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The effect of home-based behavioural weight loss combined with pelvic floor muscle training in women seeking weight loss combined with stress urinary incontinence: protocol for a randomised controlled trial

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ABSTRACT

Introduction Recent guidelines suggest behavioural weight loss (BWL) and pelvic floor muscle training (PFMT) as first-line treatment approaches for women with both obesity and stress urinary incontinence (SUI). However, the optimal therapeutic and management strategies for these populations remain uncertain.

Methods and analysis This assessor-blinded parallel-group randomised controlled trial aims to compare the efficacy of BWL alone, BWL plus conventional PFMT and BWL plus PFMT with a biofeedback device for women who are overweight or obese experiencing SUI or SUI-predominant mixed urinary incontinence. A total of 120 eligible women will be randomly assigned at a 1:1:1 ratio. All the three groups will be subjected to a 3-month self-supervision intervention after randomisation and will be assessed at baseline, after the 3-month intervention, 6 months after the intervention and 12 months after the intervention. The primary outcome measure is the self-reported severity of urinary incontinence assessed by the International Consultation on Incontinence Questionnaire-Urinary Incontinence short form. The secondary outcomes include weight loss effectiveness, pelvic muscle strength, pelvic floor ultrasound, three-dimensional body posture, adherence to the intervention and questionnaires for symptoms of pelvic organ prolapse, quality of life and sexual function.

Ethics and dissemination This study has been approved by the Peking Union Medical College Hospital ethics committee (K5504). All results from the study will be submitted to international journals and international conferences.

Trial registration number This trial has been registered with the Chinese Clinical Trial Registry (ChiCTR2400084015).

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ A relatively large sample size and a long follow-up period enhance the reliability of the results.
⇒ A comprehensive assessment encompassing weight loss effectiveness, urinary incontinence symptoms, pelvic muscle strength, pelvic floor ultrasound, quality of life, mental health, sexual function and three-dimensional body posture will be conducted.
⇒ To minimise bias, all three groups will adhere to the same expert-developed weight loss programme; for the two pelvic floor muscle training (PFMT) groups, training protocols and supervisor contact frequencies will be standardised, with the sole distinction being the use of a biofeedback device. A standardised approach for questionnaire completion and PFMT monitoring will be employed, ensuring consistency in data collection.
⇒ While assessor blinding will be achieved, it is only possible for the assessors and not for participants or supervising physicians, which could introduce potential bias.

INTRODUCTION

Overweight and obesity are growing public health problems, as projections indicate that approximately 20% of the global adult population could be affected by 2025,[1] with some studies suggesting higher prevalence rates among women compared with men.[2 3] Extensive evidence supports the gender-specific manifestation of obesity-associated comorbidities.[4] Notably, women with obesity demonstrate higher risks for cardiovascular complications and osteoarthritis, while men show greater predisposition to type 2 diabetes and non-alcoholic fatty liver disease.[5] With increasing population ageing, pelvic floor disorders, which are among the top five chronic diseases affecting women's health-related quality of life (HRQoL), have become increasingly pressing public health issues. Recent studies have also revealed a

connection between obesity and pelvic floor disorders, particularly stress urinary incontinence (SUI).[6–8] While obesity and SUI may not be life-threatening, they significantly impact the HRQoL for those affected[9–11] and impose a considerable financial burden on healthcare systems.[12]

The first-line treatment option for women struggling with SUI or SUI-predominant mixed urinary incontinence (MUI) is pelvic floor muscle (PFM) training (PFMT) for a minimum duration of 3 months.[13 14] To enhance the effectiveness of PFMT and cater to diverse needs, various therapeutic combinations have been devised, such as biofeedback, electrical stimulation and bladder diaries.[13 13] Notably, biofeedback has a well-established reputation for its efficacy.[13–15] In addition, several randomised controlled trials (RCTs)[10 11 16 17] have demonstrated the positive impact of behavioural weight loss (BWL) on reducing urinary incontinence symptoms among women with obesity. Current guidelines advocate coordinated management involving gynaecologists and nutritionists in this population[13–15]; however, there is limited research on the optimal combined management strategy.

