



One-day vs two-day low-residue diets for bowel preparation: A randomized controlled trial assessing colonoscopy quality indicators

Kolonoskopi hazırlığında 1-günlük ve 2-günlük düşük rezidülü diyetlerin karşılaştırılması: Kolonoskopi kalite göstergelerinin değerlendirildiği randomize kontrollü bir çalışma

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ABSTRACT • Background and Aims: Adequate bowel preparation is critical for high-quality colonoscopy. Although low-residue diets are recommended over clear liquid diets, the optimal duration of low-residue diets remains uncertain. This study aimed to compare the effectiveness of 1-day versus 2-day low-residue diets regimens in terms of bowel preparation quality and colonoscopy performance. **Materials and Method:** In this single-blind, randomized controlled trial, 179 patients scheduled for elective colonoscopy were assigned to either a 1-day (n = 89) or 2-day (n = 90) low-residue diets regimen, followed by a split-dose magnesium citrate with sodium picosulfate preparation. The primary outcome was bowel cleanliness assessed using the Boston Bowel Preparation Scale. Secondary outcomes included insertion and withdrawal times, cecal and ileal intubation rates, polyp detection rate, and adenoma detection rate. **Results:** Boston Bowel Preparation Scale total and segmental scores were similar between groups, except for significantly higher left colon scores in the 1-day low-residue diets group (p = 0.02). Insertion time was shorter in the 1-day group (4.61 vs. 4.83 minutes, p = 0.03), while withdrawal time, polyp detection rate, and adenoma detection rate were comparable (adenoma detection rate: 42.6% vs. 44.4%, p=0.48). No patient-related factors were significantly associated with bowel preparation quality. **Conclusion:** A 1-day low-residue diets regimen is as effective as a 2-day regimen for bowel cleansing and does not compromise colonoscopy performance. Shorter dietary restriction may enhance patient comfort without affecting procedure quality.

Key words: Colonoscopy, bowel preparation, low-residue diet, adenoma detection rate, dietary duration

ÖZET • Giriş ve Amaç: Yüksek kaliteli kolonoskopi için yeterli bağırsak hazırlığı kritik öneme sahiptir. Berrak sıvı diyetlere kıyasla düşük rezidü diyetler önerilse de, düşük rezidü diyetlerin optimal süresi belirsizliğini korumaktadır. Bu çalışma, bağırsak hazırlığı kalitesi ve kolonoskopi performansını açısından 1 günlük ve 2 günlük düşük rezidü diyet rejimlerinin etkinliğini karşılaştırmayı amaçlamaktadır. **Gereç ve Yöntem:** Bu tek kör, randomize kontrollü çalışmada, elektif kolonoskopi planlanan 179 hasta 1 günlük (n = 89) veya 2 günlük (n = 90) düşük rezidü diyet rejimine ve ardından sodyum pikosülfat preparatı ile bölünmüş doz magnezyum sitrat rejimine atanmıştır. Birincil sonlanım, Boston Bağırsak Hazırlığı Ölçeği kullanılarak değerlendirilen bağırsak temizliği idi. İkincil sonlanımlar arasında giriş ve çıkış süreleri, çekal ve ileal entübasyon oranları, polip tespit oranı ve adenom tespit oranı yer almıştır. **Bulgular:** Boston Bağırsak Hazırlığı Ölçeği toplam ve segmental skorları, 1 günlük düşük rezidü diyet grubunda anlamlı derecede daha yüksek sol kolon skorları dışında, gruplar arasında benzerdi (p = 0.02). Giriş süresi 1 günlük grupta daha kısaydı (4.61'e karşı 4.83 dakika, p = 0.03), çıkış süresi, polip tespit oranı ve adenom tespit oranı ise benzerdi (adenom tespit oranı: %42.6'ya karşı %44.4, p=0.48). Hasta ile ilgili hiçbir faktör bağırsak temizliği kalitesiyle anlamlı bir şekilde ilişkili değildi. **Sonuç:** Bir günlük düşük rezidü diyet rejimi, bağırsak temizliği için 2 günlük rejim kadar etkilidir ve kolonoskopi performansını etkilemez. Daha kısa süreli diyet kısıtlaması, işlem kalitesini etkilemeden hasta konforunu artırabilir.

