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ORIGINAL ARTICLE

Bowel preparation for colonoscopy: is diet restriction necessary?

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Background: Bowel preparation is essential for quality colonoscopy. Although most bowel preparation regimens recommend dietary restriction for 24 to 48 hours before the procedure, the evidence for this is poor. This study aimed to investigate whether dietary restriction during bowel preparation improves the quality of colonoscopy.
Methods: A prospective, randomised controlled pilot study in which the dietary restriction (DR) group (control) was instructed not to ingest high fibre foods for 48 hours prior to the use of a polyethylene glycol (PEG) bowel preparation. The non-dietary restriction (NDR) group were given no dietary instruction but received instructions for the use of the PEG-based preparation. On the day of colonoscopy, the quality of the bowel effluent was assessed, and additional preparation given as necessary. The primary endpoint was quality of bowel cleansing using the Harefield Cleansing Scale during colonoscopy. The secondary endpoints were the need for additional bowel preparation and the quantity of additional bowel preparation given prior to endoscopy. Data were analysed on an intention to treat basis.
Results: Twenty-three participants were randomised to the intervention group and thirty-four to the control group. Patient demographics were similar in both groups. Dietary restriction did not influence the success rate of bowel preparation: 97% successful bowel preparation in the DR group, vs 91% successful bowel preparation in the NDR group ($p = 0.559$). Additional bowel preparation requirement were similar in both groups: 35% in the DR group vs 39% in the NDR group ($p = 0.768$). Mean amount of additional bowel preparation required was similar: 560 ml in the DR group vs 460 ml in the NDR group ($p = 0.633$).
Conclusion: The quality of bowel preparation was comparable in patients with and without dietary restrictions prior to colonoscopy. Non-restrictive diets prior to bowel preparation should be considered to increase compliance. The sample size of this pilot study prohibited definite statistical conclusions but demonstrated this to be a reasonable methodology for a larger study.
Keywords: bowel preparation, colonoscopy, regular diet, non-dietary restriction.

Introduction

The incidence and prevalence of colon cancer has decreased significantly with the advent of screening colonoscopy, which can detect and remove pre-cancerous polyps.[1,2] Detection of inconspicuous lesions such as sessile adenomas during colonoscopy relies on the quality of bowel preparation.[3] Inadequate bowel preparation results in incomplete examinations and reduces cost-effectiveness for both patient and endoscopy units.[4] There are three types of bowel preparation: 1) isosmotic/hypo-osmotic polyethylene glycol (PEG), 2) hyperosmotic agents, and 3) combination regimens (stimulating and osmotic laxatives).[3] PEG bowel preparations are the most commonly accepted safe regimens, due to their minimal fluid and electrolyte shift effects.[5]

Historically, bowel preparations for colonoscopy were accompanied by dietary restriction, typically 48 hours of clear liquids only prior to the procedure.[6,7] More recently, this protocol has been liberalised, and a low residue diet is now standard from two days prior to the procedure. Although, once bowel preparation commences, only a clear liquid diet is allowed.[8-10] Current bowel preparation guidelines from the European Society of Gastrointestinal Endoscopy (ESGE) recommends a low fibre diet on the day before colonoscopy and either one of the following bowel preparation regimens: 1) split-dose regimen of 4 L PEG solution, 2) split regimen of 2 L PEG plus ascorbate or sodium picosulphate plus magnesium citrate.[11] The delay between the last dose of bowel preparation and colonoscopy should be minimised and no longer than four hours. ESGE advised against the routine use of oral sodium phosphate for bowel preparation because of safety concerns (0.1% chance of acute phosphate nephropathy).[11]

The effect of dietary restriction (DR) on the quality of bowel cleansing is not well described. Wu et al. reported no significant difference in terms of polyp detection rate or caecum intubation time between three diet groups: high residue diet, normal residue diet, and low residue diet.[12]

Understanding the effect of DR on bowel cleansing prior to colonoscopy can potentially improve colon cancer screening. In the study of Jung et al., only 52.1% of patients were compliant with the three meals of clear liquid diet; this shows poor patient willingness to follow the dietary

restriction. Removal of strict DR may improve patient participation in screening programmes.[13] Therefore, DR should be associated with a clear diagnostic benefit and improved treatment outcomes for patients to justify its use.

The aim of this study was to compare the quality of bowel cleansing between two groups: dietary restriction group (DR) and non-dietary restriction group (NDR). The primary endpoint was adequate bowel cleansing quality for screening colonoscopy as determined by Harefield Cleansing Scale during colonoscopy. The secondary endpoints were the administration of additional bowel preparation and the quantity of additional bowel preparation given prior to endoscopy. We hypothesised there is no difference between the DR and NDR groups.

