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Full Length Article

The effectiveness of an online exercise program on urinary incontinence of postpartum women: a quasi-experimental study

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ABSTRACT

Objective: To assess the effectiveness of a six-week online exercise program on self-assessed urinary incontinence (UI) symptoms and their impact on daily life among postpartum women immediately and six months after the intervention.

Methods: A quasi-experimental pre–post design without a control group was used. Participants (n = 297) completed a six–week online exercise program focused on core and pelvic floor strengthening. Data were collected via electronic questionnaires at baseline, post–intervention, and six months later. UI symptoms were measured with the UDI–6 and symptoms impact on daily life with the IIQ–7. Changes across timepoints were analyzed using linear mixed models. Attrition increased across measurement points, with 89 women completing the six-month follow-up questionnaire.

Results: UI symptoms decreased statistically significantly over time ($p < 0.001$) from baseline (mean 18.8; 95% CI 16.9, 20.7) to posttest (13.2; 95% CI 11.1, 15.4). At the 6-month follow-up, the scores had increased slightly (14.1; 95% CI 11.4, 16.9) but were still lower than at the baseline. For the perceived impact of UI on daily activities, the overall change was not statistically significant ($p = 0.269$). Mean (95% CI) IIQ-7 scores were 8.5 (6.9, 10.0) at baseline, 6.6 (4.7, 8.5) at posttest, and 6.7 (3.9, 9.4) at 6-month follow-up. Time since childbirth, BMI, mode of birth, and dysfunctions or symptoms related to pelvic floor and core muscles were associated with variation in studied outcomes.

Conclusion: A six-week self-directed online exercise program was associated with a reduction in postpartum UI symptoms, with improvements largely maintained at six months. Individual characteristics were associated with symptom severity and responsiveness, highlighting the need for tailored postpartum rehabilitation and further controlled studies.

Introduction

Urinary incontinence (UI), defined as any unintentional leakage of urine [1], is highly prevalent during the postpartum period. The estimates of UI prevalence among postpartum women ranges from 26% to 32% [2,3]. The variance between the estimates might be due to differences in definitions of UI, recognition of UI symptoms, timing of the assessments, as well as cultural differences and attitudes. However, it is acknowledged that pregnancy and childbirth cause changes in the pelvic floor, which increases the risk of UI. According to a recent literature review, e.g., age of ≥ 35 years, higher pre-pregnancy body mass index (BMI), multiparity (number of childbirths ≥ 2), vaginal delivery, and elevated neonatal weight of the baby were recognized as risk factors for postpartum UI [2].

UI can profoundly affect postpartum women's overall well-being, influencing not only their physical health but also their emotional, social, and sexual lives. The condition has been associated with limitations in physical activity, which may further compromise recovery and daily functioning [4]. Beyond the physical implications, UI can disrupt social relationships [5] and contribute to feelings of isolation [6]. These symptoms often extend to psychophysical distress [2], decreasing quality of life [7], and increasing vulnerability to postpartum depression [8]. UI may also negatively affect sexual comfort and confidence, as suggested in previous studies [9].

Despite UI's significant impact on well-being, it remains undertreated among postpartum women. Many perceive UI as a normal

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consequence of pregnancy and childbirth, leading to the belief that symptoms will be resolved on their own [10]. Although some women experience spontaneous improvement in UI symptoms postpartum, many continue to suffer without seeking help [11]. This normalization, combined with feelings of embarrassment and stigma surrounding UI issues, might discourage open discussion and prevent help-seeking. In addition, there might be practical barriers such as time constraints, childcare responsibilities [12,13], and lack of access to specialized services further hinder women from seeking support.

In treatment of UI, being physically active, especially conducting pelvic floor muscle training (PFMT) [14,15] is the primary form of treatment. Regular and long-term training [4] and ensuring proper training technique [16] are central to successful treatment. Recent review suggested that electrical stimulation and biofeedback plus core training, as well as supervised PFMT, are most effective in improving incontinence-specific quality of life [4]. However, the resources of the health care services are limited, and there is a need for more accessible and flexible interventions as well.

Digital health interventions (DHIs) offer a promising alternative by enabling postpartum women to engage in rehabilitation from home. DHIs have been used successfully in perinatal care [17–19], and they seem to be highly acceptable among perinatal women [12,18]. Some DHIs aiming to reduce UI symptoms, both among women in general [20–22] and among perinatal women [23–25], have been shown to significantly reduce symptoms. The findings suggest that DHIs have the potential to facilitate women's independent PFMT.

However, in previous studies, the interventions have rarely been targeted specifically to pregnant and postpartum women, and the more robust evidence comes from studies conducted in the general population. As a result, findings concerning women in the perinatal period are often based on preliminary data, relatively small sample sizes, or heterogeneous intervention designs, limiting the strength and generalizability of the conclusions. Although PFMT and exercise have been shown to be effective during the perinatal period, access to structured programs remains limited, and there is a need for population-specific and accessible, solutions. Therefore, further research is required to determine whether structured online exercise programs can effectively support postpartum women in reducing UI symptoms and improving their daily functioning. This study aimed to assess the effectiveness of a six-week online exercise program on self-assessed UI and its impact on the lives of postpartum women immediately after the intervention and at a six-month follow-up. Part of the study dataset has been reported previously in a separate publication, which presented findings related to quality of life and physical activity [xx]. In the present article, additional analyses from the same dataset are reported, focusing on postpartum urinary incontinence outcomes that have not been published earlier.

