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Weight loss prevents urinary incontinence in women with type 2 diabetes: Results from the Look AHEAD trial

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Abstract

Purpose—To determine the effect of weight loss on the prevalence, incidence, and resolution of weekly or more frequent urinary incontinence (UI) in overweight/obese women with type 2 diabetes after 1 year of intervention in the Look AHEAD trial.

Materials and Methods—Women in this sub-study (N = 2739; 57.9 ± 6.8 years; body mass index 36.5 ± 6.1 kg/m^2) were randomized into an intensive lifestyle weight loss intervention (ILI) or a diabetes support and education (DSE) control condition.

Results—At baseline, 27% of participants reported UI on a validated questionnaire (no significant difference by ILI vs. DSE). After 1 year of intervention, the ILI group in this sub-study lost 7.7 ± 7.0 kg compared with a 0.7 ± 5.0 kg loss for DSE. At 1 year, fewer women in ILI reported UI (25.3% for ILI vs. 28.6% for DSE, p=0.05). Among participants without UI at baseline, 10.5% of ILI and 14.0% of DSE participants developed UI after 1 year (p = 0.02). There were no significant group differences in resolution of UI (p-values > 0.17). Each 1 kg of weight lost was associated with a 3% reduction in the odds of developing UI (p=0.01), and weight losses of 5–10% reduced these odds by 47% (p = 0.002).

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Author Contributions

S.P. researched data and wrote the manuscript. P.H. researched data and conducted the data analysis and wrote the manuscript. J.B., R.W., M.E., D.W., researched the data, contributed to the discussion, and reviewed/edited the manuscript. A.K., L.S., K.B, V.D, A.G. reviewed/edited the manuscript and contributed to the discussion.

Disclosures

K.B. has worked as a consultant with three companies that have products for the treatment of incontinence: Pfizer, Astellas, and Johnson & Johnson. L.S. has investigator-initiated research funded by Pfizer, which makes products to treat UI. D.S.W. is an advisory board member to the commercial weight loss program Jenny Craig, Inc.

Conclusions—Moderate weight loss reduced the incidence but did not improve resolution rates of UI at 1 year among overweight/obese women with type 2 diabetes. Weight loss interventions should be considered for prevention of UI in overweight/obese women with diabetes.

Keywords

urinary stress incontinence; urge incontinence; intervention studies

INTRODUCTION

Obesity and type 2 diabetes are well recognized independent risk factors for UI in women.[1] Each 5-unit increase in BMI is associated with 60 to 100% increased risk of daily UI.[1, 2] Type 2 diabetes is also an independent risk factor for UI in women, and the common co-occurrence of both obesity and type 2 diabetes makes UI even more prevalent in this subgroup.[3–5]

Weight loss interventions targeting diet and physical activity have been shown to improve UI in overweight and obese women [6–8] and in overweight women with impaired glucose tolerance.[9] However, whether a lifestyle modification weight loss program would have positive effects on UI in women with established type 2 diabetes is unknown. Thus, the purpose of this study was to determine the effect of a lifestyle modification weight loss program on the prevalence, incidence, and resolution of UI in overweight/obese women with type 2 diabetes. We hypothesized that the lifestyle intervention would reduce the prevalence and incidence and increase resolution rates of UI after 1 year of treatment.

MATERIALS AND METHODS

The Look AHEAD study[10] is a multi-center, randomized controlled study in overweight and obese individuals with type 2 diabetes and is designed to assess the long-term (up to 13.5 years) effects of an intensive lifestyle intervention (ILI) weight loss program versus a diabetes support and education (DSE) control condition on cardiovascular morbidity and mortality. The Look AHEAD randomization began in 2001 with planned follow-up until 2014[10] and included individuals at 16 clinical centers. Eligibility criteria were age 45–76 years, and a body mass index (BMI) ≥25 kg/m^2 (>27 kg/m^2, if currently taking insulin). Major exclusions included HbA1c ≥11%, blood pressure ≥ 160/100 mmHg, triglycerides ≥ 600 mg/dl, inadequate control of co-morbid conditions, factors that may limit adherence to the intervention, and underlying disease likely to limit lifespan and/or affect safety of the interventions. For the purposes of this sub-study, men were excluded from analysis. Informed consent was obtained from all participants before screening, consistent with the Helsinki Declaration and the guidelines of each center's institutional review board.

