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RESEARCH ARTICLE

Effect of Water Temperature on Bowel Cleansing Quality: A Prospective Observational Study

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ABSTRACT

Objective: The effectiveness of bowel preparation in colonoscopy is influenced by several factors, including the type of preparation used, timing, and level of hydration. However, the impact of water temperature consumed during bowel preparation on cleansing quality has not been adequately described in the literature. This prospective observational study aimed to compare the effects of cold and lukewarm water consumption during bowel preparation on bowel cleansing quality, patient tolerance, and procedure-related outcomes.

Materials and Methods: A total of 260 patients were included in the study. Participants were divided into two groups according to the temperature of the water consumed during bowel preparation: cold water (2–6°C) and lukewarm water (24–28°C). All patients followed the same bowel preparation protocol, consisting of a sodium phosphate solution and an enema. Bowel cleansing quality was assessed using the Boston Bowel Preparation Scale.

Results: Nausea was more frequently observed in the lukewarm water group (p=0.030), while no significant differences were found in other adverse effects. The withdrawal time was shorter in the lukewarm water group (2.7±1.5 min vs. 3.2±1.8 min; p=0.003). The mean total BBPS score was significantly higher in the lukewarm water group (7.37±1.67 vs. 6.43±2.17; p<0.001).

Conclusion: Consumption of lukewarm water during bowel preparation significantly improved bowel cleansing quality, enhanced patient tolerance, and reduced procedure time. These findings suggest that water temperature is an overlooked yet important variable that should be considered in routine colonoscopy preparation protocols.

Keywords: Boston Bowel Preparation Scale (BBPS), bowel preparation, colonoscopy, water temperature

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INTRODUCTION

Colorectal cancer (CRC) ranks as the third leading cause of cancer-related mortality worldwide, with approximately one million new cases reported annually. Colonoscopy remains the gold standard method for the early diagnosis and prevention of CRC, as it allows for the direct detection and removal of precancerous lesions. High-quality colonoscopy has been shown to significantly reduce mortality associated with colorectal cancer.[1,2]

The diagnostic and therapeutic efficacy of colonoscopy largely depends on the endoscopist's experience and, to a great extent, on the quality of bowel preparation. Inadequate bowel cleansing (IBC) may result in failure to reach the cecum, reduced mucosal visibility, and decreased adenoma detection rates (ADR).[3] Despite the availability of different bowel preparation regimens, inadequate preparation rates have been reported to reach up to 30%.[4] This situation adversely affects not only procedural success but also patient comfort, overall cost, and the need for repeat colonoscopy.[5]

Numerous studies have extensively investigated the factors leading to IBC. Age, sex, constipation, history of abdominal surgery, diabetes, compliance with preparation instructions, and the interval between bowel preparation and colonoscopy have been identified as major determinants.[4]

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Therefore, establishing an effective and safe bowel preparation protocol is of great clinical importance.

Bowel preparation solutions are generally classified into two main categories: high-volume (HV) and low-volume (LV) formulations. HV polyethylene glycol (PEG, 4 L) solutions have long been considered the standard; however, poor palatability and gastrointestinal discomfort often lead to reduced patient compliance. In contrast, LV preparations (1–2 L PEG, sodium phosphate [NaP], or sodium picosulfate with magnesium citrate [SPMC]) provide comparable cleansing quality with better tolerability and fewer adverse effects.[6,7]

In addition to the type of bowel preparation agent, the method of administration, dosage, timing, and dietary protocol also influence the effectiveness of cleansing. However, to date, no study has evaluated the impact of the temperature of water consumed during colonoscopy preparation on bowel cleansing quality. This study aimed to assess the effect of this simple yet potentially clinically significant factor on the effectiveness of bowel preparation.

MATERIALS and METHODS

Study Design and Ethical Approval

This prospective observational study was conducted in the Department of General Surgery at Bahçelievler State Hospital between February and July 2025. The study protocol was approved by the local ethics committee (Approval No: 2024-15-17, Date: December 25, 2024). Written informed consent was obtained from all participants before inclusion, and the study was performed in accordance with the principles of the Declaration of Helsinki.