Methods

The study population was a convenience sample from a cohort in the Northern Cape of South Africa (Figure 1) with a hereditary colon cancer mutation and their first-degree high-risk relatives. In brief, these individuals are at increased risk of colon cancer and undergo screening colonoscopy annually to remove polyps and biopsy non-resectable lesions.[14] Since 1994, the Colorectal Unit of Groote Schuur Hospital at the University of Cape Town has provided an outreach screening colonoscopy programme for these individuals, aimed at early detection and removal of adenomas or early detection of adenocarcinomas.

This was a prospective, single-blind, cluster randomised controlled study conducted during an annual screening colonoscopy outreach of families with known hereditary colon cancer mutations in the Northern Cape Province, South Africa. Randomisation occurred by town. The study period was from 30 July 2017 to 1 September 2017.

Individuals with a hereditary colon cancer mutation or their first-degree high-risk relatives who qualified for screening colonoscopy during the annual outreach trip in September 2017 were included. Individuals with a previous colonic resection, under the age of 18 or who had an allergy to bowel preparation were excluded.

All individuals due to undergo elective annual colonoscopy were screened in person by the first author (HJC) to discuss eligibility and participation in the study in July 2017. Towns were randomised into two groups: Group A: DR and Group B: NDR. Participants were not individually randomised because of the concern of significant crossover since many participants lived in the same household.

DR was defined as a low-fibre diet two days before the colonoscopy followed by a clear fluid diet only the day before colonoscopy (as per manufacturer instruction from MoviPrep®). The NDR group was not given any dietary restrictions until the commencement of the bowel preparation (Figure 2). Both groups were limited to clear liquids only from the commencement of the bowel preparation. Both groups received two litres of split dosed MoviPrep® (PEG + ascorbate solution): half ingested the afternoon/evening before (17:00–19:00) and half ingested the morning of colonoscopy (due to the fact that some patients lived up to four hours' drive from the hospital, it was not possible to give them uniform instructions).

On the morning of the colonoscopy, nurses, who were blinded to the randomisation, visually assessed patients' effluent. Participants with solid, semi-solid or brown effluent were given an additional 500 ml of PEG solution every 30 minutes until their effluent was clear. The total amount of additional PEG solution required was recorded. Once visually assessed as 'clear effluent', participants proceeded to the next available colonoscopy theatre.

Colonoscopies were performed or supervised by one of the four consultants (two colorectal surgeons and two gastroenterologists) blinded to randomisation. All patients received conscious sedation during the colonoscopy. Endoscopists rated the quality of bowel preparation using

