ORIGINAL PAPER
ORYGINALNY ARTYKUŁ NAUKOWY

Health Prob Civil. 2023, Volume 17, Issue 3
ISSN 2353-6942

# THE EFFECT OF AN EDUCATIONAL VIDEO ON PATIENTS' BOWEL PREPARATION BEFORE COLONOSCOPY: A SINGLE-BLIND RANDOMIZED CONTROLLED STUDY

# WPŁYW FILMU EDUKACYJNEGO NA PRZYGOTOWANIE JELIT DO BADANIA U PACJENTÓW PRZED KOLONOSKOPIĄ: RANDOMIZOWANE, KONTROLOWANE BADANIE Z POJEDYNCZĄ ŚLEPĄ PRÓBĄ

**Ayşegül Güneş**[1(A,B,E,F)], **Yasemin Eda Tekin**[2(A,E)], **Çiçek El**[3(A,B,D)], **Hasan Bektaş**[3(A,B)]

[1] Nursing Department, Faculty of Health Sciences, Beykent University, Istanbul, Türkiye
[2] Nursing Department, Faculty of Health Sciences, Mudanya University, Bursa, Türkiye
[3] Çam ve Sakura City Hopital, Istanbul, Türkiye

Authors' contribution
Wkład autorów:
A. Study design/planning
zaplanowanie badań
B. Data collection/entry
zebranie danych
C. Data analysis/statistics
dane – analiza i statystyki
D. Data interpretation
interpretacja danych
E. Preparation of manuscript
przygotowanie artykułu
F. Literature analysis/search
wyszukiwanie i analiza literatury
G. Funds collection
zebranie funduszy

Tables: 5
Figures: 2
References: 25
Submitted: 2023 Jun 17
Accepted: 2023 Jul 14

**Summary**

**Background.** The objective of this research was to assess the efficacy of bowel preparation (BP) and colonoscopy compliance of video training given to patients prior to colonoscopy.
**Material and methods.** In this single-blind randomized controlled study, patients in the control group received traditional written instructions with the same content as oral instructions. A total of 139 patients were included in the study, 70 of whom were allocated to the video education group, and 69 to the traditional education group. After the procedure, both groups' BP quality and satisfaction with education were measured. Sociodemographic Characteristics Form, Boston Bowel Preparation Scale, Colonoscopy Preparation Compliance Form, and Education Satisfaction Form were used in the study.
**Results.** The BP quality scores of the patients in the video group were found to be higher than the traditional method ($p$<0.05). In addition, it was found that the educational satisfaction scores, general BP compliance score, solid diet compliance scores, and liquid diet compliance scores were higher in the video group than in the traditional method patients ($p$<0.05).
**Conclusions.** Video-based colonoscopy preparation training is an effective alternative to traditional methods.

**Keywords:** bowel preparation, video education, instructional film and video, colonoscopy, patient education

**Streszczenie**

**Wprowadzenie.** Celem niniejszego badania była ocena skuteczności filmu edukacyjnego na temat przygotowania jelit do badania, zaprezentowanego pacjentom przed kolonoskopią.
**Materiał i metody.** W tym randomizowanym, kontrolowanym badaniu z pojedynczą ślepą próbą, pacjenci w grupie kontrolnej otrzymywali tradycyjne pisemne instrukcje o takiej samej treści jak instrukcje ustne. Do badania włączono łącznie 139 pacjentów, spośród których 70 przydzielono do grupy objętej edukacją z wykorzystaniem filmu, a 69 do grupy z edukacją tradycyjną. Po zabiegu w obu grupach mierzono jakość przygotowania jelit i zadowolenie z edukacji. W badaniu wykorzystano Formularz Charakterystyki Socjodemograficznej, Skalę Boston, Formularz Przestrzegania Zaleceń Przygotowania do Kolonoskopii oraz Formularz Satysfakcji z Edukacji.
**Wyniki.** Stwierdzono, że wyniki dotyczące jakości przygotowania jelit u pacjentów w grupie objętej edukacją z wykorzystaniem filmu były wyższe niż w przypadku metody tradycyjnej ($p$<0,05). Ponadto stwierdzono, że wyniki satysfakcji z edukacji, ogólny wynik przestrzegania zaleceń przygotowania jelit, wyniki przestrzegania diety stałej i wyniki przestrzegania diety płynnej były wyższe w grupie z wykorzystaniem filmu niż u pacjentów stosujących metodę tradycyjną ($p$<0,05).
**Wnioski.** Szkolenie w zakresie przygotowania do kolonoskopii oparte na filmie stanowi skuteczną alternatywę dla tradycyjnych metod.