Study Population

Patients scheduled for elective colonoscopy at the Endoscopy Unit of the General Surgery Department were divided into two groups according to the temperature of the water consumed during bowel preparation: the cold-water (CW) group and the lukewarm-water (LW) group. Patients in the CW group were instructed to drink water at 2–6°C (kept in the refrigerator door for 6 hours), while those in the LW group were instructed to drink water at 24–28°C (kept at room temperature for 6 hours). The allocation sequence was known only to the endoscopy secretary who provided the instructions, and patients were assigned sequentially to the CW or LW groups. Individuals under 18 years of age, pregnant or breastfeeding women, and those with renal failure, ileus, toxic megacolon, gastrointestinal obstruction, inflammatory bowel disease, or previous colorectal surgery were excluded. Patients unable to provide consent or with contraindications to bowel preparation were also excluded.

Bowel Preparation Protocol

All patients were instructed to follow a clear liquid diet one day prior to colonoscopy. The clear liquid diet included water, strained broth without solid particles, pulp-free fruit juices (excluding purple-colored fruits such as grapes and blackberries), black tea or coffee without milk, and clear carbonated or non-carbonated soft drinks. Bowel cleansing was achieved using two 45 mL oral doses of sodium phosphate (NaP) solution and two 210 mL Fleet enemas. The bowel preparation was administered the day before the procedure, and a split-dose regimen was not used. Preparation began at 16:00 with the administration of the first Fleet enema, followed by one dose of NaP solution at 18:00 and another at 22:00. After each NaP dose, patients were advised to drink 2 liters of water. A final Fleet enema was administered two hours before the procedure to complete the preparation.

Colonoscopy Procedure

All colonoscopies were performed by the same surgical endoscopy team using Fujifilm series colonoscopes. Cecal intubation was confirmed by visualization of the appendiceal orifice and the ileocecal valve. Procedures were performed under sedation with intravenous midazolam (2–5 mg) and fentanyl (50 µg), or under general anesthesia when necessary. Therapeutic interventions such as biopsy, polypectomy, clip application, and argon plasma coagulation were performed when indicated.

Assessment of Bowel Cleanliness

The quality of bowel cleanliness was assessed using the Boston Bowel Preparation Scale (BBPS). The right, transverse, and left colon segments were each scored from 0 to 3. The right colon included the cecum and ascending colon; the transverse colon included the hepatic flexure, transverse colon, and splenic flexure; and the left colon included the descending colon, sigmoid colon, and rectum. The total BBPS score was the sum of the three segment scores, ranging from 0 to 9. A total BBPS score ≥ 6 was considered adequate bowel preparation. All evaluations were performed by endoscopists blinded to group allocation.

Statistical Analysis

When planning the study, it was assumed that a difference of at least 0.8–1.0 points in BBPS between the two groups would be clinically significant. With a significance level of

α=0.05 and a target power of at least 80%, it was calculated that approximately 120 patients per group would be sufficient. Considering potential dropouts, 130 patients were included in each group.

Descriptive statistics were expressed as mean, standard deviation, median, minimum–maximum, frequency, and percentage values. The distribution of quantitative variables was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Non-normally distributed continuous variables were analyzed using the Mann–Whitney U test, while categorical variables were analyzed using the Chi-square test or Fisher's exact test when appropriate. Statistical analyses were performed using SPSS version 28.0 (IBM Corp., Armonk, NY, USA), and p<0.05 was considered statistically significant.

Clinical Trial Registration: This study was registered at ClinicalTrials.gov (Identifier: NCT07295405).

RESULTS

A total of 260 patients who underwent elective colonoscopy between February and July 2025 were included in the study. Among them, 130 patients were randomized to the CW group and 130 to the LW group. The mean age of all participants was 51.6±12.1 years (range, 19–77 years), and 50.4% were male. The mean body mass index (BMI) was 28.1±5.3 kg/m². At least one comorbidity was present in 43.5% of the patients, with hypertension (23.1%) and diabetes mellitus (15.4%) being the most common. Active smoking was reported by 32.3% and alcohol consumption by 5% of participants.

