Published in final edited form as:
Int Urogynecol J. 2011 September ; 22(9): 1151–1157. doi:10.1007/s00192-011-1444-x.

Weight loss improves fecal incontinence severity in overweight and obese women with urinary incontinence

Alayne D. Markland,
Geriatric Research, Education, and Clinical Center, Department of Veterans Affairs, Washington DC, WA, USA. Department of Medicine, Division of Gerontology, Geriatrics, and Palliative Care, University of Alabama at Birmingham, BVAMC, GRECC 11-G, Room 8220, 700 South 19th Street, Birmingham, AL 35233, USA

Holly E. Richter,
Department of Obstetrics and Gynecology, Division of Women's Pelvic Medicine and Reconstructive Surgery, University of Alabama at Birmingham, Birmingham, AL, USA

Kathryn L. Burgio,
Geriatric Research, Education, and Clinical Center, Department of Veterans Affairs, Washington DC, WA, USA. Department of Medicine, Division of Gerontology, Geriatrics, and Palliative Care, University of Alabama at Birmingham, BVAMC, GRECC 11-G, Room 8220, 700 South 19th Street, Birmingham, AL 35233, USA

Deborah L. Myers,
Department of Obstetrics and Gynecology, Alpert Medical School at Brown University, Providence, RI, USA. Department of Medicine, University of California, San Francisco, San Francisco, CA, USA

Alexandra L. Hernandez, and
Departments of Medicine, University of California, San Francisco, San Francisco, CA, USA

Leslee L. Subak
Departments of Obstetrics, Gynecology & Reproductive Sciences, Epidemiology & Biostatistics, and Urology, University of California, San Francisco, San Francisco, CA, USA

Alayne D. Markland: amarkland@aging.uab.edu

Abstract

Introduction/hypothesis—To estimate the effect of weight loss on fecal incontinence (FI) severity among overweight and obese women with urinary incontinence, we analyzed data from women randomized to a weight loss intervention or control condition.

Methods—The modified Fecal Incontinence Severity Index (FISI) was administered at 6, 12, and 18 months in 338 women. Repeated measures analyses identified factors associated with improved FISI scores among women with baseline scores >0.

Results—FISI scores improved in 45 (13%) across all time points among the 291 women (87%) completing the trial. Improved scores were associated with a one-point lower urinary tract

Correspondence to: Alayne D. Markland, amarkland@aging.uab.edu.

Conflicts of interest Markland AD (Pfizer consultant), Myers DL, Hernandez AL, Burgio KL (Pfizer, Astellas, Johnson & Johnson, consultant) have no potential conflicts of interest to disclose. Richter HE, a Pfizer investigator, was initiated a grant funding (Xanodyne consultant). Subak LL received Pfizer grant/research support.

symptoms (LUTS) score, $p<0.01$. Improved liquid stool FI frequency was associated with ≥5 kg weight loss ($p=0.001$), 10-g increase in fiber intake ($p=0.05$), and decreased LUTS ($p=0.003$).

Conclusions—FI severity improved with weight loss. Women with liquid stool FI losing at least 5 kg and/or increased dietary fiber intake had improved FI frequency.

Keywords

Fecal incontinence; Female; Food frequency questionnaire; Obesity; Urinary incontinence; Weight loss

Introduction

Fecal incontinence (FI) is a common condition occurring in 2–15% of the US population and often presents with other pelvic floor disorders in women [1–4]. Over 50% of American women are overweight [body mass index (BMI) 25 to 30 kg/m^2] or obese (BMI ≥30 kg/m^2), and the prevalence of obesity is increasing by almost 6% per year [5, 6]. In population-based observational studies, FI is reported to be approximately 50% more prevalent in obese compared to normal weight women [7–10]. Other potential risk factors for FI in women include: age, parity, mode of delivery, impaired mobility, comorbid diseases, and loose or watery stool consistency [7, 8, 11, 12].

Several studies in overweight and obese women with urinary incontinence indicate that a modest 7–8% reduction in weight can improve urinary incontinence frequency [13–17]. A recent trial demonstrated that women who underwent bariatric weight loss surgery had improvements in urinary, as well as FI frequency and severity [18]. More data are needed, however, to determine whether more modest weight loss with changes in diet and exercise may result in FI improvement.