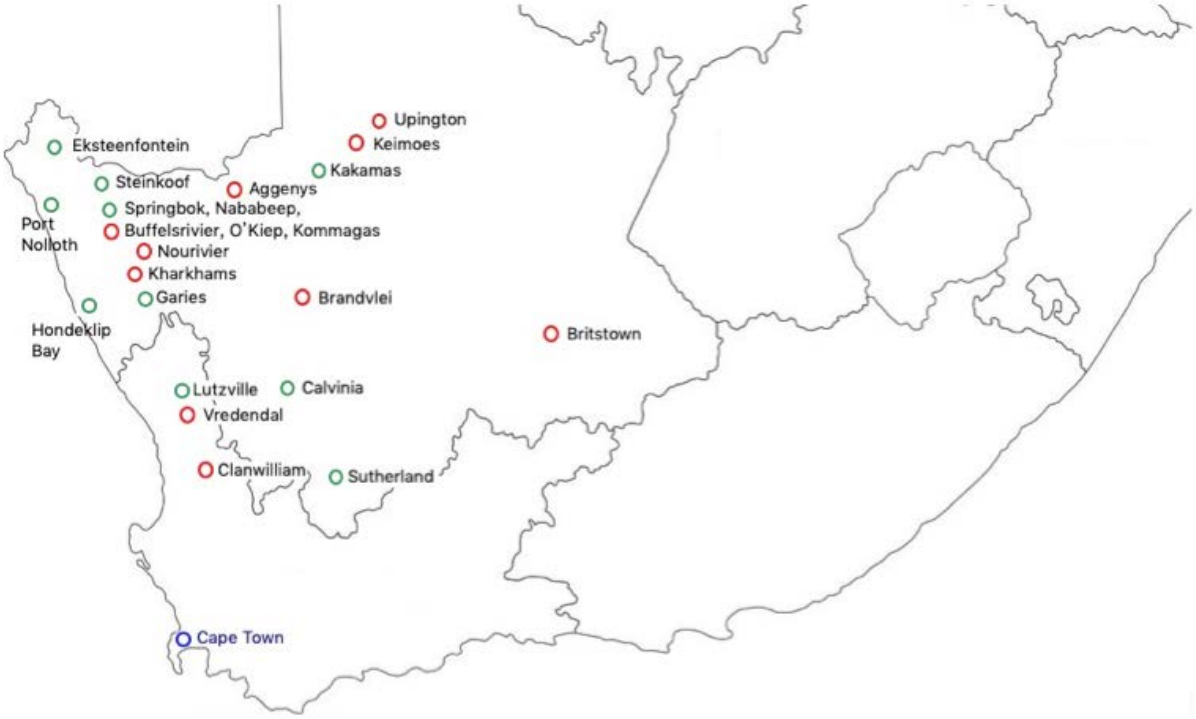


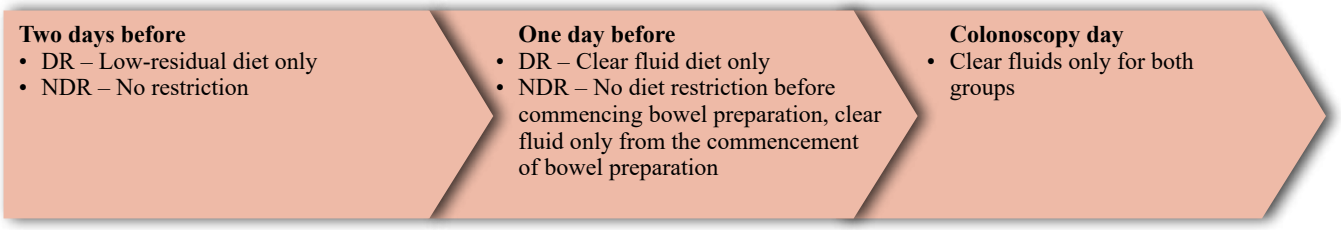
Figure 1: Study towns in the Northern Cape, South Africa
Green – non-dietary restrictions, red – dietary restrictions

Table I: Patient demographics and clinical outcomes in dietary restriction and non-dietary restriction bowel preparation groups for colonoscopy

	DR group	NDR group	*p*-value	Total
Participants	34	23		57
Female (%)	24 (71%)	21 (91%)		45 (79%)
Male (%)	10 (29%)	2 (9%)	0.097	12 (21%)
Median age	39	41	0.743	39
No. of people who vomited after ingestion of bowel prep (%)	3 (9%)	4 (17%)	0.423	7 (12%)
Median time (hours) from the start of bowel prep to scope	19.8	21.6	0.554	
Median time (hours) from last bowel prep to start of scope	8.25	3.5	0.182	
Harefield score A	24 (71%)	17 (74%)		41
Harefield score B	9 (26%)	4 (18%)		13
Harefield score C	1 (3%)	1 (4%)		2
Harefield score D	0 (0%)	1 (4%)		1
Compliant to dietary instruction (%)	17 (50%)	20 (83%)		37 (65%)
Non-compliant to dietary instruction (%)	17 (50%)	3 (17%)	0.0049	20 (35%)

Harefield score A and B are successful bowel preparation. *p*-value is derived by either independent t-test or Fisher's/chi-square test.
DR – dietary restriction, NDR – non-dietary restriction

