.36	0.095
PAC-QOL total score	pre-op	59.24±14.58	71.96 ± 22.54	0.014
	post-op 2nd week	56.27 ± 15.37	64.43 ± 21.39	0.089
	post-op 4th week	59.30 ± 11.38	68.86 ± 19.37	0.024
	post-op 6th week	58.53 ± 12.59	72.30 ± 19.70	0.002

All values are mean ± standard deviation.
PAC-QOL: Patient Asssessment of Constipation Quality of Life Scale, PAC-QOL Cronbach Alpha (pre-op, post-op 2nd week, post-op 4th week, post-op 6th week) = 0.919-0.915-0.889-0.901.

Table 6. Comparison of GIQLI scores before and after LSG of patients in probiotic and control groups.

		Probiotic Group (n=30)	Control Group (n=30)	p
Core symptoms	pre-op	35.93±8.77	33.00 ± 7.99	0.180
	post-op 2nd week	37.67 ± 6.64	35.03 ± 7.04	0.140
	post-op 4th week	39.23 ± 5.31	37.00 ± 8.24	0.210
	post-op 6th week	40.77 ± 4.75	36.50 ± 8.12	0.010
Physical items	pre-op	17.57 ± 7.97	18.30 ± 6.75	0.700
	post-op 2nd week	23.57 ± 5.22	22.37 ± 4.78	0.350
	post-op 4th week	24.67 ± 4.44	23.43 ± 4.52	0.290
	post-op 6th week	25.37 ± 3.98	24.50 ± 4.58	0.430
Psychological items	pre-op	24.36 ± 6.44	22.56 ± 5.07	0.240
	post-op 2nd week	26.90 ± 4.21	27.03 ± 3.05	0.890
	post-op 4th week	26.63 ± 3.28	26.33 ± 3.44	0.730
	post-op 6th week	26.83 ± 3.58	26.53 ± 4.18	0.760
Social items	pre-op	12.26 ± 3.72	13.13 ± 3.09	0.330
	post-op 2nd week	12.53 ± 3.18	13.23 ± 21.69	0.290
	post-op 4th week	12.86 ± 2.41	12.67 ± 1.91	0.720
	post-op 6th week	13.60 ± 2.60	13.16 ± 1.96	0.470
Disease-specific items	pre-op	41.20 ± 4.01	37.26 ± 6.45	0.000
	post-op 2nd week	39.96 ± 3.73	36.60 ± 6.80	0.020
	post-op 4th week	39.76 ± 4.12	36.93 ± 7.01	0.060
	post-op 6th week	41.00 ± 3.85	36.73 ± 7.49	0.000
GIQLI total score	pre-op	131.86± 22.49	124.47 ± 20.10	0.180
	post-op 2nd week	140.27 ± 18.51	133.63 ± 16.58	0.140
	post-op 4th week	140.30 ± 13.54	1036.07 ± 18.38	0.080
	post-op 6th week	147.50 ± 11.79	136.87 ± 18.98	0.010

All values are mean ± standard deviation.
GIQLI: Gastrointestinal Quality of Life Index, GIQLI Cronbach Alpha (pre-op, post-op 2nd week, post-op 4th week, post-op 6th week) = 0.894-0.870-0.872-0.871.

As a conclusion, probiotic supplementation improved the constipation and gastrointestinal quality of life in the early post-LSG period compared to the control group. However, the effect of probiotic supplementation after LSG on constipation and GI quality of life are limited in the literature. Probiotics may be preferred for the purpose of improving post-LSG constipation, GI symptoms and GI quality of life. Since GI symptoms may

vary according to the bariatric surgical procedure, the selection of probiotics should be symptom-specific and Bifidobacterium animalis lactis BB-12 strain may be considered as an alternative probiotic supplement for common constipation after early period of LSG. The outcome of the study provides a foundation for future studies focusing on the understanding of the effect of the probiotic supplements on constipation and GI quality of life after bariatric surgery.

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