In the baseline analysis of a randomized clinical trial that evaluated the effects of a weight loss program in overweight and obese women with urinary incontinence [16], we found that women with only solid or liquid stool FI had lower dietary intake of fiber than women with urinary incontinence alone [19]. The objective of this planned secondary analysis was to evaluate the long-term effects (18 months) of a 6-month weight loss intervention, focusing specifically on dietary intake, on FI severity and to identify risk factors associated with improvements in FI severity and frequency in a cohort of obese and overweight women with urinary incontinence.

Methods

Design

The Program to Reduce Incontinence by Diet and Exercise (PRIDE) was a multicenter, randomized, clinical trial to evaluate the effects of weight reduction as a treatment for urinary incontinence in overweight and obese women [16]. This study was IRB approved at the two clinical sites, Brown University, Providence, RI and the University of Alabama at Birmingham, Birmingham, AL and the data coordinating center at the University of California at San Francisco, CA. In brief, the 18-month study consisted of a 6-month weight loss program, followed by a 12-month weight management program (intervention) or a structured educational program (control). Women were recruited through newspaper and television advertisements, and flyers, as well as through clinics, at both participating sites. Written informed consent was obtained.

Women at least 30 years of age with a BMI of 25–50 kg/m^2 who reported ten or more urinary incontinent episodes on a 7-day voiding diary at baseline were eligible for the study. Selected exclusion criteria included the current use of medications for incontinence or weight loss within the previous month, urinary tract infection, four or more urinary tract infections in the preceding year, incontinence of neurological or functional origin, prior anti-incontinence or urethral surgery, significant medical conditions of the genitourinary tract, pregnancy, and medical conditions such as type 1 diabetes, type 2 diabetes requiring medical therapy, uncontrolled hypertension, and history of coronary heart disease. Prior medical therapy for incontinence or obesity, including behavioral treatments, did not affect eligibility. This planned secondary cohort data analysis included the women who were randomized at baseline (*n*= 338) and completed the 18-month study (*n*=291, 86%).

Dependent variable

The modified Fecal Incontinence Severity Index (FISI) was administered at 6, 12, and 18 months. The question used to ascertain FI was “during the past 3 months, how often did you experience any of the following unexpected or accidental bowel leakage, even a small amount?” The levels of response for gas, mucus, liquid bowel movement, or solid bowel movement were: “never,” “less than monthly,” “monthly (once or more each month),” “weekly (once or more each week),” or “daily (once or more each day).” This question is similar to the validated FISI, but the FISI uses finer categories of frequency of stool loss with categories for “once per week” and “two or more times per week” [20]. When we combined categories of the FISI to match our data, the lower patient-weighted scores based on stool consistency and frequency from the original scale were used. Scores ranged from 0 to 42 on the modified FISI, with higher scores representing greater symptom severity. Improvement in FI severity was calculated by subtracting the modified FISI scores at 6, 12, and 18 months from the baseline scores. Scores >0 were considered, “improved.” Data from the modified FISI were also used to ascertain types of FI and categorized as mucus, gas, liquid, and solid stool.

Independent variables

Possible predictor variables for FI severity were identified a priori for this secondary analysis. Demographic characteristics and medical, behavioral, and incontinence histories were ascertained using self-reported questionnaires at baseline. Participants reported constipation frequency (monthly or less compared to weekly/daily) and alcohol use. Obstetrical and gynecological variables included self-reported menopausal status, prior hysterectomy, and surgery for urinary incontinence. Weight in kilograms at baseline and the amount of weight lost in kilograms at 6, 12, and 18 months were recorded. For each time point, BMI was calculated with measured weight in kilograms and height in meters squared (kg/m^2).

Other potential predictors of improvement in FI severity were urinary incontinence and impact, as measured by a 7-day voiding diary [21], lower urinary tract symptoms and distress, as measured by the American Urologic Association (AUA) Symptom Index [22], Urogenital Distress Index, and the Incontinence Impact Questionnaire [23]. Higher scores on the AUA Symptom Index, the Incontinence Impact Questionnaire (IIQ), and the Urogenital Distress Index (UDI) represent greater symptoms, impact, and symptom burden, respectively.

The Block Food Frequency Questionnaire (FFQ) is a 110-item self-administered questionnaire validated for the estimation of usual and customary intake of nutrients and food groups in women [24, 25]. Women recorded how many times per day, week, or month they consumed specific food items and the approximate serving size with pictures provided

to enhance accuracy of quantification on serving size. Verbal instruction was provided by registered dietitians on completion of the FFQ. The FFQ was completed at baseline, 6, 12, and 18 months. A complete nutrient analysis, including macro- and micronutrients was provided. Additional categories were determined for total caloric intake (in kilocalories) and total fat, dietary cholesterol, protein, carbohydrates, and dietary fiber based on the distribution of the values for each specific nutrient.