Interventions

Participants were randomly assigned within centers to the ILI or the DSE conditions with equal probability. ILI[11] was designed to promote an average of ≥ 7% weight loss at 1 year. Participants were encouraged to consume a low calorie and low fat, portion-controlled diet that included liquid meal replacements and to achieve at least 175 minutes of physical activity per week. The ILI participants were seen weekly for the first 6 months and 3 times per month for the next 6 months for a total of 44 sessions. DSE participants were invited to 3 group sessions during the year, which focused on diet, physical activity, or social support.

Assessments

All measures were completed at baseline and 1 year by assessors who were masked to the participants' treatment group. UI was assessed by validated self-report questions used in previous studies.[12–14] We chose weekly or more frequent incontinent episodes ("weekly") as our primary outcome due to its clinical significance and use in previous research.[14] We also selected < weekly as the reference group, which included monthly, < monthly, and no UI episodes.[14] Women with at least weekly UI in the last year were also asked to recall the type and number of UI episodes in the past 7 days.[15] Predominant type of UI was coded based on whether a participant reported a higher frequency of stress or urgency incontinent episodes. (Due to the limited number of participants [n = 64; 2%], no analyses were conducted for "mixed UI" defined as frequency of stress= frequency of urgency UI). Similar to other research,[1] we categorized change in UI as "worsened" (increase of at least two episodes per week), "unchanged" (change of at most one episode per week); or, "improved" (decrease of at least two episodes per week). Weight was measured on a digital scale and standing height with a standard stadiometer. Standardized interviewer-administered questionnaires were used to obtain demographic and medical history information.

Statistical Analyses

All analyses were carried out using SAS version 9.1 (SAS Institute, Cary, NC). Those who completed both baseline and 1-year assessments were compared with those who did not complete 1-year assessments on relevant baseline variables and demographic characteristics using analysis of variance (ANOVA) for continuous variables and chi-square tests for categorical variables. Similar analyses were conducted to compare ILI and DSE participants on baseline variables. Subsequent analyses included only those who completed both baseline and 1-year assessments. Multivariable logistic regression models were used to examine the effect of intervention group on 1-year prevalence, incidence, and resolution of weekly UI. All models were adjusted for center, BMI, race, parity, urinary tract infection (UTI), diuretic use, and hysterectomy status. When modeling 1-year prevalence we also controlled for baseline prevalence of UI. Multivariable logistic regression analyses were also conducted examining the effects of weight loss (both as a continuous and categorical measure [<5%, 5–10%, and >10%]) on 1-year prevalence and incidence of UI, with and without adjustment for intervention group and the same covariates.

RESULTS

UI was assessed in 2,994 women at baseline (1,495 in ILI and 1,499 in DSE). Of these, 2,739 (91%) women completed the same measure at 1 year (Figure 1). The completion rate was slightly higher in the ILI group compared to the DSE group (92.6% vs. 90.3%, p = 0.02). Survey completers were more likely to be white (p=0.01) and to be never smokers (p=0.02) than non-completers, but no other significant differences were observed (p values ≥ 0.06).

Characteristics of the 2739 women survey completers are shown in Table 1. There were no significant differences between the DSE and ILI groups. About 27% of the women in each group had weekly incontinence at baseline (Table 2); about 13% in each group reported stress and 10% reported urgency UI (p=0.66 and p=0.48, respectively). Similar to results of all participants in Look AHEAD,[16] participants in the ILI in this sub-study lost more weight at 1 year than those in DSE (7.7 vs. 0.7 kg, respectively; p < 0.0001).