An RCT assessed the effects of PFMT with or without BWL in women with MUI and a body mass index (BMI) between 25 kg/m^2 and 40 kg/m^2. The results revealed that BWL offered no additional benefits over PFMT,[18] which highlights the importance of PFMT. However, the conclusion remains to be further validated considering the limitations of the study's sample size (n=22), the short duration of the protocol (8 weeks) and the low weight-loss efficiency in the BWL+PFMT group, since there were no significant differences in body weight between the two groups before and after the intervention. Moreover, in real-world clinical practice, despite the significant proportion of women seeking weight loss suffering from urinary incontinence, they do not pay adequate attention to these issues and may hesitate to discuss this symptom because of its sensitive nature. While some women may experience improvements in urinary incontinence symptoms after weight loss, research on this topic is limited. Some women with noticeable symptoms might also attempt to perform PFMT on their own, but the lack of standardised procedures and inadequate supervision can greatly impede their effective resolution. There is a critical lack of public awareness and education in these populations,[19] and the optimal therapeutic and management strategies for these populations remain uncertain. Additionally, limited medical resources in certain areas hinder access to appropriate healthcare services. Given that societal and healthcare structures, lifestyle modifications and long-term interventions are essential for early recognition and prompt management, an effective self-supervision strategy is crucial for patients with both obesity and SUI. Streamlining patient convenience and reducing healthcare costs are driving the exploration of biofeedback, which may improve treatment compliance and treatment effects.[20 21]

Prior research[22] has shown that the severity of urinary incontinence symptoms often worsens with prolonged obesity, and weight management should be provided throughout a person's lifetime. However, the existing constraints on healthcare resources impede the implementation of such comprehensive guidance. The disparities in multidisciplinary team collaboration and awareness present formidable challenges to achieve optimal management of urinary incontinence among women with obesity. Therefore, there is an urgent need to increase awareness, promote research and enhance interdisciplinary supervision in managing urinary incontinence among women with obesity. The development of an effective management strategy for BWL and PFMT tailored to this population is crucial for enhancing the quality of medical services. This research protocol is designed to explore an effective and practical home-based integrated management strategy for women with both overweight/obesity and SUI symptoms.

METHODS AND ANALYSIS

Study design

This assessor-blinded parallel-group RCT aims to compare the efficacy of BWL alone, BWL plus conventional PFM, and BWL plus PFMT with a biofeedback device for women who are overweight or obese experiencing SUI or SUI-predominant MUI. Eligible patients will be randomly allocated to one of the three groups mentioned above. The participants will undergo a comprehensive baseline evaluation that includes the following: the provision of essential baseline clinical characteristics, including demographic details, pregnancy delivery history, lifestyle factors, etc and the completion of validated questionnaires related to SUI symptoms and their impact. Furthermore, subjects will require objective evaluations, including PFM strength assessments, pelvic ultrasound scans and three-dimensional posture assessments, which will be performed by the same assessor, who will remain blinded to the allocation status. Following randomisation and baseline data collection, all participants will embark on a 3-month BWL programme instructed by the same team of nutrition experts. Throughout the programme, participants will need to record their dietary intake three times a week (including at least one during weekends) and complete a weekly questionnaire on physical activity levels via the International Physical Activity Questionnaire.[23 24] In the BWL group, participants will be solely involved in self-supervision BWL. In the other two groups, participants will also undergo PFMT for 3 months. During the study period, all three groups will receive telephone supervision every 3 weeks. Assessments will be conducted at baseline, after the 3-month intervention, 6 months after intervention and 12 months after intervention (figure 1). The primary assessment contents for each phase are detailed in table 1.

Patient selection and recruitment

The enrolment of participants in our study began in October 2024. Currently, nearly half of the participants

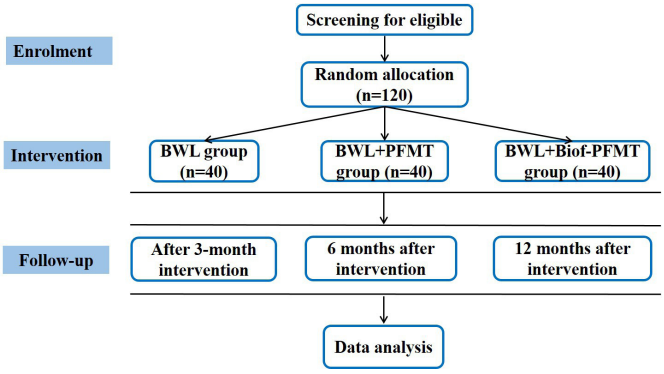

Figure 1 Flow chart of the study. BWL, behavioural weight loss; Biof-PFMT, pelvic floor muscle training with a biofeedback device; PFMT, pelvic floor muscle training.