Data analysis

The effect of the intervention was evaluated in women with any level of FI severity (including gas, liquid, solid, or mucus stool) at baseline (*n*=163) controlling for randomization group. Finding no difference in FI improvement of the weight loss intervention group in comparison to the control group, the data were analyzed as a follow-up cohort and not a randomized controlled trial. Subjects with only urinary incontinence or with no improvement in FI were compared to subjects with urinary incontinence and improved FI severity on the modified FISI at 6, 12, and 18 months on selected characteristics using means or frequency distributions.

To determine significant differences between these two groups, ANOVA was used for normally distributed continuous variables, ranked ANOVA for non-normally distributed continuous variables, and chi-square tests for categorical variables. Repeated measures generalized linear regression models were used to evaluate bivariate associations of those factors with improvement in modified FISI scores among women with FISI Scores >0. Race/ethnicity was retained in the multivariable models, despite not being a significant univariate factor. The final multivariable analysis included: age, race, baseline weight and change in weight (loss of 5 kg), total number of leaks on the 7-day bladder diary (decrease of seven leaks per week from baseline reported), AUA Symptom Index (decrease in 1 unit scale of the score from baseline), and a 10 g/day increase intake of fiber from baseline.

As liquid stool loss was the most common type of FI at baseline and the most common type found in the USA [2], women with liquid stool loss were analyzed separately. In a proportional odds repeated measures regression analysis that allowed for the five-part ordinal outcome (responses were “never,” “> monthly,” “monthly,” “weekly,” or “daily”) on the question to ascertain liquid FI frequency, the same variables (age, race, baseline and change in weight, bladder diary leaks, AUA Symptom Index scores, and fiber intake) were evaluated for any level of improvement in liquid stool FI frequency among women with FISI scores >0. Age and bladder leaks on a 7-day diary were retained in the final multivariable models due to the possible impact of age and urinary incontinence severity as confounders for FI. All multivariable analyses were adjusted for clinic site and account for clustering within the intervention groups. All analyses were performed using SAS Version 9.1 (Cary, NC).

Results

Overweight and obese women with urinary incontinence participating in the PRIDE study (*n*=291/336, 87%) had the following values at baseline: mean age (±standard deviation) 53±10 years, BMI 34±6 kg/m^2, weight 93±15 kg, and 78% were non-Hispanic Whites (19% African Americans). From the FISI category types (solid, liquid, mucus, or gas leakage), the prevalence of at least monthly or more frequent solid or liquid stool FI at baseline was 16% (*n*= 55). Forty-four percent (*n*=148) experienced gas leakage (these groups are not mutually exclusive). Despite no statistical differences in the improvement of FI types or FISI scores from the weight loss intervention in comparison to the control group, FI severity (from the FISI scores) improved overall in 13% (*n*=40) at 6 months, 10% (*n*=30) at 12 months, and 11% (*n*=33) of the women at 18 months, for a combined FI severity improvement of 13%

(*n*=45) across all time points. Of the 163 women with modified FISI scores >0 at baseline, an improved frequency (more frequent to less frequent) of gas leakage occurred in 48%, mucus leakage improved in 15%, solid stool leakage improved in 14%, and liquid FI improved in 26% across all visits.

Table 1 shows the data for the women with improved FI severity from the modified FISI scores at 18 months compared to women without FI improvement. No significant differences in any variables were seen at 6 or 12 months (data not shown) in comparison to the 18-month data. Women with improved FI severity at 18 months (*n*=33, Table 1) were more likely to have a lower weight at baseline (p=0.004) and a lower baseline BMI (p=0.02) at baseline. There were no differences between groups in obstetrical or gynecologic history, or scores on urinary incontinence-specific distress or impact measures (UDI and IIQ). Additionally, no differences were seen by the type of urinary incontinence (stress, urge, or mixed incontinence) among women with or without improvements in FI severity.

Dietary intake data from food frequency questionnaires were compared for the women with and without improvements in FI severity (data not shown). No significant differences (p>0.05) were seen in specific dietary intake of fat, saturated fat, cholesterol, protein, carbohydrates, or fiber at baseline, or the change in intake at 18 months in women with and without improved FI severity. In addition, the total caloric intake at baseline or after 18 months did not differ in women with or without improvements in FI severity.