**Słowa kluczowe:** przygotowanie jelit, edukacja wideo, film instruktażowy, kolonoskopia, edukacja pacjentów

Güneş A, Tekin YE, El Ç, Bektaş H. The effect of an educational video on patients' bowel preparation before colonoscopy: a single-blind randomized controlled study. Health Prob Civil. 2023; 17(3): 226-235. https://doi.org/10.5114/hpc.2023.130496

**Address for correspondence / Adres korespondencyjny:** Ayşegül Güneş, Faculty of Health Sciences, Beykent University, Cumhuriyet Street, 34500 Istanbul, Türkiye, e-mail: aysegulgunes@beykent.edu.tr, phone: +90 4441997.

## Introduction

Colonoscopy is a standard method for identifying colorectal abnormalities in the overall population and in individuals at higher risk. The detection rate of colorectal adenomas is significantly correlated with bowel cleansing. Inadequate bowel preparation (BP) makes the diagnosis difficult since endoscopists are unable to observe the intestinal mucosa clearly and have difficulties in conducting the procedure. In this case, the detection rate of lesions decreases [1,2].

Inadequate BP is often directly related to patient compliance. The quality of BP is affected by a variety of factors, including age, gender identity, education, and income [3]. Prior to colonoscopy, BP education is critical for a patient's healthy BP, the proper administration of prescribed medications, and adequate dietary restrictions.

In addition to conventional forms of education such as oral and written instruction, many techniques have been used to help the patient better understand BP. These techniques are booklets, brochures, cartoons, telephones, text messages, mobile applications, and training videos [4-11]. These studies show that training with different training methods enhances the quality of BP and the rate of adenoma determination [9,12]. This finding shows the importance of using various educational strategies to improve patients' compliance with colonoscopies [13].

However, training on BP is usually given only once due to time constraints; for this purpose, nurses should be assigned to this subject. In addition, especially for elderly patients, training on this subject should be given both verbally and in writing because they contain instructions that are difficult to remember [14]. Many studies use online video education methods for BP [8,9,15-19]. However, the results of these studies are not consistent sufficiently [14].

The objective of the present study was to assess the impact of pre-colonoscopy video education on BP quality and patients' adherence with regard to colonoscopy.

## Material and methods

*Participants*

The randomized, prospective, single-blinded and single-center study was planned and conducted between March 2022 and June 2022 in the Başakşehir Çam and Sakura City Hospital Endoscopy Unit (Istanbul, Türkiye), among patients undergoing first-time screening or diagnosis colonoscopy under local anesthesia.

The participants in the study had not undergone colonoscopy before, were over 18, and had no intellectual disability. The study's exclusion criteria included a history of intestinal surgery, being pregnant or breastfeeding, and being visually impaired.

The size of the sample was determined by applying G power 3.1. program, which is the tool to compute statistical power analyses. It was estimated that the difference between the quality of the BPs of the groups would be compared with a one-way analysis of variance, with the assumption that α error would be 5%, the research power would be 95%, with a practical value of 0.64, and at least 54 people should be included in each group. Considering the problems that may be experienced during the research process, a total of 140 patients, 70 patients in each group, were included in the study. The study concluded with 139 patients because one patient in the traditional education group did not undergo a colonoscopy procedure (70 were in the video education group, and 69 were in the conventional education group).