Regarding bowel preparation, 97.7% of patients reported adequate fluid intake, and 97.3% demonstrated full adherence to medication instructions. Adverse effects related to the preparation process occurred in 40.4% of patients. The most common adverse effects were nausea (24.2%) and vomiting (8.5%), followed by headache (5.4%), abdominal pain (4.2%), and dizziness (2.3%). The demographic and clinical characteristics of the patients are summarized in Table 1.

The most frequent indications for colonoscopy were constipation (20.8%), screening (18.8%), and abdominal pain (18.8%). General anesthesia was used in 32.7% of procedures, and the cecal intubation success rate was 91.9%. The mean total procedure time was 8.3±3.6 minutes, and the mean withdrawal time (cecum-to-anus withdrawal time) was 3.0±1.7 minutes.

On endoscopic evaluation, 68.1% of patients had normal colonoscopy findings, while polyps were detected in 19.2%. Other findings included inadequate preparation (4.6%), diverticulosis (4.2%), tumor (2.3%), and colitis (1.5%). The mean total Boston Bowel Preparation Scale (BBPS) score was 6.9±1.99, indicating overall adequate bowel cleansing. The colonoscopy indications, procedural characteristics, and bowel preparation quality are summarized in Table 2.

No significant differences were observed between the CW and LW groups regarding age, sex distribution, or BMI (p>0.05). Lifestyle factors such as comorbidity, smoking, and alcohol use were also similar between groups. However, a family history of colorectal cancer (21.5% vs. 11.5%; p=0.030) and allergic diseases (11.5% vs. 1.5%; p=0.001) were significantly more frequent in the LW group.

Compliance with the bowel preparation protocol, including medication intake and adequate hydration, did not differ significantly between groups (p>0.05). Although the overall incidence of adverse effects was higher in the LW group (46.2% vs. 34.6%), the difference was not statistically significant (p=0.058). When specific adverse events were analyzed, nausea was significantly more frequent in the LW group (30.0% vs. 18.5%; p=0.030). No significant differences were found in other adverse effects (vomiting, abdominal pain, headache, etc.). The comparison of demographic and clinical characteristics between the cold and lukewarm water groups is presented in Table 3.

Regarding colonoscopy indications, constipation (24.6%) and abdominal pain (19.2%) were most common in the LW group, while constipation (16.9%) and rectal bleeding (13.1%) predominated in the CW group. Weight loss as an indication was observed only in the CW group, showing a statistically significant difference (p=0.013).

When procedural characteristics were evaluated, the cecal intubation rate was similar between the two groups (90.0% vs. 93.8%; p=0.255). There was no significant difference in the total procedure time (8.2±3.8 minutes vs. 8.4±3.3 minutes; p=0.881), whereas the withdrawal time was significantly shorter in the lukewarm water group (2.7±1.5 minutes vs. 3.2±1.8 minutes; p=0.003).

In terms of colonoscopic findings, the rate of normal colonoscopy was significantly higher in the LW group (73.8% vs. 62.3%; p=0.047), while inadequate bowel preparation was significantly more frequent in the CW group (7.7% vs. 1.5%; p=0.034). There were no significant differences between groups regarding the rates of polyps, diverticula, colitis, or tumors (Fig. 1).