have been recruited, and some of them have completed the assessment after the 3-month intervention. Women visiting the clinical nutrition department with clinically diagnosed SUI or MUI as the primary problem following the definition recognised by international guidelines[25] will be informed about this programme. Trained physicians will screen suitable candidates who satisfy all qualifying standards and express interest in participating, and a consent document (Supplementary material) will then be signed by those qualified for enrolment. Theoretically, all three groups in this study will experience some degree of improvement in their condition. If any adverse events or unexpected issues arise during the study period, participants are encouraged to promptly contact the project manager.

► *Inclusion criteria:*

1. Women with a BMI ≥25 kg/cm^2.
2. Patients currently experiencing symptoms of SUI or SUI-dominated MUI.
3. Age ≥18 years and ≤70 years.
4. Agree to refrain from self-initiating new treatments during the study period.

► *Exclusion criteria:*

1. The presence of only urgency urinary incontinence.
2. Pelvic organ prolapse greater than stage II (prolapse beyond the hymen >1 cm).
3. Having received drug treatment for urinary incontinence or weight loss within the past month.
4. History of pelvic floor surgery or bariatric surgery.
5, History of pelvic or abdominal malignancy.
6. Presence of urinary tract infection or ≥4 urinary tract infections within the past year.
7. Previous PFMT under the guidance of a trained therapist lasting more than 3 months in the past 5 years.
8. Delivery within the past 6 months or current plans for pregnancy.[11 26]
9. Severe systematic diseases such as uncontrolled diabetes, hypertension or hyperlipidaemia.
10. Other factors that may impede participation in the trial, such as frequent business travel, mental illness, inability to voluntarily contract PFMs, denial of sexual

Table 1 The assessments of the participants

Outcomes	Baseline	After a 3-month intervention	6 months after intervention	12 months after intervention
ICIQ-UI-SF	√	√	√	√
MOS	√	√		
MVCP	√	√		
POP-Q	√	√		
Pelvic floor ultrasound	√	√		
Three-dimensional body posture	√	√		
Body weight	√	√	√	√
Abdominal circumference	√	√	√	√
I-QOL	√	√	√	√
POP-SS	√	√	√	√
OABSS	√	√	√	√
PISQ-12	√	√	√	√
EQ-5D-5L	√	√	√	√
HADS	√	√	√	√
BPMSES	√	√	√	√
PGI-I		√	√	√

BPMSES, Broome Pelvic Muscle Self-Efficacy Scale; EQ-5D-5L, European Quality of Life-5 Dimensions 5-Level questionnaire; HADS, Hospital Anxiety and Depression Scale; ICIQ-UI-SF, Incontinence Modular Questionnaire-Urinary Incontinence Short Form; I-QOL, Incontinence Quality of Life Instrument; MOS, Modified Oxford Scale; MVCP, maximum voluntary contraction pressure; OABSS, Overactive Bladder Symptom Score; PGI-I, Patient Global Impression of Improvement; PISQ-12, Short-form Prolapse Incontinence Sexual Questionnaire; POP-Q, Pelvic Organ Prolapse Quantification; POP-SS, Pelvic Organ Prolapse Symptom Score.

activity history, refusal to have a pressure measurement device placed inside the vagina, etc.

Randomisation and masking

On the evaluation of the inclusion criteria and completion of the baseline assessments, the participants will be allocated into three groups via a computer-generated randomisation tool as previously described,[27] preserving an allocation ratio of 1:1:1. Considering the complexity of the intervention and the nature of the study, blinding of patients and physicians delivering the intervention and overseeing follow-ups is unfeasible. However, the assessors responsible for evaluating data will remain uninformed about group assignments, and participants will be instructed against disclosing their study group status to evaluating physicians.

Interventions

The training protocols for the PFMT will be the same as our previous research[27] and consist of three sets of fast and slow contractions daily in the supine position (6 min/set, three repetitions). Each rep has eight max contractions (6 s) + four fast contractions (1 s), with 30 s of rest between reps. The BWL protocol used in our previous research[28] emphasised health education and behaviour modification. The participants will be asked to follow a balanced diet with protein accounting for 30% of their daily energy, primarily whey protein and fat and carbohydrates accounting for 30% and 40%, respectively. They will also be advised to engage in a combination of cardio- and resistance exercises.