Anahtar kelimeler: Kolonoskopi, kolonoskopi hazırlığı, düşük rezidü diyet, adenom tespit oranı, diyet süresi

INTRODUCTION

Colonoscopy is an effective and widely used screening method that reduces both the incidence and mortality of colorectal cancer (CRC). However, its effectiveness may vary depending on several factors, and lower-quality colonoscopies have been associated with increased CRC incidence and mortality (1). Indicators of high-quality colonoscopy include adequate bowel preparation, cecal intubation rate, withdrawal time, adenoma detection rate (ADR), and sessile serrated lesion detection rate (2).

Effective bowel cleansing is crucial to achieve a high-quality colonoscopy. Inadequate preparation negatively affects all aspects of the procedure and is associated with a reduced ADR (3).

Alongside bowel-cleansing agents, dietary restriction plays an important role in colonoscopy preparation. Traditionally, a clear liquid diet (CLD) has been recommended; however, patient compliance with this regimen has been suboptimal (4). Recent studies have shown that a low-residue diet (LRD) is better tolerated and associated with improved compliance. Moreover, no significant differences have been observed between CLD and LRD in terms of bowel cleansing efficacy or adverse event profiles (4-6). Consequently, the American Society of Gastrointestinal Endoscopy (ASGE) and the European Society of Gastrointestinal Endoscopy (ESGE) currently advise using LRD as the preferred method for colonoscopy preparation.

Some studies have reported that a 2-day LRD regimen may reduce patient adherence (7). Although the evidence remains limited, ESGE guidelines suggest that a 1-day LRD is sufficient for adequate bowel preparation (3). Nevertheless, many centers still implement a 2- to 3-day dietary restriction to optimize colonoscopy quality, often advising prolonged avoidance of fiber-containing foods (3-8).

In this randomized controlled trial, we compared 1-day and 2-day low-residue diets in terms of pa-

rameters associated with high-quality colonoscopy, including bowel preparation adequacy and adenoma detection rate.

MATERIALS and METHOD

Study Design and Population

The study was designed as a prospective, single-blinded, randomized controlled trial aiming to evaluate the differences between 1-day and 2-day low-residue diet protocols. The study was approved by the Institution's Scientific Research Ethics Committee (Approval no: 2024/279, Date: 29/11/2024).

Consecutive patients scheduled for colonoscopy between December 2024 and May 2025 were recruited. Written informed consent was obtained from all participants. Patients who declined participation were excluded from the study.

Inclusion and Exclusion Criteria

Eligible participants were aged 18–85 years and met at least one of the following criteria:

1. Persistent non-specific gastrointestinal symptoms
2. Abnormal findings on radiological imaging
3. Positive fecal occult blood test
4. Alarm symptoms suggestive of lower gastrointestinal pathology
5. Scheduled for screening colonoscopy

Exclusion criteria were as follows:

1. Diagnosis of or follow-up for gastrointestinal malignancy
2. History of gastrointestinal surgery
3. Contraindications for colonoscopy
4. Detection of colorectal malignancy during colonoscopy
5. Contraindication to the bowel preparation agent used in the study

Randomization and Blinding

This single-blind randomized controlled trial included 190 patients, randomized in a 1:1 ratio to either the 1-day LRD group ($n = 95$) or the 2-day LRD group ($n = 95$). Randomization was performed using a simple method: equal numbers of assignments (Group A and Group B) were written on identical paper slips, thoroughly shuffled, and placed in sealed, opaque envelopes.

An independent secretary, uninvolved in any aspect of the study procedures or assessments, allocated patients by handing them an envelope in the order of enrollment. To ensure the integrity of the single-blind design, neither the endoscopist (AA) nor the nursing staff were informed of participants' group assignments during the course of the study.

Diet

The low-residue diet consisted of peeled and seedless fruits and steamed vegetables (such as apples and carrots), along with white bread, dairy products like yogurt, milk, and cheese, as well as meat and fish. Whole-grain products, raw fruits, and vegetables were prohibited (3). In this study, patients were provided a normocaloric, low-fiber (< 10 g/day), protein-rich LRD.