According to the BBPS assessment, the LW group achieved significantly higher scores across all colonic segments. The mean BBPS scores for the right, transverse, and left co-

Table 1. Demographic and clinical characteristics of the patients

	Min-max	Median	Mean±SD	n	%
Age (years)	19.0–77.0	53.0	51.6±12.1		
Gender					
Female				129	49.6
Male				131	50.4
BMI (kg/m²)	8.0–48.9	27.7	28.1±5.3		
Comorbidity					
(–)				147	56.5
(+)				113	43.5
Hypertension				60	23.1
Diabetes mellitus				40	15.4
Asthma / COPD				13	5.0
Coronary artery disease				11	4.2
Other comorbidities				6	2.3
Smoking				84	32.3
Alcohol consumption				13	5.0
Allergy				17	6.5
Previous abdominal surgery				51	19.6
Family history of colorectal cancer				43	16.5
Anticoagulant use				35	13.5
Compliance with medication					
No				7	2.7
Yes				253	97.3
Adequate water intake					
No				6	2.3
Yes				254	97.7
Adverse effect					
(–)				155	59.6
(+)				105	40.4
Nausea				63	24.2
Vomiting				22	8.5
Headache				14	5.4
Abdominal pain				11	4.2
Dizziness				6	2.3
Fatigue				3	1.2
Syncope				1	0.4

SD: Standard deviation; BMI: Body mass index; COPD: Chronic obstructive pulmonary disease

lon were 2.35±0.79 vs. 2.05±0.99 (p=0.018), 2.48±0.70 vs. 2.15±0.88 (p=0.001), and 2.57±0.58 vs. 2.23±0.84 (p=0.001), respectively. The total BBPS score was also significantly higher in the LW group (7.37±1.67 vs. 6.43±2.17; p<0.001). These findings indicate that LW water consumption significantly improves the quality of bowel preparation (Fig. 2). The comparative data on colonoscopy indications, procedural characteristics, and bowel preparation quality between the cold and lukewarm water groups are presented in Table 4.

DISCUSSION

The quality of colonoscopy largely depends on adequate bowel preparation, which directly influences diagnostic accuracy and the adenoma detection rate (ADR). In contrast,

Table 2. Colonoscopy indications, procedural characteristics and bowel preparation quality

	Min-Max	Median	Mean±SD	n	%
Indication					
Constipation				54	20.8
Screening				49	18.8
Abdominal pain				49	18.8
Bleeding				37	14.2
Anemia				17	6.5
Dyspepsia				16	6.2
Positive fecal occult blood				15	5.8
Diarrhea				7	2.7
Weight loss				6	2.3
Perianal disease				5	1.9
History of polyps				5	1.9
Cecal intubation achieved				239	91.9
Procedure time (min)	1.0–27.0	8.0	8.3±3.6		
Withdrawal time (min)	0.0–13.0	3.0	3.0±1.7		
Findings					
Normal				177	68.1
Polyp				50	19.2
Poor preparation				12	4.6
Diverticulum				11	4.2
Tumor				6	2.3
Colitis				4	1.5
Bowel preparation quality (BBPS)					
Right colon	0.00–3.00	2.00	2.20±0.91		
Transverse colon	0.00–3.00	2.00	2.32±0.81		
Left colon	0.00–3.00	3.00	2.40±0.74		
Total BBPS score	0.00–9.00	7.00	6.90±1.99		

inadequate bowel preparation reduces the sensitivity of colonoscopy, prolongs the procedure time, increases the risk of adverse events, and raises the likelihood and cost of repeat examinations.[8] Several scales have been developed to assess the quality of bowel preparation, including the BBPS, the Ottawa Scale, and the Aronchick Scale. Among these, the BBPS is recognized as the most valid and widely used scoring system for evaluating bowel cleanliness.[1] In the present study, bowel cleanliness was assessed using the BBPS.

In this prospective observational study, we investigated the effects of water temperature consumed during bowel preparation on bowel cleansing quality, procedure duration, and patient tolerance before elective colonoscopy. Our findings demonstrated that patients who consumed LW had significantly higher BBPS scores, shorter withdrawal times, and greater overall satisfaction. These results suggest that water temperature, a variable not sufficiently explored in the literature, may represent a clinically meaningful factor influencing bowel preparation quality.