*Study procedure*

The research procedure was designed as follows, adhering to the routine colonoscopy preparation procedure of the hospital where the study was conducted:

1. After the decision to perform a colonoscopy, it was decided whether the patient was suitable for the study (approximately two weeks before the colonoscopy).
2. As a result of the evaluation, 15 of the patients were excluded from the study because of previous colonoscopy and two of the patients were postoperative.
3. Patients were randomly allocated to the video group and to the control group using a numerical distribution algorithm generated by the randomisers.org website.
4. Patients in both groups were informed of the purpose of the study and consented to participate.
5. Verbal bowel cleansing instructions and a brochure were given to the patients in the control group following the hospital's routine preparation procedure. In addition to this standard preparation, the patients in the video training group were shown a video covering the training content.
6. The training video was uploaded to a website, and patients were sent the website's address via WhatsApp or e-mail. Individuals were advised to view the video two weeks prior to their colonoscopy and one week prior to their BP.
7. Prior to the day of the colonoscopy, all patients completed the Sociodemographic Characteristics Form regarding age, gender, BMI, educational status, marital status, chronic disease status, frequency of regular defecation and amount of medication consumption.
8. After the procedure, both groups' BP quality and satisfaction with their instruction were measured. Boston Bowel Preparation Scale (BBPS), Colonoscopy Preparation Compliance Form, and Education Satisfaction Form were used in the study.

Patients were informed by the endoscopy nurse, while the procedure of colonsocopy and the assessment of the patient was performed by a physician who did not know which group the patients were in.

*BP procedures and educational video content*

The education content includes information on the importance of BP, the use of laxatives and other instructions. In addition, all patients were given written instructions on food restriction and laxative use.

We designed a 3-minute BP video with standard written and verbal preparation instructions. The video content is consistent with the verbal training given. In addition, the video consists of attractive visuals that show the clinical importance of BP, including photographs of optimal and poor BP (Figure 1).


**Figure 1.** The training video in Turkish

*Measurement Forms*

The Sociodemographic Characteristics Form, BBPS, Colonoscopy Preparation Compliance Form, and Education Satisfaction Form were used in the study.

The Colonoscopy Preparation Compliance Form consists of 3 parts. The first part of the data collection form evaluates the level of compliance with colonoscopy preparation, the second part evaluates the level of compliance with solid diet and the third part evaluates the level of compliance with liquid diet with a 0-10 scale.

Education Satisfaction Form was used to assess the level of satisfaction with bowel preparation training (5 – Very satisfied, 4 – Satisfied, 3 – Undecided, 2 – Dissatisfied, 1 –Unsatisfied).

BBPS contains detailed statements to determine the level of bowel cleansing during colonoscopy [15]. The endoscopist evaluated the patient's BP with the use of this scale (Table 1).

**Table 1.** Boston Bowel Preparation Scale [15]

| | |
|---|---|
| **0** | "Unprepared colon segment with mucosa not seen due to solid stool that cannot be cleared'' |
| **1** | "Portion of mucosa of the colon segment seen, but other areas of the colon segments not well seen due to staining, residual stool and/or opaque liquid'' |
| **2** | "Minor amount of residual staining, small fragments of stool and/or opaque liquid, but mucosa of colon segment seen well'' |
| **3** | "Entire mucosa of colon segment seen well with no residual staining, small fragments of stool or opaque liquid'' |

*Ethics*

The institutional review board approved the study, the Clinical Research Ethics Committee of the Başakşehir Çam and Sakura City Hospital (approval no. 2021.12.275 ). In this study in which human subjects were involved, all protocols were conducted in accordance with institutional and national ethical guidelines and in accordance with the Declaration of Helsinki of 1964 and its subsequent amendments or equivalent ethical guidelines. All patients were provided with informed consent in writing.

*Statistical analysis of data*

The data obtained in the research were analyzed using the SPSS (Statistical Package for Social Sciences) for Windows 22.0 program. Number, percentage, mean, and standard deviation were used as descriptive statistical methods to evaluate the data. Differences between the ratios of categorical variables in independent groups were analyzed with Chi-square and Fisher's exact tests. The t-test was used to compare continuous quantitative data between two separate groups, and Pearson correlation analysis was applied between the constant variables of the study. *P*-value≤0.05 was considered statistically significant.