Bowel Preparation

Although the ESGE guidelines recommend polyethylene glycol (PEG)-based solutions as the first-line bowel preparation agent, magnesium citrate with sodium picosulfate (MCSP) has also been shown to be effective in several studies (3). In our study, MCSP was used as a split-dose regimen because it is the most commonly prescribed preparation in our clinical setting and is covered by the national health insurance.

The LRD was implemented either 1 or 2 days prior to colonoscopy depending on group assignment. All patients stopped solid food intake at 7:00 PM

the day before the procedure and continued with clear liquids. The first dose of MCSP was administered at 8:00 PM, and the second dose at 8:00 AM on the day of colonoscopy. All colonoscopies were performed between 11:00 AM and 2:00 PM.

Colonoscopy Procedure

All colonoscopies were performed by a single experienced endoscopist (> 3000 procedures) using a high-resolution Olympus EVIS EXERA III CF-HQ190L/I colonovideoscope (Olympus, Tokyo, Japan).

Data Collection and Outcomes

Demographic data including age, sex, height, weight, colonoscopy indication, history of constipation or colonoscopy, comorbid conditions associated with constipation, and medication use were recorded.

Bowel cleanliness was assessed using the Boston Bowel Preparation Scale (BBPS), a validated 9-point scale that evaluates the colon in three segments: right, transverse, and left. Each segment is scored from 0 to 3 (9,10). A score ≥ 2 in each segment and a total score ≥ 6 indicate adequate preparation (2). Total scores were classified as follows: $\leq 5 =$ poor, $6-7 =$ good, $\geq 8 =$ very good (9). Measured outcomes encompassed the duration of scope insertion and withdrawal, the success rates of cecal and ileal intubation, as well as the detection rates for polyps and adenomas. A blinded endoscopy nurse, unaware of participant allocation, documented the insertion and withdrawal times.

Statistical Analysis

Statistical evaluations were performed using the SPSS software version 30.0 (SPSS Inc., Chicago, IL, USA). The distribution of continuous variables was assessed through the Kolmogorov–Smirnov test. For data following a normal distribution, the independent samples t-test was applied, whereas

the Mann–Whitney U test was used for data not meeting normality assumptions. Categorical data were analyzed using the chi-square test. The association between potential factors (e.g. age, gender, constipation history, disease history) and bowel preparation quality (categorized as poor, good, and very good) was evaluated using ordinal logistic regression analysis. In this analysis, statistical significance was defined by a threshold of $p < 0.05$.

Although a priori sample size calculation was not performed, the final sample size ($n = 179$) is comparable to previously published randomized controlled trials evaluating dietary regimens for bowel preparation, which included similar patient numbers. Therefore, the study population was considered adequate to detect clinically meaningful differences between groups.

RESULTS

After exclusions, 179 patients were included in the final analysis (89 in the 1-day LRD group and 90 in the 2-day LRD group) (Figure 1).

Baseline characteristics were generally similar between groups, except for a higher prevalence of diabetes mellitus in the 2-day LRD group (24.4% vs. 12.4%, $p = 0.03$) (Table 1).

Bowel preparation quality, assessed by the BBPS, was comparable between groups in the right and transverse colon and in total score. However, the left colon score was significantly higher in the 1-day LRD group ($p = 0.02$). Insertion time was significantly shorter in the 1-day LRD group (4.61 minutes) compared to the 2-day group (4.83

minutes, $p = 0.03$). There was no significant difference in withdrawal time between the groups (16.07 minutes vs. 15.37 minutes, $p = 0.39$) (Table 2).

Cecum intubation, ileal intubation and polyp detection rates were similar between groups. Adenoma detection rate also did not differ significantly (42.6% vs. 44.4%, $p = 0.48$) (Table 3). None of the evaluated factors—age, gender, colonoscopy history, diabetes mellitus history, hypothyroidism history, constipation history—were significantly associated with colon cleanliness in ordinal logistic regression analysis (all $p > 0.05$).