Figure 2: Timing of dietary restriction and non-dietary restriction groups



DR – dietary restriction group, NDR – non-dietary restriction group

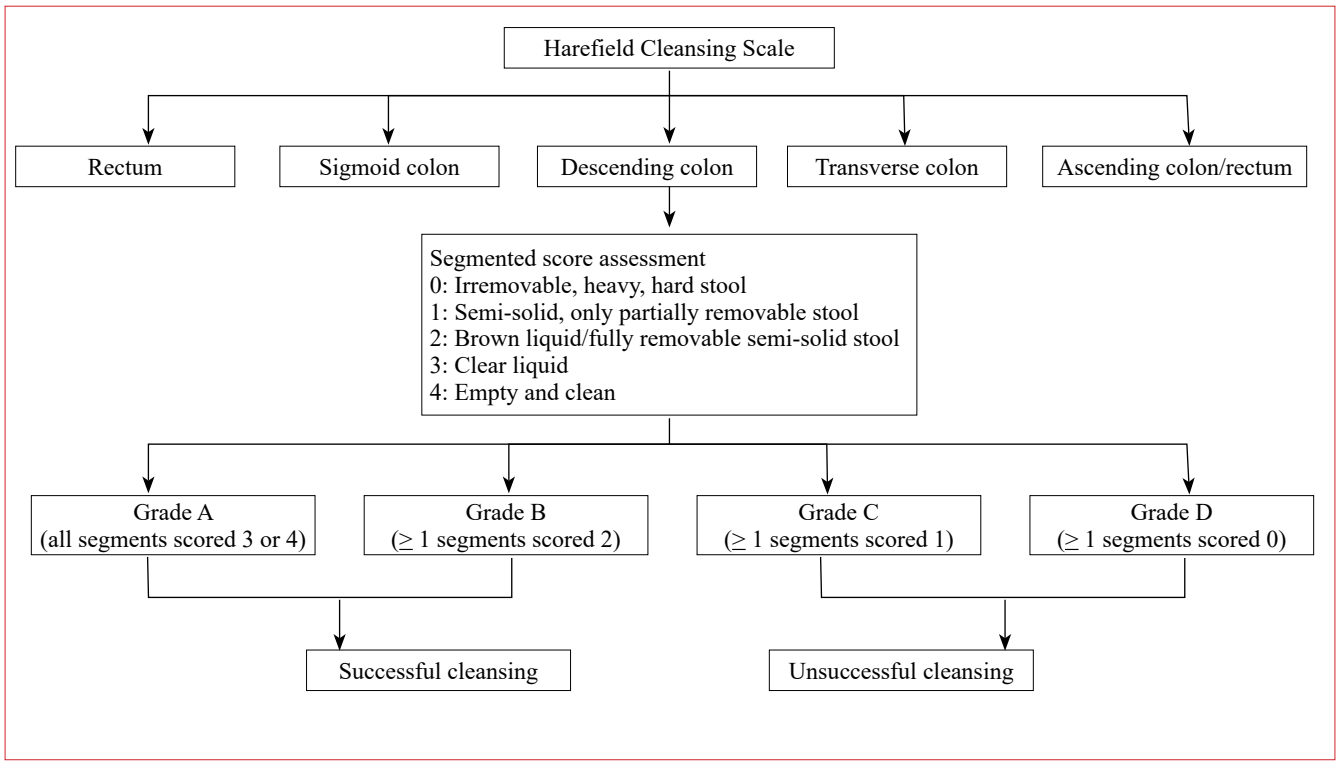


Figure 3: Harefield Cleansing Scale

Table II: Comparison of primary and secondary endpoints between dietary restriction and non-dietary restriction groups				
	DR group (*n* = 34)	NDR group (*n* = 23)	*p*-value	Total
Primary endpoint				
Successful preparation	33	21		54
Unsuccessful preparation	1	2	0.559	3
Secondary endpoint				
No. of people who had additional bowel prep (%)	12 (35%)	9 (39%)	0.768	21 (37%)
Mean amount (ml) of additional bowel prep	560	460	0.633	

DR – dietary restriction, NDR – non-dietary restriction

the Harefield Cleansing Scale. Only Olympus Exera III 190 endoscopy systems with ScopeGuide® (colonoscopy model) were used during this study to ensure consistent image quality.

The Harefield Cleansing Scale (Figure 3) is a visual scoring system, from A to D, to rate bowel preparation quality. This scoring system divides the colon into five segments and each segment receives a 'segmental score' given by the endoscopist. Scores A or B were considered successful and scores C or D were considered unsuccessful.[15]

Data collection and statistical analysis

Data was collected on a standard study intake sheet and entered into an electronic database. Variables included age and gender, randomisation group, time dietary modification commenced, time of last meal, time of first sachet of bowel preparation, time of second sachet of bowel preparation, estimated volume of vomitus after bowel preparation, additional amount of bowel preparation administered by nursing staff, time of colonoscopy, and Harefield Cleansing.

Data was analysed using SPSS®. Students T-test was used for parametric data and Fisher's exact test, chi-square test and Mann–Whitney U test was used for non-parametric data as appropriate. A *p*-value of less than 0.05 was regarded as statistically significant.

Results

There were a total of 57 participants; 34 in the DR group and 23 in the NDR group; 45 (79%) were female (Table I). The median age was 39 years (interquartile range 16). There was no significant difference in patient demographics between the two groups (Table I). The bowel preparation was well tolerated; seven (12%) participants vomited some of their bowel preparation: three in the DR group and four in the NDR group (*p*-value = 0.423). According to estimation by patients, two participants vomited approximately one litre of bowel preparation, one vomited approximately half a litre, and the remainder vomited small amounts only (< 0.2 litre) (Table I).