All variables associated with improved FI severity at 18 months (p<0.2; Table 1) in univariate analyses were included in a multivariable model comparing women with improvements in FI severity with those without any improvement (only among women with FISI scores >0). Only one factor was independently associated with improved FI severity from the modified FISI scores (p≤0.01) across all visits (Table 2): a one-point lower AUA Symptom Index score from baseline (0.2 point reduction).

Factors independently associated with improvement in the frequency of liquid FI across all visits (Table 3) were: 5 kg weight loss from baseline [odds ratio (OR) 1.2, 95% confidence interval (CI) 1.1, 1.4], 10-g increase in dietary fiber intake from baseline (OR 1.2, 95% CI 1.0, 1.4), and decreased lower urinary tract symptoms from baseline (OR 1.1, 95% CI 1.0, 1.1). Age, baseline urinary incontinence severity or change in urinary incontinence frequency, number of medications used, prior incontinence treatment, and menopausal status were not independent predictors for FI improvement in this study. No associations with other dietary variables were seen among the women with FI improvement compared to women without improved FI.

Comment

Overweight and obese women with urinary and fecal incontinence who completed a weight loss intervention program had an improvement of 13% overall in FI severity and frequency. In a subgroup of women with the most common type of FI, liquid stool incontinence, potentially modifiable factors for improvement in FI frequency were at least 5-kg weight loss and at least a 10-g increase in dietary fiber intake per day.

Overweight and obese women have an increased number of pelvic floor disorders, including urinary and FI, in comparison to normal weight women [9, 16, 18, 26]. Nonsurgical and surgical weight loss strategies reduce the frequency of urinary incontinence episodes, but less is known about the impact of weight loss treatments on FI improvement [13, 16, 18]. Cohort studies done in obese women undergoing surgical weight loss interventions, such as gastric bypass, report a decrease in FI to solid and liquid stool from 19% to 9% at 12 months, a 10% relative improvement rate [18]. Despite the modest weight loss seen in this

nonsurgical weight loss trial (7.8 kg) and the lack of any differences between the intervention and the control group, we found that 13% have improvements in FI severity.

FI is a multifactorial condition that may be caused by increased abdominal pressure (obesity), increased intestinal motility or loose stool (dietary intake and medications), and sphincter or pelvic floor weakness from an anatomic defect or nerve damage (obstetrical injury and neuropathy) [27]. Since obesity is a modifiable condition, the prospect of an improved FI may help motivate women to undertake difficult lifestyle and dietary changes.

From the baseline analysis of this cohort of overweight and obese women with FI, we found that women with FI were more likely to have a lower dietary intake of fiber than women without FI [19]. Because diet and exercise are two potential lifestyle modifications that can improve weight loss and incontinence, further evaluation of the dietary intervention on improving FI is important for understanding potential mechanisms of FI treatment. Although overall caloric consumption and other macronutrients such as carbohydrates, protein, fat, and cholesterol intake improved in women enrolled in this weight loss intervention program at 18 months, only the increased intake of fiber (by 10 g/day) improved the frequency of liquid stool FI. This is an important finding for two reasons. First, we can inform obese and overweight women of specific targets to achieve in weight loss that may translate into improved FI. Second, since dietary fiber may improve FI by increasing stool weight and improving stool consistency [28], recommending a 10-g/day increase in dietary fiber intake may improve FI.

While we found that BMI was weakly protective for FI on the baseline analysis of this cohort, we also found that a lower baseline weight was independently associated with improved liquid FI frequency at 18 months in this study [19]. This specific finding may be difficult to interpret since all women in our study were overweight or obese, with no normal weight control group. It is also possible that women with a lower baseline weight were able to achieve dietary and weight loss goals faster than the women with a higher baseline weight, thus having a faster improvement in FI severity at 18 months.

We observed factors that impacted improvement in FI severity and frequency in our cohort of overweight and obese women that are similar to those found in studies that included both normal weight and obese women [7, 8]. For both improvement in FI severity and frequency, we found that decreased urinary tract symptoms were associated with improved FI severity and less frequent liquid stool FI frequency even after controlling for improvements in urinary incontinence frequency on a 7-day bladder diary. Although these findings were statistically significant, the clinical implications of a 0.2 change in modified FISI scores with improved lower urinary tract symptoms as measured by a one-point decline in the AUA symptoms index score may not be clinically relevant [22].

