Original article

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Eating marshmallows reduces ileostomy output: a randomized crossover trial

E. Clarebrough, G. Guest and D. Stupart

*Department of Surgery, Deakin University, Geelong, Victoria, Australia

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Abstract

Aim Anecdotally, many ostomates believe that eating marshmallows can reduce ileostomy effluent. There is a plausible mechanism for this, as the gelatine contained in marshmallows may thicken small bowel fluid, but there is currently no evidence that this is effective.

Method This was a randomized crossover trial. Adult patients with well-established ileostomies were included. Ileostomy output was measured for 1 week during which three marshmallows were consumed three times daily, and for one control week where marshmallows were not eaten. There was a 2-day washout period. Patients were randomly allocated to whether the control or intervention week occurred first. In addition, a questionnaire was administered regarding patient's subjective experience of their ileostomy function.

Results Thirty-one participants were recruited; 28 completed the study. There was a median reduction in ileostomy output volume of 75 ml per day during the study period ($P = 0.0054$, 95% confidence interval 23.4–678.3) compared with the control week. Twenty of 28 subjects (71%) experienced a reduction in their ileostomy output, two had no change and six reported an increase. During the study period, participants reported fewer ileostomy bag changes (median five per day *vs* six in the control period, $P = 0.0255$). Twenty of 28 (71%) reported that the ileostomy effluent was thicker during the study week ($P = 0.023$). Overall 19 (68%) participants stated they would use marshmallows in the future if they wanted to reduce or thicken their ileostomy output.

Conclusion Eating marshmallows leads to a small but statistically significant reduction in ileostomy output.

Keywords Stoma, ileostomy, stool frequency, marshmallow, gelatine

What does this paper add to the literature?
This study provides evidence for the consumption of marshmallows as a novel and simple intervention that can be used as an adjunct to pharmacological therapy for ostomates who wish to reduce and thicken their ileostomy output.

Introduction

Patients with ileostomies are frequently troubled by high stoma output. Up to 16% of patients with ileostomies experience high stoma output defined as an output exceeding 2000 ml per day in the early postoperative period, and half of these patients require ongoing treatment [1,2]. Anti-motility and anti-secretory medications are commonly used to reduce ileostomy output [3–5]. Dietary modifications are commonly advised but evidence to support this is lacking [6]. Anecdotally, many ileostomy patients and stoma therapists advocate eating marshmallows to reduce ileostomy output [7–9]. A plausible mechanism for this is that marshmallows contain gelatine (E 441), a well-known thickening agent. Gelatine forms a semi-solid colloid gel when mixed with water and its high viscosity in solution may explain how the compound thickens and slows faecal effluence in people with ileostomies. No previous randomized trials have investigated whether the consumption of gelatine-containing foods can reduce stoma output.

The purpose of this study was to determine the effect of marshmallow consumption on ileostomy output.

Methods

This was a randomized crossover trial comparing a 5-day period during which marshmallows were eaten with a 5-day control period. Non-diabetic adult patients with

Correspondence to: D. Stupart, Department of Surgery, University Hospital Geelong, Ryrie St, Geelong, Victoria, Australia.
E-mail: douglasstupart@yahoo.co.uk

well-established ileostomies of at least 3 months were included in the study. During the intervention period three marshmallows were consumed three times daily. Pascall® marshmallows were used, approximately 4.8 g per marshmallow or 14.5 g per serving, three times daily. During the control period, subjects did not eat marshmallows. There was a 2-day washout period between the intervention and control periods, which occurred on consecutive weeks. The subjects were their own controls. The order of the two time periods (marshmallow week first or control week first) was randomly assigned (randomization was by sealed envelopes).

Patients were instructed not to make any other changes to their normal diet, and any medications they were taking (including those aimed at reducing stoma output) were continued throughout both weeks of the study.

Ileostomy output was measured by the patients and the frequency of stoma appliance changes was also documented. Participants completed a post-trial questionnaire reporting their subjective assessment of how the introduction of marshmallows affected their output, as well as whether they would use marshmallows to influence their stoma effluent in future.

Participants were excluded if they had any recent change in medications including motility agents or steroids, illness requiring hospitalization or a change in their underlying disease that would affect stoma output over the trial period.

Statistics

This study was powered to detect a reduction in daily ileostomy output of 150 ml (in keeping with a previous study of loperamide use in reducing ileostomy output by Tytgat *et al.* [5]), assuming a mean daily stoma output of 465 ml (standard deviation 219) as reported by Kanaghinis *et al.* [10], with an α level of 0.05 and β of 0.1. We calculated that 23 patients were required to power the study. We aimed to recruit 40 to allow for drop-out. Non-parametric data analyses were used as ileostomy output was not normally distributed. Ileostomy output and number of bag changes were compared using the Wilcoxon test for paired samples. A P value of < 0.05 was regarded as significant. Ethical approval for this project was gained through HREC at Barwon Health (approved June 2013, reference no. 13/56). The trial was registered prospectively with ANZCTR (Trial ID ACTRN12613000633785).