## Results

Research data were obtained from patients self-reporting and the clinical evaluation of the colonoscopist. To analyze the findings, we cooperated with a statistician who is an expert in the field. The demographic characteristics of the patients in the experimental and control groups and their clinical information that may be related to colonoscopy are given in Table 2.

**Table 2.** Demographics and clinical characteristics (n=139)

| Features | Total (n=139) | | Video (n=70) | | Control (n=69) | | *p*-value |
|---|---|---|---|---|---|---|---|
| **Age** | 51.1 | ±12.7 | 50.7 | ±12.2 | 51.4 | ±13.4 | t=0.311** *p*=0.756 |
| **Gender** | | | | | | | $X^2$=3.808* ***p*=0.037** |
| **Female** | 76 | 54.7 | 44 | 62,9 | 32 | 46.4 | |
| **Male** | 63 | 45.3 | 26 | 37.1 | 37 | 53.6 | |
| **Educational status** | | | | | | | |
| **Illiterate** | 11 | 7.9 | 4 | 5.7 | 7 | 10.1 | $X^2$=3.813* *p*=0.432 |
| **Primary school** | 56 | 40.3 | 31 | 44.3 | 25 | 36.2 | |
| **Middle school** | 27 | 19.4 | 16 | 22.9 | 11 | 15.9 | |
| **High school** | 31 | 22.3 | 14 | 20 | 17 | 24.6 | |
| **University** | 14 | 10.1 | 5 | 7.1 | 9 | 13 | |
| **Marrital status** | | | | | | | |
| **Married** | 118 | 84.9 | 60 | 85.7 | 58 | 84.1 | $X^2$=0.074* *p*=0.486 |
| **Single** | 21 | 15.1 | 10 | 14.3 | 11 | 15.9 | |
| **BMI** | | | | | | | |
| **Weak** | 4 | 2.9 | 2 | 2.9 | 2 | 2.9 | $X^2$=2.637* *p*=0.756 |
| **Normal** | 28 | 20.1 | 15 | 21.4 | 13 | 18.8 | |
| **Overweight** | 57 | 41.0 | 27 | 38.6 | 30 | 43.5 | |
| **1st degree obese** | 28 | 20.1 | 15 | 21.4 | 13 | 18.8 | |
| **2nd degree obese** | 20 | 14.4 | 11 | 15.7 | 9 | 13 | |
| **Morbidly obese** | 2 | 1.4 | 0 | 0 | 2 | 2.9 | |
| **Chronic disease status** | | | | | | | |
| **Yes** | 67 | 48.2 | 32 | 45.7 | 35 | 50.7 | $X^2$=0.349* *p*=0.337 |
| **No** | 72 | 51.8 | 38 | 54.3 | 34 | 49.3 | |
| **Frequency of defecation** | | | | | | | |
| **1 time per day** | 52 | 37.4 | 24 | 34.3 | 28 | 40.6 | $X^2$=5.318* *p*=0.150 |
| **2-3 times per day** | 53 | 38.1 | 24 | 34.3 | 29 | 42 | |
| **Every 2-3 days** | 22 | 15.8 | 16 | 22.9 | 6 | 8.7 | |
| **Once a week** | 12 | 8.6 | 6 | 8.6 | 6 | 8.7 | |

Notes: Values presented as Mean SD or n (column %); BMI = body mass index; *$X^2$ Chi-square Analysis; $p<0.05$; ** Independent Groups t-test.

A total of 139 colonoscopies were analyzed. Seventy (50.3%) patients were in the video group, and 69 (49.7%) in the control group. No significant correlation was found between the groups in terms of age, education level, marital status, BMI, chronic disease status, and frequency of defecation typically ($p$>0.05). A significant relationship was found between gender and groups ($p$<0.05). In the control group, 32 (46.4%) were female, and 37 (53.6%) were male. In the video group, 44 (62.9%) were female, and 26 (37.1%) were male (Table 2).

Table 2 shows the distribution of bowel cleansing proficiency of the patients according to the groups. BP quality scores of the patients differ significantly according to the groups (t(137)=-2.893; $p$=0.004). BP evaluation scores in the video group ($\bar{x}$=1.610) were higher than the control group ($\bar{x}$=1.190). When bowel cleansing adequacy was compared by the classification in BBPS (Table 3), it was revealed that the quality of BP of the patients in the video training group was better than the patients in the control group ($p$<0.05).