Physiologically, the temperature of ingested fluids can affect gastric and intestinal motility. Sun et al.[9] reported that both cold (4°C) and hot (50°C) water delayed gastric emptying, whereas fluids at 37°C accelerated it. Similarly, Fujihira et al.[10] demonstrated that cold water (2°C) suppressed gastric contractions compared to warm (37°C) and hot (60°C) water. These physiological mechanisms suggest that warm water may facilitate intestinal transit and enhance the efficacy of bowel preparation. In our study, the higher BBPS scores observed in the LW group may represent the clinical reflection of this physiological effect.

Table 3. Comparison of demographic and clinical characteristics between cold and Lukewarm Water Groups

	Cold (n=130)				Lukewarm (n=130)				p	
	Mean±SD	n	%	Median	Mean±SD	n	%	Median		
Age (years)	50.5±12.2			53.0	52.7±11.9			53.5	0.188	m
Gender										
Female		62	47.7			67	51.5		0.535	X^2
Male		68	52.3			63	48.5			
BMI (kg/m²)	27.7±5.0			27.6	28.4±5.5			28.0	0.177	m
Comorbidity										
(-)		80	61.5			67	51.5		0.104	X^2
(+)		50	38.5			63	48.5			
Smoking		36	27.7			48	36.9		0.112	X^2
Alcohol consumption		5	3.8			8	6.2		0.393	X^2
Allergy		2	1.5			15	11.5		0.001	X^2
Previous abdominal surgery		21	16.2			30	23.1		0.160	X^2
Family history of colorectal cancer		15	11.5			28	21.5		0.030	X^2
Anticoagulant use		15	11.5			20	15.4		0.364	X^2
Medication compliance										
No		4	3.1			3	2.3		0.702	X^2
Yes		126	96.9			127	97.7			
Adequate water intake										
No		3	2.3			3	2.3		1.000	X^2
Yes		127	97.7			127	97.7			
Adverse effects										
(-)		85	65.4			70	53.8		0.058	X^2
(+)		45	34.6			60	46.2			
Nausea		24	18.5			39	30.0		0.030	X^2
Vomiting		14	10.8			8	6.2		0.181	X^2
Fatigue		2	1.5			1	0.8		1.000	X^2
Abdominal pain		8	6.2			3	2.3		0.123	X^2
Headache		4	3.1			10	7.7		0.099	X^2
Dizziness		2	1.5			4	3.1		0.409	X^2
Syncope		0	0.0			1	0.8		1.000	X^2

m: Mann-whitney u test; X^2: Chi-square test (Fischer test). SD: Standard deviation; BMI: Body mass index

Zessner-Spitzenberg et al.,[1] using the Aronchick Scale, reported that patients with excellent or good bowel preparation had higher ADR and greater success in completing colonoscopy. Interestingly, they also observed that the mean number of detected polyps increased as the quality of bowel preparation decreased. Pantaleón Sánchez et al.[11] found that patients with IBC who underwent repeat colonoscopy within a short interval had a higher incidence of adenomas, serrated polyps, and colorectal cancer. Similarly, Wong et al.[12] reported that poorer bowel preparation was associated with a lower neoplasia detection rate. In the present study, although the detection rate of polyps was proportionally higher in the CW group, this difference was not statistically significant.

Previous studies have demonstrated that patient education prior to colonoscopy can improve bowel preparation quality and shorten procedure duration.[13,14] In our study, all patients received face-to-face instruction, which may have contributed to the high rate of adequate preparation. The mean total BBPS score was 6.9±1.99, indicating an overall satisfactory level of bowel cleanliness.