Results

Thirty-one participants were recruited for the study. Two subjects withdrew prior to randomization and one withdrew during week 2, so 28 subjects (17 men and 11 women) completed the study. The median age was 66 years (range 33–82). The pathologies for which the ileostomy had been fashioned are summarized in Table 1. Six patients were taking loperamide and one patient was taking both codeine phosphate and loperamide prior to commencement of the study; all of these continued their medications throughout the study period without changes.

The median daily output for the control group was 742 ml (range 353–2600 ml). The changes in ileostomy output between the control and marshmallow weeks for each participant are summarized in Fig. 1. There was a median reduction in ileostomy output of 75 ml per day (95% confidence interval 23–678, $P = 0.0054$) or 8% reduction (95% confidence interval 1.4–12). Of the 28 participants to complete the trial, 20 (71%) experienced a reduction in their ileostomy output, two had no change and six reported an increase in stoma output.

During the marshmallow period, participants reported fewer stoma bag changes [median six (range 2–14) *vs* five (range 2–13) in the control week, $P = 0.0255$). Eighteen of the 28 participants (64%) reported that there was a noticeable reduction in ileostomy output. Twenty (71%) noticed a change in the consistency of the output, reporting it was thicker and more predictable. Nineteen (68%) of the participants stated that they would use marshmallows in the future to reduce or thicken their ileostomy output. There was no difference in output between those subjects who were randomized to marshmallows in the first week *vs* those who were randomized to marshmallows in the second week ($P = 0.1501$; Mann–Whitney test).

Discussion

In this study, we found that eating marshmallows reduced ileostomy output in the majority of patients with established ileostomies. We also found that there was a small reduction in the frequency of stoma bag changes, and that participants reported subjective

Table 1 Reason for ileostomy.

Reason for ileostomy	No. of participants
Colorectal cancer	10
Inflammatory bowel disease	12
Bowel obstruction	3
Familial adenomatous polyposis	2
Ischaemic bowel	1

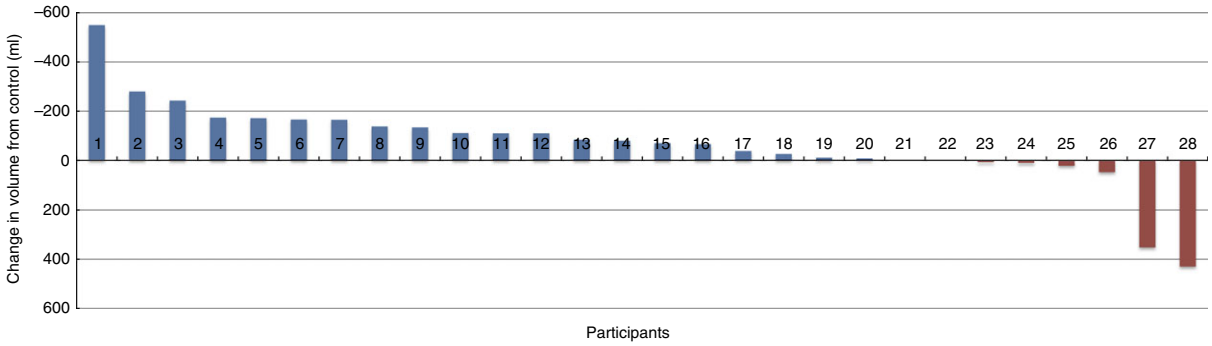

Figure 1 Change in daily ileostomy output when eating marshmallows.

improvements in the volume and consistency of their stoma output.

High output ileostomies have a significant impact on patients' lives with physiological, practical as well as psychological implications. A high output stoma is generally defined as an output exceeding 2000 ml per day. However, interventions may be required if the daily output consistently exceeds 1200 ml due to the risk of dehydration, malnutrition and electrolyte disturbances [11,12]. Furthermore, high outputs requiring regular appliance changes can result in social and practical difficulties.

Loperamide and codeine phosphate are widely used to reduce ileostomy output. Both pharmacological agents have been shown to reduce daily ileostomy output and also thicken the effluent in landmark studies conducted in the 1960s and 1970s [4,10,13]. Tytgat *et al.* [13] demonstrated a 22% reduction in median daily ileostomy output with the use of loperamide in 20 patients. A single patient case report of the effect of codeine phosphate on ileostomy output was presented by Khanaginis *et al.* in 1963 [10] and a later study by Newton [4] also described a reduction in water and electrolyte content of ileostomy effluent in five patients when taking codeine in a randomized crossover trial. No randomized trials of codeine phosphate for reducing stoma output have been published. Eating marshmallows as a method to reduce stoma output is already widely used by ostomates with high or troublesome ileostomy outputs as well as those who simply want to slow their output for certain occasions or reduce the requirement for a bag empty over a short period of time. This has been widely discussed in informal internet chat groups [14–16] but only one small study of this has been reported (in abstract form) in the scientific literature. Donoghue *et al.* [17] conducted a pilot study that was presented as an abstract at the Association of Surgeons in Training in 2009. The authors recruited eight patients with high output stoma and documented the correlation between marshmallow consumption and stoma output volume as well as frequency of daily bag changes. The authors followed these patients for 1 week and found a statistically significant reduction in both stoma output and number of daily bag changes.