**Table 3.** Bowel preparation status of the patients (n=139)

| Groups | Total (n=139) | | Video (n=70) | | Control (n=69) | | $p$-value | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | | | | |
| **Bowel preparation evaluation** | | | | | | | | | | |
| **Class 0** | 27 | 19.4 | 11 | 15.7 | 16 | 23.2 | $X^2$=11,781 **$p$=0.008** | | | |
| **Class 1** | 40 | 28.8 | 13 | 18.6 | 27 | 39.1 | | | | |
| **Class 2** | 61 | 43.9 | 38 | 54.3 | 23 | 33.3 | | | | |
| **Class 3** | 11 | 7.9 | 8 | 11.4 | 3 | 4.3 | | | | |
| **Boston Bowel Preparation score** | | | | | | | | | | |
| **Scores** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Min** | **Max** | **t*** | **$p$** |
| | 1.40 | 0.89 | 1.610 | 0.889 | 1.190 | 0.845 | 0 | 3 | -2.893 | **0.000** |

Notes: $X^2$ – Chi-Square Analysis; * Independent Groups t-test.

The mean scores for compliance with general preparation, compliance with a solid diet, and liquid diet differ significantly according to the groups ($p$<0.05). General preparation compliance scores ($\bar{x}$=8.840, $\bar{x}$=8.070), solid diet compliance scores ($\bar{x}$=8.760, $\bar{x}$=6.550), and liquid diet compliance scores ($\bar{x}$=8.590, $\bar{x}$=7.490) were higher in the video group than in the control group (Table 4).

**Table 4.** Mean scores according to groups (n=139)

| Variables | Total (n=169) | | Video (n=70) | | Control (n=69) | | Min | Max | t* | $p$-value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | | | | |
| **Education satisfaction** | 3.80 | 0.8 | 4.190 | 0.597 | 3.410 | 0.810 | 1 | 5 | -6.468 | **0.004** |
| **General preparation compliance** | 8.460 | 1.337 | 8.840 | 1.058 | 8.070 | 1.478 | 3 | 10 | -3.536 | **0.001** |
| **Solid diet compliance** | 7.660 | 1.998 | 8.760 | 1.209 | 6.550 | 2.033 | 2 | 10 | -7.790 | **0.000** |
| **Liquid diet compliance** | 8.040 | 1.610 | 8.590 | 1.335 | 7.490 | 1.686 | 2 | 10 | -4.241 | **0.000** |

Notes: * Independent Groups t-test.

The relationship between adherence to general preparation, compliance with solid diet, compliance with liquid diet and BBPS score was analyzed with correlation analysis. A poor positive correlation (r=0.382, $p$=0.000<0.05) was found between compliance with a solid diet and compliance with colonoscopy preparation, and a poor positive correlation (r=0.445, $p$=0.000<0.05) was found between compliance with a liquid diet and adherence to colonoscopy preparation (Table 5).

The educational satisfaction scores of the patients differ significantly according to the group (t(137)=-6.468; $p$<0.05) (Table 5). Education satisfaction scores in the video group ($\bar{x}$=4.190) were higher than the control group ($\bar{x}$=3.410) (Figure 2).

**Table 5.** Correlation analysis

| Variables | | General preparation compliance | Solid diet compliance | Liquid diet compliance | Bowel preparation quality |
|---|---|---|---|---|---|
| **General preparation compliance** | **r** | 1.000 | - | - | - |
| | ***p*** | 0.000 | - | - | - |
| **Solid diet compliance** | **r** | 0.382** | 1.000 | - | - |
| | ***p*** | 0.000 | 0.000 | - | - |
| **Liquid diet compliance** | **r** | 0.445** | 0.505** | 1.000 | - |
| | ***p*** | **0.000** | **0.000** | **0.000** | - |
| **Bowel preparation quality** | **r** | 0.202* | 0.163 | 0.220** | 1.000 |
| | ***p*** | **0.017** | 0.056 | **0.009** | 0.000 |

Notes: *<0.05; **<0.01; Pearson Correlation Analysis.