Outcome measures

Primary outcome measure

The primary outcome measure of SUI severity will be the validated Chinese version of the International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI-SF).[29] This scale consists of four items—frequency of urine leakage (with a score range from 0= never to 5= always), volume of urine leakage (awarded points: 0, 2, 4 and 6 for ascending volumes per occurrence), impact of urinary incontinence on daily life (scored on a scale from 0= not at all to 10= extremely) and types of leakage symptoms experienced during the last 4 weeks.[30] The total ICIQ-UI-SF score ranges from 0 to 21, with severity categorised as mild (0–7), moderate (8–13) or severe (14–21).

Secondary outcome measures

Weight loss

The effect of weight loss will be assessed by measuring various indicators, such as body weight, BMI, body surface area and abdomen and hip circumference.

PFM strength

The strength of the PFM will be quantified by employing subjective (vaginal palpation) and objective (manometry) techniques.

Subjective PFM strength will be evaluated via digital vaginal palpation via the modified Oxford grading scale. The participants will be guided to exert their maximum PFM contraction against the examiner's fingers within the vagina, rating their strength from 0 (no contraction) to 5 (strong contraction).[31]

Objective PFM strength will be measured as the maximum voluntary contraction pressure via an intravaginal manometer with a vaginal probe, 20 mL of air and a PHENIX USB 8 neuromuscular stimulation system. The maximum voluntary contraction pressure is obtained by deducting the vaginal resting pressure from the peak pressure achieved during maximal PFM contraction. The participants performed three trials, each 15 s apart, without involving abdominal, gluteal or hip adductors. The average of these three values quantifies muscle strength, with higher pressure implying greater strength.[32 33]

Pelvic floor ultrasound

Using a Mindray Nuewa R9 ultrasonic diagnostic instrument, a transperineal three-dimensional volumetric probe (SD8-1U) will be used. The participants will be requested to empty their bladder before the examination and assume the lithotomy position. All pelvic floor ultrasound examinations for patients will be performed by the same experienced physician who has undergone training and assessment, with images saved for subsequent analysis and the grouping hidden. Measurements will be taken at rest and during the maximum Valsalva manoeuvre. Signal acquisition and data recording include parameters such as the detrusor thickness, bladder neck mobility, posterior bladder angle, urethral inclination angle, urethral rotation angle and levator hiatal area.

Pelvic organ prolapse

Pelvic organ prolapse staging is determined through the utilisation of the Pelvic Organ Prolapse Quantification system,[34] which quantifies the positioning of vaginal structures relative to the hymenal ring. The subjective symptoms will be assessed with the Pelvic Organ Prolapse Symptom Score (POP-SS) questionnaire, which consists of seven questions examining symptom prevalence over the past month. The POP-SS comprises seven items, each scored on a 5-point Likert scale (0= never, 1= occasionally, 2= sometimes, 3= most of the time and 4= all of the time). A total score (range: 0–28) is calculated by summing responses to the seven symptom items. Additionally, participants indicate which symptom causes them the greatest bother.[35 36]

Three-dimensional body posture

The participants assume a natural standing position with their hands by their sides, feet together, their toes forward and their eyes facing forward. Depth cameras capture front and back images, followed by a full-body gait video. A smart three-dimensional posture analysis system, comprising the Advanced Posture and Human Rehabilitation Optimization (APHRO) platform and the European

Union Real-time Anatomical Data Integration System (EURADIS), employs depth cameras and artificial intelligence technology to comprehensively assess multiple key body areas. This integrated solution provides detailed evaluations of joint positioning accuracy, spinal curvature alignment, and muscular distribution patterns across anatomical regions. The measured parameters include the thoracic kyphosis angle, lumbar lordosis angle, sacral inclination angle, shoulder tilt, leg type, lower limb (functional) length, pelvic left-right tilt, pelvic rotation, pelvic anterior-posterior tilt and spinal sagittal axis.