Our study had several limitations that should be considered when interpreting the results. First, the study was a subgroup analysis of a randomized controlled trial and may not have been adequately powered to detect statistically significant differences in obese women with FI who enrolled in a trial to test the effects of a weight loss intervention program on urinary incontinence. The ability to detect significant variables in the multivariable models that impact a change in the FISI scores is limited by our sample size and may not represent a clinically meaningful important difference. Second, fiber intake on the food frequency questionnaire was defined by self-report which may have under- and overestimated intake and introduced recall basis for the frequency of specific types of food for women with FI. However, others have found that nutrition estimates from food frequency questionnaires and short-term dietary recall are similar [24, 25]. Third, the modified FISI score measures the severity of liquid and solid stool incontinence, in addition to flatal incontinence and mucus

incontinence, which may inflate the improvements seen in FI severity in this study. However, scales that measure severity of FI usually include incontinence of flatus and mucus as part of the total score [29]. Although we present a "modified" FISI score in this analysis, the data on improved FI severity (any score change based on FI frequencies of monthly, weekly, and daily; not stool type) should not be affected by the modification. No data were collected on the presence of irritable bowel syndrome, which may also play a role on FI improvement in these women. Also, overweight and obese women with more severe urinary incontinence, a risk factor for FI, may have been more motivated to participate in a weight loss study due a larger symptom burden, thus introducing a participation bias. Finally, the participants in the study were generally healthy, community-dwelling volunteers enrolled in a randomized clinical trial, which may limit the generalizability of our findings.

In summary, FI severity and frequency improved 18 months after a weight loss intervention program in overweight and obese women with urinary incontinence in the PRIDE trial. The health benefits achieved with weight reduction and increased dietary fiber intake may also improve FI severity. Although this trial was not powered to show an improvement in FI, future studies are needed to evaluate the impact of weight loss and dietary modification in overweight and obese women with FI.

Acknowledgments

Funding support This study was supported by grant numbers U01DK067860, U01 DK067861, and U01 DK067862 from the National Institute of Diabetes and Digestive and Kidney Diseases. Funding was also provided by the Office of Research on Women's Health. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Diabetes and Digestive and Kidney Diseases or the National Institutes of Health.

References

1. Nelson R, Norton N, Cautley E, Furner S. Community-based prevalence of anal incontinence. JAMA. 1995; 274:559–561. [PubMed: 7629985]
2. We W, Borrud L, Goode PS, et al. Fecal incontinence in US adults: epidemiology and risk factors. Gastroenterol. 2009; 137:512–517.
3. Nygaard I, Barber MD, Burgio KL, et al. Prevalence of symptomatic pelvic floor disorders in US women. JAMA. 2008; 300:1311–1316. [PubMed: 18799443]
4. Lawrence JM, Lukacz ES, Nager CW, Hsu J-WY, Luber KM. Prevalence and co-occurrence of pelvic floor disorders in community-dwelling women. Obstet Gynecol. 2008; 111:678–685. [PubMed: 18310371]
5. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999–2004. JAMA. 2006; 295:1549–1555. [PubMed: 16595758]
6. Mokdad AH, Ford ES, Bowman BA, et al. Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. JAMA. 2003; 289:76–79. [PubMed: 12503980]
7. Varma M, Brown J, Creasman J, et al. Fecal incontinence in females older than aged 40 years: who is at risk? Dis Colon Rectum. 2006; 49(6):841–851. [PubMed: 16741640]
8. Melville JL, Fan MY, Newton K, Fenner D. Fecal incontinence in US women: a population-based study. Am J Obstet Gynecol. 2005; 193:2071–2076. [PubMed: 16325618]
9. Erekson EA, Sung VW, Myers DL. Effect of body mass index on the risk of anal incontinence and defecatory dysfunction in women. Am J Obstet Gynecol. 2008; 198:596e1–596e4. [PubMed: 18455543]
10. Altman D, Falconer C, Rossner S, Melin I. The risk of anal incontinence in obese women. Int Urogynecol J. 2007; 18:1283.
11. Goode PS, Burgio KL, Halli AD, et al. Prevalence and correlates of fecal incontinence in community-dwelling older adults. J Am Geriatr Soc. 2005; 53:629–635. [PubMed: 15817009]