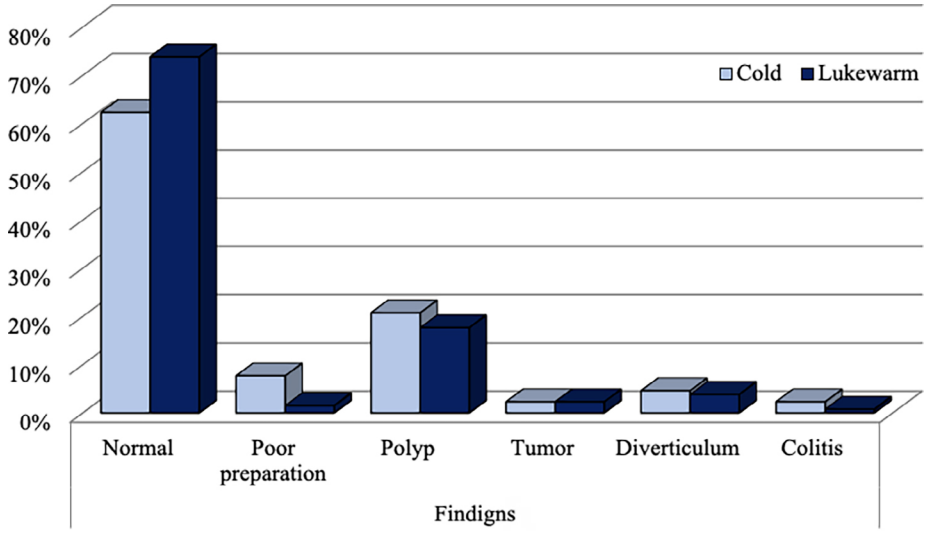

Figure 1. Distribution of colonoscopic findings in the cold-water (CW) and lukewarm-water (LW) groups

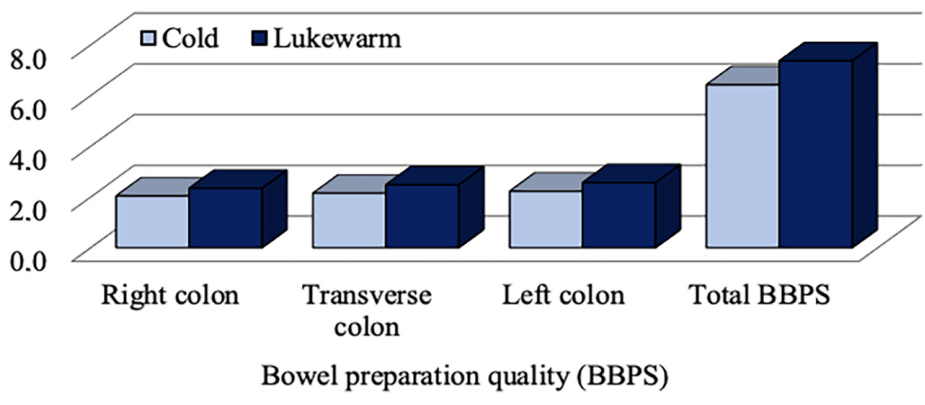

Figure 2. Comparison of Boston bowel preparation

Before colonoscopy, a low-residue diet (LRD) or clear liquid diet (CLD) is commonly recommended.[8] Song et al.[15] reported that an LRD did not affect the quality of bowel preparation compared with a CLD but improved patient tolerance. Patients following an LRD demonstrated better compliance with the bowel preparation regimen, fewer side effects, and a greater willingness to repeat the same regimen in the future. Similarly, Alvarez-Gonzalez et al.[16] found that an LRD provided superior tolerability as well as more adequate bowel cleansing. For these reasons, the European Society of Gastrointestinal Endoscopy (ESGE) guidelines recommend an LRD prior to colonoscopy.[17] In the present study, all patients followed a CLD, which resulted in adequate bowel cleansing.

According to the ESGE guidelines, both HV and LV PEG-based regimens, as well as non-PEG-based regimens, can be used for bowel preparation.[17] Hernandez et al.,[18] in a study comparing low-, medium-, and high-volume bowel preparation agents in hospitalized patients, reported that LV regimens could be preferred due to their comparable cleansing efficacy and better tolerability. Scalvini et al.[19] compared 1 L-PEG, 2 L-PEG, and MCSP regimens and demonstrated that the 1 L-PEG regimen provided superior bowel cleansing. Similarly, Waldmann et al.[20] found no significant difference between high- and low-volume preparations in terms of bowel cleansing quality.