Health-related quality of life

The specific HRQoL will be evaluated via the Chinese version of the Incontinence Quality of Life Instrument.[37] This tool consists of 22 items categorised into three subdomains: avoidance and limiting behaviour, psychosocial impacts and social embarrassment, with each query rated on a 5-point Likert-type scale. The total score is ultimately transformed to a 0–100 scale. The participants' general HRQoL will be assessed via the European Quality of Life-5 Dimensions 5-Level questionnaire,[38] which consists of a health description system and a visual analogue scale. The health description system covers five dimensions of HRQoL: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension is rated on a scale from 1 (no problems) to 5 (extreme problems), providing a comprehensive evaluation of the participants' overall well-being. The associated visual analogue scale allows patients to subjectively rate their health status on a scale from 0 to 100, with higher scores indicating better health status.

Sexual function

Sexual function will be assessed via the Short-form Prolapse and Incontinence Sexual Questionnaire. This instrument gauges sexual dysfunction by querying 12 questions, with scores ranging from 0 to 48. Elevated values reflect more significant sexual difficulties.[39]

Mental health

The Hospital Anxiety and Depression Scale[40] is a widely used, 14-item self-report questionnaire designed to assess the level of anxiety and depression in patients being treated in non-psychiatric hospital settings. The Hospital Anxiety and Depression Scale comprises two subscales: seven items measuring anxiety and seven items assessing depression. Each item is rated on a 0 to −3 scale, yielding scores ranging from 0 to 21 for both subscales. Scores of 8 or higher on either subscale indicate the presence of clinically relevant symptoms.

Overactive Bladder Symptom Score

Symptoms of overactive bladder will be assessed by the Overactive Bladder Symptom Score[41] with a cumulative threshold of three or more and a subscore of at least two on item three regarding urgency. For severity grading, a total score of 3–5 indicates mild severity, scores between 6 and 11 indicate moderate severity and a score of 12 or above signifies severe severity.

Broome Pelvic Muscle Self-Efficacy Scale

Self-efficacy will be evaluated with the Broome Pelvic Muscle Self-Efficacy Scale, which consists of 23 items covering two domains: efficacy beliefs and outcome expectations.[42 43] In the efficacy beliefs portion, participants express their faith in PFMT practice. In the outcome expectations component, they assess their assurance of PFMT's ability to curb urine loss. Scores from this scale range from 0 to 100, with higher values indicating greater perceived self-efficacy.

Patient Global Impression of Improvement

During the 3-month intervention, participants' perceptions of urine leakage will be tracked via the Patient Global Impression of Improvement questionnaire. Physicians will conduct weekly phone calls with participants asking, 'Compared with before this study, how would you rate your urinary symptoms now?' The responses are rated on a seven-point scale (1 =marked improvement, 7 =marked worsening), with improvement defined as a rating of 1 (very much better) or 2 (much better).[44]

Patient adherence to treatment

Patient adherence to treatment will be evaluated according to subjective self-reports and the completion of relevant questionnaires. Overall adherence will be classified as follows: low adherence (fewer than 50% of the anticipated exercises), moderate adherence (between 50% and 75% of the anticipated exercises) and high adherence (75% or more of the anticipated exercises). To enhance compliance, a strict informed consent process will be implemented to ensure that participants fully understand the study requirements during the recruitment phase. Besides, we adopt a single-centre design in the current study and have a dedicated person in charge of regular supervision to facilitate closer patient monitoring and streamlined communication.

Sample size

The primary outcome of this study was the ICIQ-UI-SF score. According to a literature review, the SD of ICIQ-SF scores in obese patients with concurrent urinary incontinence ranges from 2.61 to 4.9.[18 45 46] In this study, an SD of 4 was selected for all three groups. According to the literature, the minimum clinically important difference in the ICIQ-SF score is 2.5 points.[47] A minimum difference of 3 points was chosen in this study, and the estimated mean scores for the three groups were 15, 14 and 12, respectively.[18] With a bilateral alpha level of 0.05 and a power of 0.8, sample size calculation via PASS V.15 software revealed that each group should include 35 participants. Considering a dropout and refusal rate of 10%, 40 participants per group will be planned to be recruited, resulting in a minimum total of 120 study subjects.