Prevalence of weekly incontinence at 1 year

The prevalence of UI at 1 year was less in ILI compared to DSE (Table 2: 25.3% vs. 28.6%, respectively; p=0.05). ILI, compared with DSE, was associated with a 20% reduction in the

odds of having UI (Table 3: OR = 0.80 [0.65–0.98]; p = .03), after adjusting for baseline characteristics including UI status and relevant medical history

The prevalence of stress UI at 1 year was also less in ILI compared to DSE (10.5% vs. 12.8 % p=0.07). ILI reduced the odds of having stress UI by 27% (Table 3: OR = 0.73; CI [0.55–0.96] p = .03). Of note, no significant effect of treatment group was seen on the 1-year prevalence of urgency UI. When weight loss was entered as a covariate, intervention group differences in the 1-year odds of having UI or stress UI were attenuated and no longer statistically significant.

Incidence and resolution of weekly incontinence at 1 year

Table 2 shows the percent of women without weekly UI at baseline who then developed incident weekly UI at the 1-year assessment (10.5% of ILI vs. 14.0% of DSE; p = .02). ILI, compared with DSE, reduced the odds of incident UI by 26% (Table 3: OR = 0.74 [0.56–0.98]; p = .04), after adjusting for baseline characteristics and relevant medical history.

By type of UI, fewer women developed stress UI in the ILI vs. DSE treatment groups (3.8% (38/1009) of ILI vs. 6.2% (61/992) of DSE; p = 0.01). ILI, compared with DSE, reduced the odds of developing incident stress UI by 40% (Table 3: OR = 0.60; CI (0.39–0.91); p = 0.02], after adjusting for baseline characteristics and relevant medical history. There were no significant differences in development of urgency UI in the two groups in adjusted and unadjusted analyses (p values > 0.42). When weight loss was entered as a covariate, group differences in the 1-year incidence of UI or stress UI were attenuated.

There were no significant group differences in resolution of UI among women who reported UI at baseline, overall (OR=1.20 [CI=0.97–10.21], p=0.28) or for stress and urge UI (p-values > 0.17). Approximately one-third of women in both groups had resolution of UI at 1 year (Table 2). Similarly, among those with UI at baseline, UI improved (i.e., a decrease of ≥ 2 episodes/week) in 37% and 33% of ILI and DSE participants, respectively, worsened (i.e., an increase of ≥ 2 episodes/week) in 33% and 37%, respectively, and remained unchanged in approximately 30% of each group (p values = 0.45). There were also no significant group differences in magnitude of reduction of incontinent episodes based on amount of 1-year weight loss.

Weight loss and weekly incontinence

We next examined the relationship between amount of weight lost and overall weekly incontinence at 1 year in the two groups combined, adjusting for baseline UI status and relevant medical history. As shown in table 4, each kg of weight lost reduced the odds of having any UI at 1-year by 3% (CI [0.96–0.99]; p = .001). Women who lost 5–10% of initial body weight had a 42% reduction in odds (CI [0.44–0.77]; p = .0001) and those who lost ≥10% of initial body weight had a 34% reduction (CI = .50–.87; p =.004) in odds of having any UI compared with those losing <5%.

By type of UI, similarly, each 1 kg of weight lost reduced the odds of having any stress UI at 1-year by 3% (OR 0.97, 95% CI [0.95– 0.99]; p = .008). Participants who lost 5–10% of initial body weight had a 33% reduction in odds (OR 0.67, 95% CI [0.47–0.95]; p = .03) and those who lost ≥10% of initial body weight had a 41% reduction in odds (OR 0.59, 95% CI = .40–.87 p =.008) of having stress UI compared with those losing <5%. There was no significant effect of weight loss as a continuous or categorical measure on odds of 1-year urgency UI. The effect of weight loss on overall and stress UI tended to persist after adjusting for treatment group in the model, but this did not reach statistical significance for stress UI (p=0.07).