In total, 21 (37%) participants required additional bowel preparation; 12 (35%) in the DR group and nine (39%) in the NDR group (*p*-value = 0.768). Mean additional bowel preparation ingested was 560 ml in the DR group, 460 ml in the NDR group (*p*-value = 0.633) (Table II).

Median preparation-to-colonoscopy interval (the interval of time between the last PEG dose ingestion and the start of the colonoscopy) was 8.25 hours in the DR group and 3.5 hours in the NDR group (*p*-value = 0.182) (Table I).

In the DR group, 50% of participants were non-compliant to their dietary instructions (those who failed to obey only clear fluid the day before colonoscopy), while only 17% of participants in the NDR group were non-compliant (those who only ingested clear fluid diet the day before colonoscopy; as majority of the patients had previous colonoscopy experiences, they recalled the dietary restriction instructions from previous years).

In total, 54 patients (95%) had successful bowel preparation: 33 in the DR group (24 grade A, nine grade B Harefield cleansing scores) and 21 in the NDR group (17 grade A, four grade B Harefield cleansing scores) (Table I). There was no statistical difference when comparing the adequacy of bowel preparation between the DR and NDR groups (*p* = 0.559) (Table II).

One participant refused effluent checking prior to colonoscopy. This resulted in her initial colonoscopy being abandoned due to inadequate bowel preparation (Harefield grade D). Although her repeat colonoscopy showed Harefield grade B score, only the first colonoscopy findings were included in the final data analysis.

Discussion

Bowel cleansing quality is an essential component of successful colonoscopy. Pre-procedure bowel preparation is time and energy-consuming with many instructions, restrictions and inconveniences.

Our results demonstrated no statistically significant difference in the success rate of bowel cleansing (primary endpoints) between the DR and NDR groups. The proportion of participants requiring additional bowel preparation and the quantity of additional bowel preparation (secondary endpoint) were similar between the two groups.

In this study there was higher colonoscopy uptake among the female population, probably because females in this population are more compliant to the colonoscopy screening programme; this is in keeping with previous studies on this population.[16,17] Twelve per cent (12%) of patients vomited after drinking bowel prep. Whilst this number appears high, it is in keeping with other published studies.[18,19]

Our study had some limitations. First, dietary instruction compliance in the DR group was significantly worse than in the NDR group. Fifty per cent (50%) of patients in the DR group did not follow the diet restriction instruction. This may be because, as part of the consent process, patients were informed about the nature of the study and lack of clarity regarding absolute necessity of dietary restriction. Secondly, it is not considered an internationally standard procedure to check participants' effluent to assess bowel-cleansing adequacy prior to colonoscopy, and certainly, this is not suggested by any of the manufacturers of bowel preparation.

Additionally, in the context of a study, a more direct comparison between DR and NDR would be achieved without visual effluent assessments and administration of additional bowel preparation. However, in the setting of an outreach screening programme, with limited time and resources, it would not be feasible to wait until the colonoscopy to discover inadequate bowel cleansing. Effluent assessment with or without additional bowel preparation has been our strategy for many years and anecdotally has improved colonoscopy completion rates with a successful bowel preparation rate of 95%, compared to 88–92% in the literature.[18,19]

Additionally, colonoscopy is not a procedure without complications. Although the colonoscopic perforation rate is usually less than 0.1%, it can be as high as 0.3%.[20] The use of a visual effluent assessment improved the adequacy of bowel preparation prior to colonoscopy and therefore avoids repeat colonoscopy. For example, one participant in this study who initially refused to have visual effluent assessment had Harefield score D initially (irremovable solids from descending colon and proximally). However, it became Harefield score B (successful cleansing) on repeat colonoscopy after our visual effluent assessment and additional bowel preparation strategy.

Our small sample size limited the generalisability of our findings. All patients who met the inclusion criteria for this study were successfully recruited and therefore our sample size represents the limitation of recruitment within a dedicated mobile screening programme. However this cohort did provide a young patient group (median age 39 years old) with minimal comorbidities which ensured less variability in bowel preparation efficacy due to patient factors.

Conclusion

Our results suggest that there was no significant difference in the adequacy of bowel preparation or need for additional bowel preparation solution with or without dietary restriction. Visual effluent assessment with or without additional bowel preparation prior to colonoscopy is a useful and pragmatic adjunct tool to improve colon visualisation and completeness of colonoscopy.

Conflict of interest

The authors declare no conflict of interest.

Funding and sources

None.

Acknowledgement

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Ethical approval

The study was approved by the University of Cape Town Human Ethics Committee (HREC Ref: 277/2017). Written consent was taken from each participant prior to enrolment in the study.

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