Statistical analysis

The data will be analysed with SPSS V.23.0 software. Descriptive statistics, such as the mean, SD, median and IQR, will be employed for continuous variables, whereas relative frequencies with percentages (n, %) will be determined for categorical variables. One-way analysis of variance will be used to compare continuous variables consistent with homogeneity of variance among groups; otherwise, the Kruskal-Wallis test will be used. The χ^2 test or Fisher's exact test will be used for categorical variable analysis. To examine the main and interactive effects, repeated measures analysis of variance will be employed for continuous variables following a normal distribution, denoted as the means±SD. The generalised estimating equations approach, with Bonferroni correction, will be used for continuous variables deviating from normality, presented as medians with IQRs (P_{25}, P_{75}). Significance testing will use a two-tailed approach, with a cut-off value of p value <0.05.

Data management

As previously described in our research,[27] the data management system for this study will comprise MySQL and the Peking Union Medical College Hospital intelligent follow-up system databases for data storage. Data within the system will be stored in a multitier architecture using a local cache and cloud storage. To maintain data integrity and clarity, data managers will frequently review entries using both computerised and manual techniques, focusing on completeness, omissions and ambiguous values. Publication of study data will exclude personally identifiable information such as names, images and any other identifying details to protect participant confidentiality. This trial will also be audited by the ethics committee.

Missing data

To assess the potential bias caused by missing data, we will compare the baseline characteristics of participants who did and did not have missing values. By identifying predictive factors for missingness, we can adjust the primary outcome analysis to account for these factors if they are significantly associated with the data missing. Additionally, as part of a sensitivity analysis, we will consider using multiple imputations through chained equations to address any missing data in the primary outcome model.

Advantage and limitation

The key advantages of this study design are that it focuses on urinary incontinence symptom improvement as the primary outcome while also considering weight loss effectiveness, pelvic muscle strength, pelvic floor ultrasound, quality of life, mental health, sexual function, three-dimensional body posture, etc. Furthermore, the use of a relatively large sample size and a long follow-up period will strengthen the reliability of the results. Throughout the study, assessor blinding will be maintained to ensure fairness. Moreover, the study provides a standardised method for completing questionnaires and monitoring PFM contractions. However, it is important to acknowledge that this study also has several limitations. First, intervention blinding will only be possible for assessors, not for participants or supervising physicians. Additionally, the BWL programme used in this study focuses primarily on a high-protein diet. Future investigations exploring various BWL approaches will contribute to more personalised treatment plans.

ETHICS AND DISSEMINATION

This trial has been registered with the Chinese Clinical Trial Registry (http://www.chictr.org.cn: ChiCTR2400084015). All participants will be provided with written informed consent, and the study will be conducted in accordance with the Declaration of Helsinki. The study protocol (version 2) and the informed consent form have been approved by the Peking Union Medical College Hospital ethics committee (K5504, 2024-4-26). All results from the study will be submitted to relevant scientific journals and international conferences.

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Contributors All the listed authors have made essential contributions to the work. Guarantor is ZS and the entire study will be directed by ZS to ensure the execution and completion of the study according to the protocol. ZS, WC and ZT conceived and designed the study protocol. ZT drafted the original manuscript. XW, LF and TL participated in refining the study design. All the authors have read and approved the final manuscript for publication.

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Competing interests None declared.

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REFERENCES

1 Mohammed MS, Sendra S, Lloret J, *et al*. Systems and WBANs for Controlling Obesity. *J Healthc Eng* 2018;2018:1564748.