We next examined the relationship between total amount of weight lost and incidence of 1-year UI in the two groups combined. For each 1 kg of weight lost, the odds of developing weekly UI at 1-year were reduced by 3% (OR 0.97, 95% CI [0.95–0.99]; p = .01). Women who lost 5–10% of initial body weight had a 47% reduction in odds (OR 0.53, 95% CI [0.0.36–0.80]; p = .002) and those who lost ≥10% of initial body weight had a 33% reduction (OR 0.67, 95% CI = 0.46–0.98; p =.04) in odds of developing UI compared with those losing <5%. Adding weight loss to the model for incidence of overall UI explained the effect of the treatment group. Weight loss as a continuous (p = 0.11) or categorical measure (p= 0.14) was not significantly associated with incident stress UI.

DISCUSSION

To the best of our knowledge, this study was the first to examine the impact of an intensive lifestyle modification weight loss program on UI in overweight/obese women with type 2 diabetes. At 1 year, we found the ILI significantly reduced prevalence of weekly UI, incident UI, and incident stress UI specifically. In multivariable analyses, we observed a significant reduction of approximately 25% in the odds of developing UI and 40% in odds of developing stress UI. Thus, our findings suggest that, in overweight/obese women with diabetes, lifestyle modification promoting weight loss should be considered an effective tool for the prevention of UI.

Weight loss (7.7 kg average) appeared to be the driving force behind the reduced prevalence and incidence of UI and stress UI. Overall, we found that for each 1 kg of weight lost, there was a significant 3% reduction in odds of developing UI, and stress UI specifically. As found in other studies,[6] modest weight loss (5–10%) reduced the odds of developing UI by about 50%. Moreover, larger weight losses (≥10%) did not appear to result in greater benefits. This finding has been reported in other studies[6] and is encouraging because weight loss of 5 –10% can be achieved and largely maintained with current behavioral weight loss programs.[17] Losing 5–10% of initial body weight may be sufficient for prevention of incontinence in overweight and obese women with type 2 diabetes.

Surprisingly, ILI did not appear to be associated with greater 1-year resolution of or improvement in UI. Other lifestyle intervention studies in overweight/obese women without diabetes[18, 19] or with impaired glucose tolerance[9] have shown a reduction in UI after weight loss. It is possible that weight loss is more effective for the prevention than treatment of UI in women who already have type 2 diabetes. However, this study did not specifically recruit women with UI, and only 27% of participants had weekly UI at study entry. Thus, future research is needed that specifically recruits women with UI and type 2 diabetes and also uses detailed assessments to document changes in UI (e.g., bladder diaries).

Interestingly, ILI was associated with the prevalence and incidence of UI and stress but not urgency UI at 1 year. Prior studies[18, 19] have also shown greater effects of weight loss on stress than urgency UI. It has been hypothesized that obesity may contribute to stress UI due to increased intra-abdominal pressure from central adiposity, which in turn increases bladder pressure and urethral mobility, exacerbating UI.[20] Weight loss may reduce forces on the bladder and pelvic floor, thus reducing stress UI preferentially.

This is the first randomized clinical trial to examine the impact of ILI on the prevalence and incidence of UI in women with type 2 diabetes. However, our study participants were clinical trial volunteers, and the study exclusion criteria were relatively strict. The 1-year retention rate was high (90–92%), but survey completers were more likely to be white and non-smokers. Thus, our findings may not generalize to population-based samples. The study used blinded assessors and a validated measure of UI. Also, ILI was not designed to inform

participants that weight loss could potentially reduce or improve incontinence. Nonetheless, the use of a self-report measure of UI could have introduced bias (e.g., ILI participants might have responded more positively as a function of being seen more frequently); future research with objective measures of UI is needed. Future analyses are also needed to examine potential mediators (e.g., physical activity, HbA1c) of the effect of weight loss on incident UI. Also, a future trial in women with weekly incontinence and diabetes is needed to confirm the effects of this intervention for improving weekly incontinence overall and by subtypes.