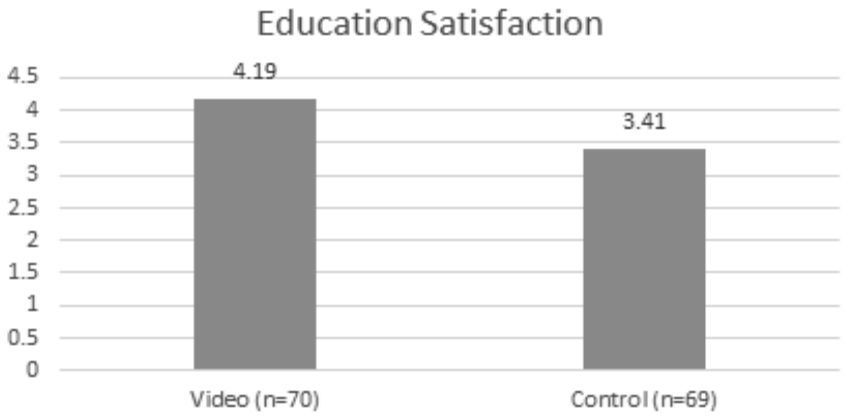


**Figure 2.** Education satisfaction scores

129 (92.8%) of the patients were satisfied with the education they received. BP evaluation scores of the patients differ significantly according to their educational satisfaction (t(137)=2.255; $p$=0.026).

No relationship was found between the patients' gender, BMI, chronic disease status, education level, marital status, income level, family history of colon cancer, frequency of defecation, BP quality, adequate preparation, and satisfaction with the education they received ($p$>0.05). No significant correlation was found between the mean age and BMI of the patients and their satisfaction with education ($p$>0.05).

## Discussion

Colonoscopy is recognized as the most reliable method for detecting colorectal cancer and other malignancies. Moreover, BP quality is critical to the procedure's success [20]. However, this process may fail due to patient-related factors such as low motivation low health literacy or institutional factors such as understaffing and excessive workload. The literature contains many studies stating that traditional education methods are ineffective for achieving the desired BP quality. Therefore alternative methods are investigated [4-11,21].

Today, rapidly developing technological methods are used to increase the effectiveness of health education. Video education, one of these methods, can be used to supplement traditional education methods in intensive care units, as it allows individuals to accurately repeat the points they do not understand or forget during conventional education. Pilliai's study stated that video BP training creates a significant difference between the quality of BP and the level of knowledge about colonoscopy in individuals with poor education (Afro-American) [17]. Similarly, in a 2022 study examining the effect of interactive videos, it was discovered that video education was effective among African-Americans and the elderly (>65 years old) people [22].

The bowel cleansing procedure can be unusual and complex for many patients. Checking whether this complex content is understood by patients is a crucial step for the success of education. In the study of Liu et al., in addition to the BP video training, the effect of the retelling procedure was examined, and it was revealed that the patients in the experimental group had higher BP scores [23]. Virtual reality-based video applications, which are increasingly used in health education, are also used to increase the effectiveness of bowel cleansing education. The study published in 2019 stated that the BP scores of the video training group given a virtual reality-based BP process were higher [13,16,24,25]. In the results obtained in our study, similar to the literature, it was found that video training has a significant positive effect on BP quality and is an effective method.

If the individual adopts the education method for BP given to the patients and encourages cooperation, the quality of bowel preparation is positively affected. In our study, the satisfaction level with the treatment of the patients in the experiment group was significantly higher than in the control group. In similar studies mentioned in the literature, it may be observed that the evaluation of patient satisfaction level is underrepresented. Prakash's study stated that there was no difference between the post-procedure satisfaction levels of the people in the experimental and control groups [8]. A study by Walker et al. [24] reported that the training method did not affect patient satisfaction. On the contrary, patients in the video education group stated they understood the preparation materials more efficiently. Therefore, video education provides cooperation between the health professional and the patient individual on patient education, satisfaction and usefulness. Therefore, patient opinions on this issue should also be investigated [22].