2 Abarca-Gómez L, Abdeen ZA, Hamid ZA, *et al*. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. *The Lancet* 2017;390:2627–42.
3 Cooper AJ, Gupta SR, Moustafa AF, *et al*. Sex/Gender Differences in Obesity Prevalence, Comorbidities, and Treatment. *Curr Obes Rep* 2021;10:458–66.
4 Katsareli EA, Dedoussis GV. Biomarkers in the field of obesity and its related comorbidities. *Expert Opin Ther Targets* 2014;18:385–401.
5 Kautzky-Willer A, Harreiter J, Pacini G. Sex and Gender Differences in Risk, Pathophysiology and Complications of Type 2 Diabetes Mellitus. *Endocr Rev* 2016;37:278–316.
6 Gordon B, Shorter B, Isoldi KK, *et al*. Obesity with Comorbid Stress Urinary Incontinence in Women: A Narrative Review to Inform Dietetics Practice. *J Acad Nutr Diet* 2017;117:889–907.
7 Brusciano L, Schiattarella A, De Franciscis P, *et al*. Prevalence of Pelvic Floor Dysfunction and Impact on the Quality of Life in Epidemiological Evaluation of Bariatric Patients. *Bariatr Surg Pract Patient Care* 2021;16:15–20.
8 Pomian A, Lisik W, Kosieradzki M, *et al*. Obesity and Pelvic Floor Disorders: A Review of the Literature. *Med Sci Monit* 2016;22:1880–6.
9 Fontenele MQS, Moreira MA, de Moura ACR, *et al*. Pelvic floor dysfunction distress is correlated with quality of life, but not with muscle function. *Arch Gynecol Obstet* 2021;303:143–9.
10 Wing RR, Creasman JM, West DS, *et al*. Improving urinary incontinence in overweight and obese women through modest weight loss. *Obstet Gynecol* 2010;116:284–92.
11 Subak LL, Wing R, West DS, *et al*. Weight loss to treat urinary incontinence in overweight and obese women. *N Engl J Med* 2009;360:481–90.
12 Turner DA, Shaw C, McGrother CW, *et al*. The cost of clinically significant urinary storage symptoms for community dwelling adults in the UK. *BJU Int* 2004;93:1246–52.
13 Palmer MH, Cockerell R, Griebling TL, *et al*. Review of the 6th International Consultation on Incontinence: Primary prevention of urinary incontinence. *Neurourol Urodyn* 2020;39:66–72.
14 NICE Guidance - Urinary incontinence and pelvic organ prolapse in women: management: NICE (2019) Urinary incontinence and pelvic organ prolapse in women: management. *BJU Int* 2019;123:777–803.
15 Nambiar AK, Bosch R, Cruz F, *et al*. EAU Guidelines on Assessment and Nonsurgical Management of Urinary Incontinence. *Eur Urol* 2018;73:596–609.
16 Fuselier A, Hanberry J, Margaret Lovin J, *et al*. Obesity and Stress Urinary Incontinence: Impact on Pathophysiology and Treatment. *Curr Urol Rep* 2018;19:10.
17 Phelan S, Kanaya AM, Subak LL, *et al*. Weight loss prevents urinary incontinence in women with type 2 diabetes: results from the Look AHEAD trial. *J Urol* 2012;187:939–44.
18 de Oliveira MCE, de Oliveira de Lima VC, Pegado R, *et al*. Comparison of pelvic floor muscle training isolated and associated with weight loss: a randomized controlled trial. *Arch Gynecol Obstet* 2019;300:1343–51.
19 Husk KE, Leong K, Rogers RG, *et al*. Public Awareness of Obesity and Risk of Pelvic Floor Disorders: A Cohort Study. *Urogynecology (Phila)* 2023;29:260–5.
20 Novara G, Checcucci E, Crestani A, *et al*. Telehealth in Urology: A Systematic Review of the Literature. How Much Can Telemedicine Be Useful During and After the COVID-19 Pandemic? *Eur Urol* 2020;78:786–811.
21 Grimes CL, Balk EM, Crisp CC, *et al*. A guide for urogynecologic patient care utilizing telemedicine during the COVID-19 pandemic: review of existing evidence. *Int Urogynecol J* 2020;31:1063–89.
22 Choi JM, Jiang J, Chang J, *et al*. Impact of Lifetime Obesity on Urinary Incontinence in the Women's Health Initiative. *J Urol* 2022;207:1096–104.
23 Macfarlane DJ, Lee CCY, Ho EYK, *et al*. Reliability and validity of the Chinese version of IPAQ (short, last 7 days). *J Sci Med Sport* 2007;10:45–51.
24 Deng HB, Macfarlane DJ, Thomas GN, *et al*. Reliability and validity of the IPAQ-Chinese: the Guangzhou Biobank Cohort study. *Med Sci Sports Exerc* 2008;40:303–7.
25 Haylen BT, de Ridder D, Freeman RM, *et al*. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourol Urodyn* 2010;29:4–20.