CONCLUSION

Moderate weight loss was associated with reduced prevalence and incidence of UI but did not improve resolution rates of UI among overweight/obese women with type 2 diabetes. This underscores the value of weight loss for the prevention of UI in overweight and obese women with type 2 diabetes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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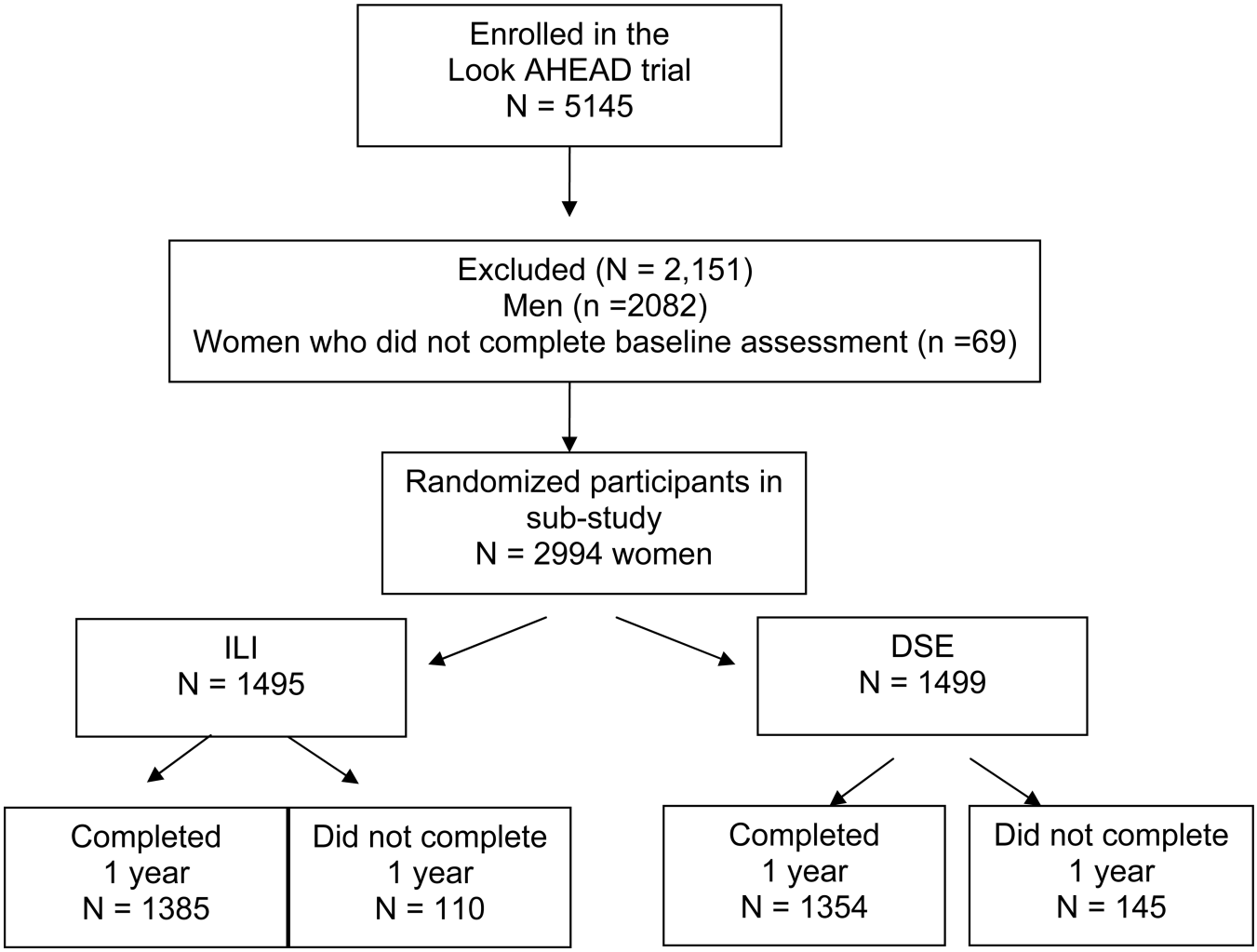

Figure 1.
Flow chart of participants in the urinary incontinence sub-study of Look AHEAD. DSE = diabetes support and education; ILI = intensive lifestyle intervention.