12. Quander CR, Morris MC, Melson J, Bienias JL, Evans DA. Prevalence of and factors associated with fecal incontinence in a large community study of older individuals. Am J Gastroenterol. 2005; 100:905–909. [PubMed: 15784039]
13. Subak LL, Whitcomb E, Shen H, Saxton J, Vittinghoff E, Brown JS. Weight loss: a novel and effective treatment for urinary incontinence. J Urol. 2005; 174:190–195. [PubMed: 15947625]
14. Hannestad YS, Rortveit G, Daltveit AK, Hunskaar S. Are smoking and other lifestyle factors associated with female urinary incontinence? The Norwegian EPINCONT Study. BJOG. 2003; 110:247–254. [PubMed: 12628262]
15. Townsend MK, Curhan GC, Resnick NM, Grodstein F. BMI, waist circumference, and incident urinary incontinence in older women. Obesity. 2008; 16(4):881–886. [PubMed: 18379564]
16. Subak LL, Wing R, West DS, et al. Weight loss to treat urinary incontinence in overweight and obese women. N Engl J Med. 2009; 360:481–490. [PubMed: 19179316]
17. Brown JS, Wing R, Barrett-Connor E, et al. Lifestyle intervention is associated with lower prevalence of urinary incontinence: the diabetes prevention program. Diabetes Care. 2006; 29:385–390. [PubMed: 16443892]
18. Burgio KL, Richter HE, Clements RH, Redden DT, Goode PS. Changes in urinary and fecal incontinence symptoms with weight loss surgery in morbidly obese women. Obstet Gynecol. 2007; 110:1034–1040. [PubMed: 17978117]
19. Markland AD, Richter HE, Burgio KL, Bragg C, Hernandez AL, Subak LL. Fecal incontinence in obese women with urinary incontinence: prevalence and role of dietary fiber intake. Am J Obstet Gynecol. 2006; 200(5):566.e1–566.e6. [PubMed: 19136088]
20. Rockwood TH, Church JM, Fleshman JW, et al. Patient and surgeon ranking of the severity of symptoms associated with fecal incontinence: the fecal incontinence severity index. Dis Colon Rectum. 1999; 42:1525–1532. [PubMed: 10613469]
21. Wyman JF, Choi S, Harkins SW, Wilson M, Fantl J. The urinary diary in evaluation of incontinent women: a test-retest analysis. Obstet Gyneco. 1988; 81:812–17.
22. Scarpero HM, Fiske J, Xue X, Nitti VW. American Urological Association Symptom Index for lower urinary tract symptoms in women: correlation with degree of bother and impact on quality of life. Urology. 2003; 61:1118. [PubMed: 12809877]
23. Shumaker SA, Wyman JF, Uebersax JS, McClish D, Fantl JA. Health-related quality of life measures for women with urinary incontinence: the Incontinence Impact Questionnaire and the Urogenital Distress Inventory. Continence Program in Women (CPW) Research Group. Qual Life Res. 1994; 3:291–306. [PubMed: 7841963]
24. Boucher B, Cotterchio M, Kreiger N, Nadalin V, Block T, Block G. Validity and reliability of the Block98 food-frequency questionnaire in a sample of Canadian women. Public Health Nutr. 2006; 9:84–93. [PubMed: 16480538]
25. Block G, Sinha R, Gridley G. Collection of dietary-supplement data and implications for analysis. Am J Clin Nutr. 1994; 59:232S–239S. [PubMed: 8279432]
26. Wasserberg N, Haney M, Petrone P, et al. Fecal incontinence among morbid obese women seeking for weight loss surgery: an underappreciated association with adverse impact on quality of life. Int J Colorectal Dis. 2008; 23:493. [PubMed: 18228028]
27. Greer WJ, Richter HE, Bartolucci AA, Burgio KL. Obesity and pelvic floor disorders: a systematic review. Obstet Gynecol. 2008; 112:341–349. [PubMed: 18669733]
28. Bliss DZ, Jung HJ, Savik K, et al. Supplementation with dietary fiber improves fecal incontinence. Nurs Res. 2001; 50(4):203–213. [PubMed: 11480529]
29. Vaizey CJ, Carapeti E, Cahill JA, Kamm MA. Prospective comparison of faecal incontinence grading systems. Gut. 1999; 44:77–80. [PubMed: 9862829]

Table 1

Distribution of sociodemographic and medical characteristics comparing overweight and obese women with urinary incontinence who had improved fecal incontinence severity and those without improved FI severity in PRIDE at 18 months

