

Increased Long-term Dietary Fiber Intake Is Associated With a Decreased Risk of Fecal Incontinence in Older Women

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BACKGROUND & AIMS: Fiber supplements are frequently used as treatment for fecal incontinence (FI), but little is known about the role of dietary fiber in the prevention of FI. **METHODS:** We performed a prospective study to examine the association between long-term dietary fiber intake and risk of FI in 58,330 older women (mean age, 73 years) in the Nurses' Health Study who were free of FI in 2008. Energy-adjusted long-term dietary fiber intake was determined using food frequency questionnaires starting in 1984 and updated through 2006. We defined incident FI as at least 1 liquid or solid FI episode per month during the past year during 4 years of follow-up using self-administered biennial questionnaires. We used Cox proportional hazards models to calculate multivariable-adjusted hazard ratios and 95% CIs for FI according to fiber intake, adjusting for potential confounding factors. **RESULTS:** During 193,655 person-years of follow-up, we documented 7,056 incident cases of FI. Compared with women in the lowest quintile of fiber intake (13.5 g/day), women in the highest quintile (25 g/day) had an 18% decrease in risk of FI (multivariable hazard ratio, 0.82; 95% CI, 0.76–0.89). This decrease appeared to be greatest for risk of liquid stool FI, which was 31% lower in women with the highest intake of fiber compared with women with the lowest intake (multivariable hazard ratio, 0.69; 95% CI, 0.62–0.75). Risk of FI was not significantly associated with fiber source. **CONCLUSIONS:** In an analysis of data from almost 60,000 older women in the Nurses' Health Study, we found higher long-term intake of dietary fiber was associated with decreased risk of FI. Further studies are needed to determine the mechanisms that mediate this association.

Keywords: Nurses' Health Study; Population-Based Study; Diarrhea; Prevention.

Fecal incontinence (FI) is a common yet debilitating pelvic floor disorder associated with a deleterious impact on quality of life and increasing prevalence with age.¹ Estimates suggest that the prevalence of FI will increase by almost 60% (10.6–16.8 million affected) in US women by 2050.² Although many studies have retrospectively assessed risk factors for FI in those already affected by the condition, there are scant prospective data on risk of

incident FI.³ Thus, there is an imperative to identifying potential populations who might benefit from prevention strategies targeting modifiable risk factors.

Dietary factors are of particular interest given broader interest in dietary modification for other health outcomes. Fiber has long been a staple first-line treatment for FI,⁴ with one trial suggesting a standalone benefit compared with a constipating agent⁵ and another showing variable benefits when added to a constipating agent.⁶ Furthermore, a randomized clinical trial found that psyllium supplementation led to a decreased frequency of FI compared with placebo.⁷ However, to our knowledge, there are sparse data evaluating the role of dietary fiber in the prevention of incident FI in those at risk.

Therefore, we sought to prospectively examine the association between long-term dietary fiber intake and risk of FI in a large ongoing study of older US women, the Nurses' Health Study. This cohort allows for comprehensive and periodic assessments of dietary intake and other lifestyle and medical factors that could play a role in the development of incident FI.

Methods

Study Population

The Nurses' Health Study is a prospective cohort that began in 1976, when 121,706 US female registered nurses 30–55 years old completed a self-administered, mailed questionnaire regarding their health and lifestyle. Participants have received follow-up questionnaires on a biennial basis to update information and repeated mailings are sent to nonresponders during the 2-year period before the following cycle's questionnaire is mailed, with a follow-up rate of approximately 90%. The present study included women who completed a detailed, semiquantitative, dietary food frequency questionnaire (FFQ)

Abbreviations used in this paper: BMI, body mass index; FFQ, food frequency questionnaire; FI, fecal incontinence; HR, hazard ratio; MHT, menopausal hormone therapy.

WHAT YOU NEED TO KNOW**BACKGROUND AND CONTEXT**

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in 1984 with updated information through 2006. We specifically queried participants about FI on the 2008 questionnaire. For this analysis, we included 61,600 women who returned the standard version of the 2008 questionnaire that contained the questions about FI and did not report prevalent FI at that time. Then we excluded 1,505 women with missing dietary data and 1,765 women who could not walk to address potential confounding by physical limitations.⁸ The final analytic population for the present analysis ultimately included 58,330 women (Figure 1). The study was approved by the institutional review board of Brigham and Women's Hospital (Boston, Massachusetts).