26 Ferrari A, Mannella P, Caputo A, *et al*. Risk and protective factors for pregnancy-related urinary incontinence until 1 year postpartum: A cohort study using patient-reported outcome measures in Italy. *Int J Gynaecol Obstet* 2024;164:200–9.
27 Wang X, Sun Z, Xu T, *et al*. Efficacy of supervised pelvic floor muscle training with a home-based biofeedback device for urinary incontinence in postpartum women: protocol for a multicentre randomised controlled trial. *BMJ Open* 2023;13:e069874.
28 Tian Z, Chen W, Sun Z. Protocol for a prospective longitudinal cohort study on the effects of non-surgical weight loss on pelvic floor dysfunction. *BMJ Open* 2024;14:e079143.
29 Huang L, Zhang S, Wu S, *et al*. The Chinese version of ICIQ: a useful tool in clinical practice and research on urinary incontinence. *Neurourol Urodyn* 2008;27:522–4.
30 Avery K, Donovan J, Peters TJ, *et al*. ICIQ: a brief and robust measure for evaluating the symptoms and impact of urinary incontinence. *Neurourol Urodyn* 2004;23:322–30.
31 Navarro Brazález B, Torres Lacomba M, de la Villa P, *et al*. The evaluation of pelvic floor muscle strength in women with pelvic floor dysfunction: A reliability and correlation study. *Neurourol Urodyn* 2018;37:269–77.
32 Frawley H, Shelly B, Morin M, *et al*. An International Continence Society (ICS) report on the terminology for pelvic floor muscle assessment. *Neurourol Urodyn* 2021;40:1217–60.
33 Bo K, Frawley HC, Haylen BT, *et al*. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for the conservative and nonpharmacological management of female pelvic floor dysfunction. *Neurourol Urodyn* 2017;36:221–44.
34 Bump RC, Mattiasson A, Bø K, *et al*. The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction. *Am J Obstet Gynecol* 1996;175:10–7.
35 Hagen S, Elders A, Stratton S, *et al*. Effectiveness of pelvic floor muscle training with and without electromyographic biofeedback for urinary incontinence in women: multicentre randomised controlled trial. *BMJ* 2020;371:m3719.
36 Ma Y, Xu T, Zhang Y, *et al*. Validation of the Chinese version of the Pelvic Organ Prolapse Symptom Score (POP-SS). *Menopause* 2020;27:1053–9.
37 Patrick DL, Martin ML, Bushnell DM, *et al*. Quality of life of women with urinary incontinence: further development of the incontinence quality of life instrument (I-QOL). *Urology* 1999;53:71–6.
38 Luo N, Liu G, Li M, *et al*. Estimating an EQ-5D-5L Value Set for China. *Value Health* 2017;20:662–9.
39 Zhu L, Yu S, Xu T, *et al*. Validation of the Chinese version of the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire short form (PISQ-12). *Int J Gynaecol Obstet* 2012;116:117–9.
40 Leung CM, Ho S, Kan CS, *et al*. Evaluation of the Chinese version of the Hospital Anxiety and Depression Scale. A cross-cultural perspective. *Int J Psychosom* 1993;40:29–34.
41 Hung MJ, Chou CL, Yen TW, *et al*. Development and validation of the Chinese Overactive Bladder Symptom Score for assessing overactive bladder syndrome in a RESORT study. *J Formos Med Assoc* 2013;112:276–82.
42 Broome BA. Development and testing of a scale to measure self-efficacy for pelvic muscle exercises in women with urinary incontinence. *Urol Nurs* 1999;19:258–68.
43 Medrano Sánchez EM, Suárez Serrano CM, De la Casa Almeida M, *et al*. Spanish version of the broome pelvic muscle self-efficacy scale: validity and reliability. *Phys Ther* 2013;93:1696–706.
44 Yalcin I, Bump RC. Validation of two global impression questionnaires for incontinence. *Am J Obstet Gynecol* 2003;189:98–101.
45 Pereira TA, D'ancona CAL, Cândido EC, *et al*. Prevalence of LUTS and urodynamics results in obese women. *Neurourol Urodyn* 2022;41:468–74.
46 Nygaard CC, Schreiner L, Morsch TP, *et al*. Urinary Incontinence and Quality of Life in Female Patients with Obesity. *Rev Bras Ginecol Obstet* 2018;40:534–9.
47 Nyström E, Sjöström M, Stenlund H, *et al*. ICIQ symptom and quality of life instruments measure clinically relevant improvements in women with stress urinary incontinence. *Neurourol Urodyn* 2015;34:747–51.