Table 1

Baseline characteristics of women who completed the urinary incontinence ancillary study (N = 2739)

	ILI N=1385	DSE N=1354
Age (yrs), mean ± SD	57.8 ± 6.7	58.1 ± 6.9
Race/ethnicity		
Non-Hispanic White	56%	55%
African American	20%	20%
Hispanic	15%	15%
Native American/Alaskan Native	6%	7%
Other	3%	3%
Body mass index (kg/m^2), mean ± SD	36.3 ± 6.2	36.7 ± 6.0
Hysterectomy	38%	41%
≥ 1 urinary tract infection in the past year, %	13%	13%
Parity >2, %	70%	71%
HbA1c (%), mean ± SD	7.3 ± 1.1	7.3 ± 1.2
Diabetes duration, year	6.6 ± 6.6	6.5 ± 6.4
Use of diuretics	7.3 ± 1.1	7.3 ± 1.2
None	57%	56%
Baseline only	6%	6%
1 year only	6%	7%
Both baseline and 1 year	31%	32%

DSE= diabetes support and education
ILI = intensive lifestyle intervention

Table 2

Proportion of women by treatment group with and without weekly or greater incontinence at baseline and after one year of intervention

	ILI (N = 1385)	DSE (N =1354)	P*
Prevalence			
Baseline (%)	27.2 (376/1385)	26.7 (362/1354)	0.81
1-year (%)	25.3 (350/1385)	28.6 (387/1354)	0.05
Incidence †			
1-year (%)	10.5 (106/1009)	14.0 (139/992)	0.02
Resolution ‡			
1-year (%)	35.1 (132/376)	31.5 (114/362)	0.30

DSE= Diabetes Support and Education
ILI=Intensive Lifestyle Intervention

*P value based on chi-square test

†Among women without weekly UI at baseline, those who developed weekly UI

‡Among women with weekly UI at baseline, those who no longer had UI

Table 3

Odds ratios of prevalent and incident of weekly or greater incontinence at one year for Intensive Lifestyle Intervention vs. Diabetes Support and Education treatment groups.

	Odds ratio	95% Confidence Interval	p*
Prevalent incontinence†			
Weekly incontinence	0.80	0.65–0.98	0.03
Stress predominant incontinence	0.73	0.55–0.96	0.03
Urge predominant incontinence	0.93	0.70–1.23	0.59
Incident incontinence‡			
Weekly incontinence	0.74	0.56 – 0.98	0.04
Stress predominant incontinence	0.60	0.39 –0.91	0.02
Urge predominant incontinence	0.91	0.61–1.36	0.65

*Multivariate logistic regression models were adjusted for clinic, BMI, race, parity, urinary tract infection, diuretic use, and hysterectomy

†When modeling 1-year prevalence, baseline prevalence of incontinence was also included in the model.

‡Among women without weekly urinary incontinence at baseline

Table 4

Odds ratios of any incontinence by amount of weight lost at one year in the women overall

	Odds ratio	95% Confidence Interval	
Weekly incontinence by weight loss			
Per 1 kg	0.97	0.96 – 0.99	0.001
5–10% versus < 5%	0.58	0.44 – 0.77	0.0001
>10% versus < 5%	0.66	0.50 – 0.87	0.004
Stress predominant incontinence by weight loss			
Per 1 kg	0.97	0.95 – 0.99	0.008
5–10% versus < 5%	0.67	0.47 – 0.95	0.03
>10% versus < 5%	0.59	0.40 – 0.87	0.008

Note: For weekly urgency incontinence, there was no effect of weight loss.

* Multivariate logistic regression models were adjusted for center, body mass index, race, parity, urinary tract infection, diuretic use, hysterectomy, and baseline incontinence prevalence.