Dietary Assessment

Intake of dietary fiber and other nutrients was assessed by validated, self-administered, semiquantitative FFQs administered in 1984, 1986, 1990, 1994, 1998, 2002, and 2006. The original 1984 questionnaire included 121 items, which was

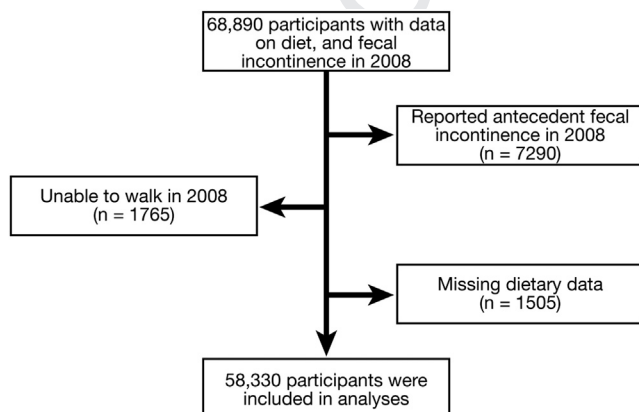


Figure 1. Flow of eligible participants into the study.

increased to 136 items starting in 1986. For each food item, a commonly used portion size was specified and participants were asked how frequently they consumed the given food—on average—during the previous year. Nutrient intake was calculated by multiplying the consumption frequency of each food item by the nutrient content based on tables provided by the US Department of Agriculture. We calculated total dietary fiber intake based on the Association of Official Analytical Chemists method,⁹ which has been accepted by the US Food and Drug Administration and the World Health Organization for nutrition labeling. We adjusted fiber intake for total caloric intake using the nutrient residual method.¹⁰ FFQs have shown good reproducibility and validity for the assessment of fiber intake.¹¹

Ascertainment of FI

On the 2008, 2010, and 2012 questionnaires, participants were asked, “On average, how often in the past year have you experienced any amount of accidental bowel leakage?” Response categories included “never,” “less than once a month,” “1–3 times per month,” “about once a week,” “several times a week,” or “nearly daily.” Women were considered to have FI if they reported incontinence of liquid or solid stool at least monthly.

Assessment of Covariates

On each biennial questionnaire, detailed information about lifestyle factors pertinent to the risk of FI were ascertained, including body weight (height was reported on the 1976 questionnaire for calculation of body mass index [BMI]), history of smoking, and physical activity. Participants also were asked on each questionnaire about medical factors relevant to the risk of FI, including parity, history of cholecystectomy, history of hysterectomy, diagnosis with diabetes mellitus, hypertension, use of menopausal hormone therapy (MHT), and neurologic disease; neurologic disease was defined as a diagnosis of amyotrophic lateral sclerosis, multiple sclerosis, or Parkinson disease. We also assessed the impact of gastrointestinal conditions that could increase the risk of FI, including patient-reported surgery for diverticulitis and diagnosis of colorectal cancer or inflammatory bowel disease confirmed by medical record review.

Statistical Analysis

We calculated person-time for each participant from the date of return of the 2008 questionnaire to the date of report of FI (considered as the midcycle time from the date of report to the previous questionnaire), date of the last questionnaire returned, death of any cause, or June 1, 2012, whichever came first. We used Cox proportional hazards regression models, adjusted for confounders, to calculate multivariable-adjusted hazard ratios (HRs) and 95% CIs for incident FI. Our main exposure, dietary fiber intake, was modeled as a cumulative average of intake through the questionnaires preceding first report of at least monthly FI and was stratified into quintiles, consistent with prior analyses using this cohort^{12,13} and provides the most stable estimate of adult diet in studies that include repeat measurements.¹⁴ Because bowel disturbances can affect the relation between fiber intake and FI, we conducted separate analyses examining the association of physical activity with risk of liquid or solid stool FI alone.

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