In this randomized trial, we found that marshmallows had a statistically significant but variable effect on ileostomy output. The median reduction in output was 75 ml per day, or 8% daily reduction. One-quarter of our participants experienced a reduction in ileostomy output of more than 150 ml, which was regarded as a clinically significant reduction in previous studies [5] and which this study was powered to detect. It should be stressed that some of the study subjects were already using medications to reduce ileostomy output, so this effect occurred in addition to standard pharmacological interventions. An obvious flaw in this study is that participants were not blinded, and this may have influenced the reporting especially of the subjective findings such as consistency of stoma output.

The majority of our participants did have a reduction in their daily output; however, some patients showed no significant change and a small group actually had an increased stoma output. The crossover design is an effective method of controlling many of the cofounders for stoma outputs across the whole sample but the effect of these cofounders (e.g. diet, hydration status, comorbid disease activity) and the natural variability of an individual's stoma output may exceed the effectiveness of marshmallows. It is also possible that there may be a group of ostomates where the ingestion of marshmallows has a predictable opposite effect.

The long-term use of marshmallows and their impact on overall quality of life and concurrent medical conditions has not been evaluated. Further studies would be needed to address these parameters and to investigate predictive factors for the response to marshmallow ingestion. Finally, participants with well-established ileostomies have been used in this study, some of whom

did have high output stomas; however, we did not have a large enough sample to institute subgroup analyses of this very important group.

In conclusion, eating marshmallows is associated with a significant but highly variable reduction in ileostomy output. This is a cheap and simple intervention that may be a useful adjunct to pharmacological therapy for ostomates who wish to reduce and thicken the output from their ileostomy.

Conflict of interest

The authors declare no conflict of interest.

References

1 Nightingale J, Woodward JM. Guidelines for management of patients with a short bowel. *Gut* 2006; **55(Suppl 4):** iv1–12.

2 Baker ML, Williams RN, Nightingale JMD. Causes and management of a high-output stoma. *Colorectal Dis* 2011; **13:** 191–7.

3 King RF, Norton T, Hill GL. A double-blind crossover study of the effect of loperamide hydrochloride and codeine phosphate on ileostomy output. *Aust N Z J Surg* 1982; **52:** 121–4.

4 Newton CR. Effect of codeine phosphate, Lomotil, and Isogel on ileostomy function. *Gut* 1978; **19:** 377–83.

5 Tytgat GN, Huibregtse K, Dagevos J, van den Ende A. Effect of loperamide on fecal output and composition in well-established ileostomy and ileorectal anastomosis. *Am J Dig Dis* 1977; **22:** 669–76.

6 Burch J. Providing information and advice on diet to stoma patients. *Br J Community Nurs* 2011; **16:** 479–80, 82, 84.

7 Greenwich Hospital. *Ostomy Self-Management: Food and Your Stoma*. 2004 (updated 2004; cited October 2014). http://www.greenhosp.org/upload/docs/FactSheets/English/diet_ostomy.pdf. (accessed October 2014).

8 University Hospital. *Understanding and Caring for your Ileostomy*. 2012 (updated 2012; cited October 2014). http://www.wehealny.org/services/bi_colorectalsurgery/forms/ileostomy_booklet1.pdf. (accessed October 2014).

9 UPMC, *Ileostomy Care*. 2014 (updated 2014; cited October 2014). http://www.upmc.com/patients-visitors/education/ostomy/pages/ileostomy-care.aspx. (accessed October 2014).

10 Kanaghinis T, Lubran M, Coghill NF. The composition of ileostomy fluid. *Gut* 1963; **4:** 322–38.

11 Nightingale JM. Management of patients with a short bowel. *World J Gastroenterol* 2001; **7:** 741–51.

12 Sentongo TA. The use of oral rehydration solutions in children and adults. *Curr Gastroenterol Rep* 2004; **6:** 307–13.

13 Tytgat GN, Huibregtse K. Loperamide and ileostomy output – placebo-controlled double-blind crossover study. *Br Med J* 1975; **2:** 667.

14 HealingWell.com. *Marshmallow Trick?* 2011 (updated 2011; cited April 2013). http://www.healingwell.com/community/default.aspx?f=33&m=2092157. (accessed April 2013).

15 Inspire. *Marshmallows and Diarrhoea*, Inspire. 2013 (updated 2013; cited April 2013). Available from https://www.inspire.com/groups/ostomy/discussion/marshmallows-and-diarrhea/. (accessed April 2013).

16 The Colon Club. *Changing Ileostomy Bag*. 2009 (updated 2009; cited April 2013). http://coloncancersupport.colonclub.com/viewtopic.php?f=1&t=5889. (accessed April 2013).

17 Donoghue A, Shihab O, Norton C. A novel method for the management of high-output ileostomies. *Abstract Book for the Association of Surgeons in Training, abstract*. 2009. Available from: http://www.asit.org/assets/documents/asit_abstract_book_2009.pdf (accessed April 2013).