*Limitations*

The fact that endoscopy times were not recorded can be considered a limitation.

## Conclusions

Although the preparation for colonoscopy includes similar steps in general terms, the preparation details may differ. For this reason, it would be appropriate for each institution to create video content to support the BP process. It is important to present video content with proper tools (compatible with mobile phones, sending them by e-mail or mirroring them on screens in clinics, etc.) by considering factors such as chronic illness and education level of patients, to eliminate possible information gaps, correct mistakes and increase patient compliance.

## Disclosures and acknowledgements

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article. The research was funded by the authors.

**References:**


1. Bernstein MT, Garber J, Faucher P, Reynolds KA, Restall G, Walker JR, et al. New patient education video on colonoscopy preparation: development and evaluation study. JMIR Human Factors. 2020; 7(4): 5353. https://doi.org/10.2196/15353
2. Jeon SC, Kim JH, Kim SJ, Kwon HJ, Choi YJ, Jung K et al. Effect of sending educational video clips via smartphone mobile messenger on bowel preparation before colonoscopy. Clinical endoscopy. 2019; 52(1): 53-58. https://doi.org/10.5946/ce.2018.072
3. Mahmood S, Farooqui SM, Madhoun MF. Predictors of inadequate bowel preparation for colonoscopy: a systematic review and meta-analysis. European Journal of Gastroenterology & Hepatology. 2018; 30(8): 819-826. https://doi.org/10.1097/MEG.0000000000001175
4. Tae JW, Lee JC, Hong SJ, Han JP, Lee YH, Chung JH, et al. Impact of patient education with cartoon visual aids on the quality of bowel preparation for colonoscopy. Gastrointest Endosc. 2012; 76: 804-11. https://doi.org/10.1016/j.gie.2012.05.026
5. Lee YJ, Kim ES, Choi JH, Lee KI, Park KS, Cho KB, et al. Impact of reinforced education by telephone and short message service on the quality of bowel preparation: a randomized controlled study. Endoscopy. 2015; 47(11): 1018-1027. https://doi.org/10.1055/s-0034-1392406
6. Spiegel BM, Talley J, Shekelle P, Agarwal N, Snyder B, Bolus R, et al. Development and validation of a novel patient educational booklet to enhance colonoscopy preparation. Am J Gastroenterol. 2011; 106: 875-83. https://doi.org/10.1038/ajg.2011.75
7. Ergen WF, Pasricha T, Hubbard FJ, Higginbotham T, Givens T, Slaughter JC, et al. Providing hospitalized patients with an educational booklet increases the quality of colonoscopy bowel preparation. Clin Gastroenterol Hepatol. 2016; 14: 858-64. https://doi.org/10.1016/j.cgh.2015.11.015
8. Prakash SR, Verma S, McGowan J, Smith BE, Shroff A, Gibson GH, et al. Improving the quality of colonoscopy bowel preparation using an educational video. Can J Gastroenterol. 2013; 27: 696-700. https://doi.org/10.1155/2013/292636
9. Park JS, Kim MS, Kim H, Kim SI, Shin CH, Lee HJ, et al. A randomized controlled trial of an educational video to improve quality of bowel preparation for colonoscopy. BMC Gastroenterol. 2016; 16: 64. https://doi.org/10.1186/s12876-016-0476-6
10. Sharara AI, Chalhoub JM, Beydoun M, Shayto RH, Chehab H, Harb AH, et al. A customized mobile application in colonoscopy preparation: a randomized controlled trial. Clin Transl Gastroenterol. 2017; 8: e211. https://doi.org/10.1038/ctg.2016.65
11. Kang X, Zhao L, Leung F, Luo H, Wang L, Wu J, et al. Delivery of instructions via mobile social media app increases quality of bowel preparation. Clin Gastroenterol Hepatol. 2016; 14: 429-35. https://doi.org/10.1016/j.cgh.2015.09.038
12. Hann A, Walter BM, Mehlhase N, Meining A. Virtual reality in GI endoscopy: intuitive zoom for improving diagnostics and training. Gut. 2019; 68(6): 957-959. https://doi.org/10.1136/gutjnl-2018-317058
13. Chen G, ZhaoY, Xie F, Shi W, Yang Y, Yang A, el al. Educating outpatients for bowel preparation before colonoscopy using conventional methods vs virtual reality videos plus conventional methods: a randomized clinical trial. JAMA Network Open. 2021; 4(11): e2135576-e2135576. https://doi.org/10.1001/jamanetworkopen.2021.35576
14. Back SY, Kim HG, Ahn EM, Park S, Jeon SR, Im HH, et al. Impact of patient audiovisual re-education via a smartphone on the quality of bowel preparation before colonoscopy: a single-blinded randomized study. Gastrointestinal Endoscopy. 2018; 87(3): 789-799. https://doi.org/10.1016/j.gie.2017.09.007