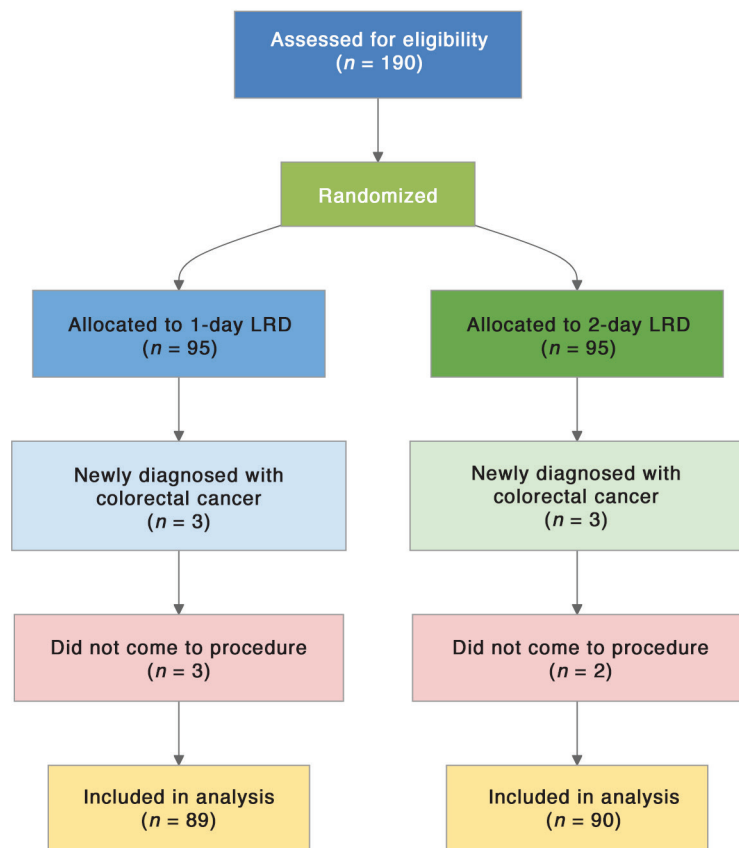


Figure 1 Flowchart of study.

LRD: Low-residue diet.

Table 1 Baseline characteristics of study participants

Variable	1-Day LRD Group (n = 89)	2-Day LRD Group (n = 90)	p-Value*
Age, mean ± SD	58.1 ± 12.1	61.2 ± 12.6	0.67
Female, n (%)	43.8%	47.8%	0.94
Indication - Screening, n (%)	66.3%	69.2%	0.56
Colonoscopy history, n (%)	25.8%	34.4%	0.21
Hypothyroidism, n (%)	19.1%	16.7%	0.67
Diabetes mellitus, n (%)	12.4%	24.4%	0.03
Constipation, n (%)	18%	10%	0.19

*p-values reflect group comparisons using independent t-tests or chi-square tests, as appropriate.
LRD: Low-residue diet; SD: Standard deviation.

Table 2 Bowel preparation quality and procedure times

Outcome	1-Day LRD Group (Median, IQR) (n = 89)	2-Day LRD Group (Median, IQR) (n = 90)	p-Value
BBPS - right colon	2.28 (2.18 - 2.39)	2.23 (2.12 - 2.35)	0.60
BBPS - transverse colon	2.56 (2.45 - 2.67)	2.51 (2.41 - 2.62)	0.45
BBPS - left colon	2.79 (2.70 - 2.87)	2.63 (2.53 - 2.73)	0.02
Total BBPS	7.63 (7.40 - 7.85)	7.39 (7.16 - 7.62)	0.12
Insertion time (min)	4.61 (4.13 - 5.09)	4.83 (4.47 - 5.20)	0.03
Withdrawal time (min)	16.07 (14.32 - 17.82)	15.37 (13.52 - 17.21)	0.39

LRD: Low-residue diet; IQR: Interquartile range; BBPS: Boston Bowel Preparation Scale.
Note: BBPS is scored from 0 to 3 per segment; higher scores indicate better bowel cleanliness.

Table 3 Colonoscopy outcomes

Outcome	1-Day LRD Group (n = 89)	2-Day LRD Group (n = 90)	p-Value
Cecum intubation rate	100.0%	100.0%	1.00
Ileum intubation rate	92.2%	91.1%	0.80
Polyp detection rate	56.2%	64.4%	0.25
Adenoma detection rate	42.6%	44.4%	0.81

LRD: Low-residue diet.

Note: Detection rates were based on histopathologic confirmation of lesions.