In the present study, an oral NaP preparation was used and supported with an enema. Overall bowel cleansing was

Table 4. Comparison of colonoscopy ındications, procedural characteristics, and bowel preparation quality between cold and Lukewarm Water Groups

	Cold (n=130)				Lukewarm (n=130)				p	
	Mean±SD	n	%	Median	Mean±SD	n	%	Median		
Indication										
Screening		23	17.7			26	20.0		0.634	X^2
Weight loss		6	4.6			0	0.0		0.013	X^2
Anemia		10	7.7			7	5.4		0.452	X^2
Fecal occult blood (FOB)		9	6.9			6	4.6		0.425	X^2
Bleeding		17	13.1			20	15.4		0.594	X^2
Dyspepsia		10	7.7			6	4.6		0.302	X^2
Abdominal pain		24	18.5			25	19.2		0.874	X^2
Diarrhea		3	2.3			4	3.1		0.702	X^2
Constipation		22	16.9			32	24.6		0.125	X^2
Perianal disease		4	3.1			1	0.8		0.176	X^2
History of polyps		2	1.5			3	2.3		0.652	X^2
Cecal intubation achieved		117	90.0			122	93.8		0.255	X^2
Procedure time (min)	8.2±3.8			8.0	8.4±3.3			8.0	0.881	m
Withdrawal time (min)	3.2±1.8			3.0	2.7±1.5			2.0	0.003	m
Findings										
Normal		81	62.3			96	73.8		0.047	X^2
Poor preparation		10	7.7			2	1.5		0.034	X^2
Polyp		27	20.8			23	17.7		0.580	X^2
Tumor		3	2.3			3	2.3		1.000	X^2
Diverticulum		6	4.6			5	3.8		1.000	X^2
Colitis		3	2.3			1	0.8		0.620	X^2
Bowel preparation quality (BBPS)										
Right colon	2.05±0.99			2.00	2.35±0.79			3.00	0.018	m
Transverse colon	2.15±0.88			2.00	2.48±0.70			3.00	0.001	m
Left colon	2.23±0.84			2.00	2.57±0.58			3.00	0.001	m
Total BBPS	6.43±2.17			7.00	7.37±1.67			8.00	0.000	m

m: Mann-whitney u test; X^2: Chi-square test (Fischer test). SD: Standard deviation

adequate, and 97.3% of patients reported full compliance with the medication regimen.

Split-dose administration is widely recommended to enhance bowel cleansing quality and improve patient compliance. Numerous studies in the literature have shown that split-dose regimens improve both cleansing efficacy and patient tolerance. Menees et al.[21] reported that split-dose bowel preparation significantly increased the quality of bowel cleansing. Likewise, Tian et al.,[22] in a randomized controlled trial comparing two low-volume split-dose PEG electrolyte regimens before morning colonoscopy, found that the 1.5 L (evening) + 0.75 L (morning) regimen achieved higher cleansing efficacy than the 0.75 L (evening) + 1.5 L (morning) regimen, with both achieving adequate bowel preparation rates exceeding 80%.

Additionally, Yadlapati et al.[23] demonstrated that split-dose administration in hospitalized patients improved the adequacy of preparation and reduced the need for repeat colonoscopy.

In our study, although a split-dose protocol was not applied, bowel cleansing was still found to be satisfactory, suggesting that other variables—such as water temperature—may have contributed to preparation quality.

The timing of bowel preparation administration is another critical factor influencing colonoscopy success. Several studies have shown that taking the final dose of the preparation closer to the procedure time significantly improves cleansing quality. Seo et al.[24] reported that when the interval between the last dose and the start of colonoscopy was 3–5 hours, bowel cleansing quality was superior. Similarly, Gao et al.,[25] in a meta-analysis, showed that shortening the interval between bowel preparation and colonoscopy resulted in better cleansing and higher polyp detection rates.

In line with these findings, the ESGE guideline recommends that the final dose of the preparation should be taken no more than 5 hours and completed at least 2 hours before colonoscopy.[17]

In the present study, despite the interval between the last dose and colonoscopy exceeding 5 hours, bowel cleansing was still found to be adequate.