Characteristic	No FI or no improvement in FI severity[a]	Improvement in FI severity[a]	*p* value
Total sample size, *n*=291	258 (89)	33 (11)	
Age at baseline (years)	53 (±10)	55 (±10)	0.12
White race/ethnicity	199 (77)	28 (85)	0.31
Treatment group			0.14
Control	77 (30)	14 (42)	
Intervention	181 (70)	19 (58)	
BMI at baseline (kg/m^2)	37 (±6)	34 (±5)	0.02
Change in BMI (kg/m^2)	−2 (±3)	−1 (±2)	0.15
Weight at baseline (kg)	97 (±17)	89 (±14)	0.003
Change in weight (kg)	−5 (±8)	−2 (±6)	0.12
Alcohol use at baseline	174 (67)	20 (61)	0.43
Menopausal status			0.15
<1 year ago	108 (45)	8 (27)	
>1 year ago	132 (55)	22 (73)	
Hysterectomy	79 (31)	12 (36)	0.76
Constipation (weekly or daily)	20 (8)	7 (21)	0.16
Urinary incontinence			0.54
Stress only	11 (4)	3 (9)	
Mixed, stress predominant	41 (16)	7 (21)	
Urge only	34 (13)	3 (9)	
Mixed, urge predominant	85 (33)	8 (24)	
Mixed, no predominant type	87 (34)	12 (36)	
Prior urinary incontinence treatment	50 (19)	11 (33)	0.16
Urinary distress inventory (total score at baseline)	164 (±53)	166 (±48)	0.79
AUA Symptom Index at baseline	10 (±5)	11 (±6)	0.51
Change in AUA Symptom Index score	−4 (±5)	−5 (±5)	0.51

All data presented as *n* (%) and mean (standard deviation)

FI fecal incontinence, *FISI* Fecal Incontinence Severity Index, *BMI* body mass index, *AUA* American Urologic Association

[a] Fecal incontinence severity as measured with the modified Fecal Incontinence Severity Index scores; lower scores indicate improved FI severity, whereas no change or a higher score represents no improvement in FI severity

Table 2

Repeated measures generalized linear model of factors independently associated with improved fecal incontinence severity among overweight and obese women with urinary incontinence across all visits

	Women with FISI scores >0 at baseline, *n*=163	
Model variable	**Beta (95% confidence interval)[a]**	***p* value**
Visit	0.63 (−1.14 to −0.12)	0.02
Clinic	0.45 (−0.87–1.76)	0.51
Age (5 years increments)	0.17 (−0.20–0.55)	0.37
White race/ethnicity	−0.95 (−3.11—1.20)	0.39
Baseline weight (kg)	0.21 (−0.01–0.44)	0.07
Change in weight from baseline(kg)	−0.28 (−0.73—0.17)	0.22
Urinary incontinent episodes at baseline	−0.17 (−0.50—0.17)	0.32
Increased fiber intake from baseline (10 g/day)	0.15 (−0.89–0.58)	0.68
Decreased AUA symptom index score from baseline	−0.20 (−0.33 to −0.06)	0.004

FISI Fecal Incontinence Severity Index, *AUA* American Urologic Association

[a] Estimates are adjusted for clinic site and account for clustering within intervention groups

Table 3

Proportional odds repeated measures regression analysis of factors independently associated with decreases in liquid fecal incontinence frequency among overweight and obese women with urinary incontinence across all visits

	Women with FISI Scores >0 at baseline, *n*=163	
Model variable	**OR (95% confidence interval)[a]**	***p* value**
Visit	1.15 (0.97–1.37)	0.11
Clinic	0.92 (0.49–1.76)	0.81
Age (5 years increments)	0.98 (0.86–1.12)	0.75
White race/ethnicity	0.63 (0.31–1.28)	0.20
Baseline weight (kg)	1.00 (0.93–1.07)	0.97
Change in weight from baseline (kg)	1.23 (1.08–1.40)	0.001
Urinary incontinent episodes at baseline	1.00 (0.99–1.01)	0.65
Increased fiber intake from baseline (10 g/day)	1.18 (1.00–1.40)	0.05
Decreased AUA symptom index score from baseline	1.07 (1.02–1.08)	0.004

[a] ORs are adjusted for clinic site and account for clustering within intervention groups

FISI Fecal Incontinence Severity Index, *AUA* American Urologic Association, *OR* odds ratio