15. Kastenberg D, Bertiger G, Brogadir S. Bowel preparation quality scales for colonoscopy. World Journal of Gastroenterology. 2018; 24(26): 2833. https://doi.org/10.3748/wjg.v24.i26.2833
16. Hayat U, Lee PJ, Lopez R, Vargo JJ, Rizk MK. Online educational video improves bowel preparation and reduces the need for repeat colonoscopy within three years. Am J Med. 2016; 129: 1219.e1-9. https://doi.org/10.1016/j.amjmed.2016.06.011
17. Pillai A, Menon R, Oustecky D, Ahmad A. Educational colonoscopy video enhances bowel preparation quality and comprehension in an inner city population. Journal of Clinical Gastroenterology. 2018; 52(6): 515-518. https://doi.org/10.1097/MCG.0000000000000893
18. Liu C, Song X, Hao H. Educational video followed by retelling bowel preparation process to improve colonoscopy BP quality: a prospective nursing intervention study. Medical Science Monitor: International Medical Journal of Experimental and Clinical Research. 2018; 24: 6029. https://doi.org/10.12659/MSM.909572
19. Chandan S, Arora S, Mohan BP, Khan SR, Chandan OC, Kassab LL, et al. Multimedia based education on bowel preparation improves adenoma detection rate: Systematic review & meta-analysis of randomized controlled trials. Digestive Endoscopy. 2021; 33(5): 730-740. https://doi.org/10.1111/den.13809
20. Rex DK, Imperiale TF, Latinovich DR, Bratcher LL. Impact of bowel preparation on efficiency and cost of colonoscopy. Am J Gastroenterol. 2002; 97(7): 1696-700. https://doi.org/10.1111/j.1572-0241.2002.05827.x
21. Zhao K, Dong R, Xia S, Feng L, Zhou W, Zhang M, el al. Improving the quality of bowel preparation by smartphone education platform prior to colonoscopy: a randomized trial. Ann Med. 2022; 54(1): 2777-2784. https://doi.org/10.1080/07853890.2022.2130972
22. Rice SC, Higginbotham T, Dean MJ, Slaughter JC, Yachimski PS, Obstein KL. Video on diet before outpatient colonoscopy does not improve quality of bowel preparation: a prospective, randomized, controlled trial. Official Journal of the American College of Gastroenterology| ACG. 2016; 111(11): 1564-1571. https://doi.org/10.1038/ajg.2016.450
23. Liu C, Song X, Hao H. Educational video followed by retelling bowel preparation process to ımprove colonoscopy BP quality: a prospective nursing ıntervention study. Med Sci Monit. 2018; 30(24): 6029-6037. https://doi.org/10.12659/MSM.909572
24. Walker TB, Hengehold TA, Garza K, Rogers BD, Early D. An interactive video educational tool does not improve the quality of bowel preparation for colonoscopy: a randomized controlled study. Dig Dis Sci. 2022; 67(6): 2347-2357. https://doi.org/10.1007/s10620-021-07215-8
25. Ye Z, Chen J, Xuan Z, Gao M, Yang H. Educational video improves bowel preparation in patients undergoing colonoscopy: a systematic review and meta-analysis. Ann Palliat Med. 2020; 9(3): 671-680. https://doi.org/10.21037/apm.2020.03.33