DISCUSSION

In this randomized controlled trial, we compared the effectiveness of a 1-day versus a 2-day LRD prior to colonoscopy. Our results demonstrate that a 1-day LRD provided comparable bowel preparation quality and colonoscopy outcomes to a 2-day LRD, with slight-

ly better left colon cleanliness and shorter insertion time in the 1-day group. These findings suggest that extending dietary restriction beyond one day may not offer additional clinical benefit and could potentially reduce patient comfort and compliance.

Concerns about decreased patient adherence with longer dietary restrictions have prompted investigations into the effect of shorter LRD durations on both compliance and bowel cleanliness. Previous studies, such as those by Machlab et al. and Gimeno-García et al., have explored this topic (11,12). In the randomized controlled trial by Machlab et al., comparing 1-day and 3-day LRDs, bowel preparation quality was found to be similar between groups, while patient adherence was significantly better in the 1-day LRD group (11). Similarly, Gimeno-García et al. reported no significant differences in bowel cleanliness between 1-day and 3-day LRD groups (12). Our findings align with these studies, further supporting the adequacy of a 1-day LRD for bowel preparation.

Unlike previous studies focusing on patient adherence, our study prioritized key quality indicators of colonoscopy. According to the American Gastroenterological Association (AGA) guidelines, high-quality colonoscopy is defined by specific metrics: $\geq 90\%$ of patients achieving a BBPS score ≥ 6 (with each segment scoring ≥ 2), a cecal intubation rate $\geq 90\%$, withdrawal time of ≥ 6 minutes (aspirational target ≥ 9 minutes), and an adenoma detection rate (ADR) $\geq 30\%$ (aspirational $\geq 35\%$) (2). According to the findings reported by Jiao et al., there were no statistically significant differences between the 1-day and 2-day LRD groups regarding BBPS scores, insertion/withdrawal durations, or the rate of polyp detection (13). Similarly, in our study, withdrawal time, polyp detection rate, and ADR were comparable between groups and met the recommended quality standards of the AGA. Notably, our ADR values were even higher than those reported in several previous studies (12,13). Cecal intubation was successfully achieved in all patients, and dietary duration had no impact on this outcome.

Since colon cleanliness has been shown to affect ileal intubation rates, we evaluated this parameter as well and found no difference between the groups

(14). Moreover, colon cleanliness is a key factor influencing insertion time (15). In our study, insertion time was marginally shorter in the 1-day LRD group, possibly due to reduced colonic residue and improved bowel transit.

One notable difference was the higher prevalence of diabetes mellitus in the 2-day group, which could have potentially affected bowel motility. However, regression analysis did not identify diabetes or other patient-related variables (e.g., age, constipation, thyroid disease) as significant predictors of bowel cleanliness.

Although the term “low-residue diet” encompasses a variety of low-fiber foods, there is currently no standardized dietary protocol, and most centers develop their own institutional dietary plans (3). In our study, we employed a normocaloric, low-fiber, high-protein LRD, a variant previously shown to outperform clear liquid diets (CLDs) in terms of satiety and tolerability (16). However, this particular LRD has not yet been compared with other forms of LRDs, such as those emphasizing higher proportions of low-fiber carbohydrates.

The choice of magnesium citrate with sodium picosulfate (MCSP) as a bowel preparation agent, although not the first-line recommendation in ESGE guidelines, reflects local clinical practice where polyethylene glycol (PEG) is less accessible due to insurance limitations (3). Nevertheless, MCSP has been shown to be effective and was used in accordance with split-dose timing, as recommended by guidelines (3).

This study has several strengths, including its prospective, randomized design and blinded outcome assessment. Additionally, all colonoscopies were performed by a single experienced endoscopist, reducing inter-operator variability. Nevertheless, certain limitations need to be recognized. First, the study was conducted at a single center, which could restrict the applicability of the findings. Second, patient-reported outcomes such as tolerability

ty and satisfaction were not assessed, which could have provided further insights into the impact of diet duration on compliance. Lastly, while our sample size was adequate to detect differences in bowel preparation quality, it may have been underpowered to detect smaller differences in ADR.

In conclusion, a 1-day low-residue diet is as effective as a 2-day diet in achieving high-quality bowel preparation and colonoscopy performance. These results suggest that shorter dietary restrictions do not compromise colonoscopy quality.

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