In addition to efficacy, the safety profile of bowel preparation agents is of paramount importance. Tadano et al.[26] reported that bowel cleansing agents were associated with 78 serious adverse events, including intestinal obstruction, ischemic colitis, electrolyte disturbances, spontaneous esophageal rupture, Mallory–Weiss syndrome, and anaphylaxis. Hernandez et al.[18] also noted that low-volume preparations were associated with fewer complaints of unpleasant taste and nausea.

Reumkens et al.[6] compared NaP and high-volume PEG solutions and found that the incidence of hypokalemia was significantly higher in the NaP group (17.2%) compared with the PEG group (4.8%). The rates of hyponatremia were 0.9% vs. 3.3%, hyperphosphatemia 37.3% vs. 0.65%, and hypocalcemia 15.6% vs. 8.1%, respectively. Kamran et al.[27] reported that the use of adjunct agents during bowel preparation reduced adverse effects such as bloating and vomiting. In our study, adverse events related to the preparation process were observed in 40.4% of patients, most commonly nausea (24.2%) and vomiting (8.5%), while headache (5.4%), abdominal pain (4.2%), and dizziness (2.3%) were less frequent. No serious adverse events were observed.

Identifying risk factors associated with inadequate bowel preparation is crucial to improving colonoscopy quality. Scalvini et al.[19] identified male sex, history of constipation, smoking, previous pelvic surgery, and the presence of psychiatric, neurological, or renal disorders as predictors of poor bowel cleansing. Wong et al.[12] associated advanced age and smoking with inadequate preparation. Sadeghi et al.[28] found that older age, BMI > 25 kg/m², abdominal circumference >95 cm, smoking, low fruit-and-vegetable intake, low literacy, and low physical activity were correlated with insufficient preparation. Similarly, Shi et al.[29] identified male sex, inpatient status, and the spring season as independent risk factors for poor bowel cleansing. Therefore, in patients at high risk for inadequate bowel preparation, enhanced education and optimized preparation protocols may help improve cleansing quality.

Overall, our study is consistent with previous literature and highlights that "water temperature," a factor not previously emphasized, may also play a significant role in bowel preparation quality. This parameter represents a cost-free and easily applicable improvement strategy that could be incorporated into clinical practice.

This study has several limitations. Being conducted at a single center with a relatively limited sample size and the inability to fully monitor at-home preparation conditions may have influenced the results to some extent. Nevertheless, the prospective design, balanced group allocation, and use of a standardized bowel preparation protocol strengthen the reliability and overall validity of the findings.

CONCLUSION

This study demonstrates that the temperature of the water consumed during bowel preparation before colonoscopy has a clinically significant impact on the quality of bowel cleansing and procedural efficiency. The use of lukewarm water was found to significantly improve bowel preparation scores, shorten withdrawal time, and enhance patient comfort. These findings indicate that not only the volume but also the temperature of hydration is a determining parameter in bowel preparation.

From a clinical standpoint, the use of lukewarm water represents a simple, safe, cost-free, and easily applicable method that may be integrated into routine bowel preparation protocols. This approach has the potential to improve both endoscopic image quality and patient satisfaction, thereby enhancing the diagnostic efficacy of colonoscopy.

Future multicenter randomized studies investigating the potential effects of water temperature on adenoma detection rate, intestinal microbiota composition, and electrolyte balance will help further clarify the clinical relevance of this parameter. Moreover, its impact on patient comfort and cost-effectiveness, particularly in repeated colonoscopies, should be further supported by subsequent research.

Disclosures

Ethics Committee Approval: The study was approved by the Bakırköy Dr. Sadi Konuk Training and Research Hospital Non-interventional Ethics Committee (No: 2024-15-17, Date: 25/12/2024).

Informed Consent: Written informed consent was obtained from all participants before inclusion, and the study was performed in accordance with the principles of the Declaration of Helsinki.

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