Methods

Study design

A quasi-experimental pre- and posttest design, without a control group, was used in this study [26]. The intervention consisted of a six-week online exercise program designed to strengthen the core and pelvic floor muscles in postpartum women. Participants completed the training independently following the program's instructions. Data were collected and managed using REDCap electronic data capture tools hosted at xx [27] at baseline (pretest), immediately after (six weeks from baseline) the intervention (posttest), and six months after the intervention (six-month follow-up). This dataset has been partially reported previously in a publication focusing on physical activity and quality of life [xx].

Setting

In xx, all pregnant women are entitled to free maternity and child health services throughout pregnancy and after childbirth. These services are primarily delivered through maternity clinics located in primary health care centers, staffed by registered public health nurses or midwives. During pregnancy and after childbirth, women typically attend 11–15 visits focusing on monitoring fetal development and maternal health. After childbirth, care transitions to child health clinics, where the emphasis shifts to the child's growth and development, and only two postpartum visits are scheduled for the mother. [xx] Although these clinics aim to support the well-being of the entire family, many women report receiving insufficient guidance on maintaining healthy lifestyle behaviors after childbirth [xx], such as resuming physical activity or receiving guidance related to PFMT.

Intervention

The intervention was a commercial six-week online exercise program,"Rehabilitate your core", designed to strengthen the core and pelvic floor muscles in postpartum women. The program was developed by team included specialists in personal training for perinatal women, gynecology, midwifery, and physiotherapy. After purchase (89€), participants gained access to a website where the program was organized into six weekly modules, each with a specific theme and subthemes (Table 1). The content progressed gradually from basic activation and relaxation of the pelvic floor and core muscles toward more comprehensive and intensive training. Participants completed the exercises independently, with approximately 10 min of training per day, five days per week. In addition to the weekly modules, the program included supplementary educational materials on topics such as pelvic floor activation, breathing, relaxation, and scar care following cesarean section or episiotomy. Participants also had access to a closed online

Table 1
The weekly themes of the online exercise program.

Week	Theme and content	Materials
1	**Pelvic Floor Muscle Testing and Recognition** • Learning to activate and relax pelvic floor muscles • Understanding the importance of the pelvic floor for overall well-being	General guidance videos Written material Exercise videos Written exercise instructions
2	**Diastasis Recti Testing and Deep Abdominal Muscles** • Learning to test for diastasis recti and performing safe exercises to activate and rehabilitate the deep abdominal muscles • Aiming for a better connection with core muscles and entire body	
3	**Core, Mobility, and Personal Time** • Continuing to exercise with new movements to strengthen and energize body, while also caring for mind	
4	**Good Posture and New Life Situation** • Understanding the impact of posture on overall body function • Continuing progressive pelvic floor training • Gaining insights into new life situations and learning to be kind to oneself	
5	**Progressive Training and Postpartum Sexuality** • Addressing sexuality after childbirth • Continuing mobility exercises to keep body flexible and prevent stiffness	
6	**Core Strengthening and Integrating Full-Body Workouts into Daily Life** • Engaging in more intensive training • Receive guidance on how to continue exercising after the program	

community that offered opportunities for peer support, asking questions, and general discussion. The program is designed to be easily integrated into daily life and to address common postpartum challenges, such as breastfeeding, that may hinder returning to exercise.

The program is planned to be accomplished in six weeks, but the materials are available for six months after purchase, allowing participants to follow the program and continue exercising at their own pace. The intervention materials consist of educational content, including exercise instructions accompanied by images and videos. Participants receive daily reminders of the day's exercise via −mail. During this study, participants were instructed to follow the intervention as planned, and the questionnaires were sent to the participants at the baseline before starting the intervention, after six weeks from the baseline, and at six months.

Sample and sample size

The eligibility criteria for participants were as follows: (1) an age ≥ 18; (2) ≤ 2 years since the last childbirth; (3) a standard postpartum health examination (usually conducted 5–12 weeks after childbirth); (4) fluency in xx; and (5) the ability to pay for access to the online exercise program. We set the upper limit at two years postpartum to capture a broader range of recovery experiences, recognizing that physiological, functional, and psychosocial adaptations may continue beyond the initial postpartum months.

The sample size was determined by the WHOQOL-BREF instrument since the quality of life was the primary outcome of the study [xx]. Based on a power analysis, a total of 127 participants were required to detect a statistically significant difference between pretest, posttest, and six-month follow-up WHOQOL-BREF scores at a 5% (2-sided) significance level with a power of 80%. Considering the loss to follow-up, the sample size was increased to 303 at the baseline, allowing a 30% dropout between the pre- and posttests and 40% dropout between the posttest and six-month follow-up.

Recruitment and data collection

Recruitment was open to all postpartum women who visited the online exercise program's website. The study was advertised on the online exercise program's website, and women could self-enroll by indicating their interest through the online form. The research team then contacted all interested women by e-mail and provided them with a detailed information letter and a link to the electronic questionnaire, which included the informed consent form. Data were gathered using REDCap e-questionnaires, encompassing demographic information and four validated instruments, from September 2021 to September 2023. Two of these instruments (WHOQOL-BREF and IPAQ-SF) have been reported previously [xx], and the present article focuses on the two remaining instruments (UDI-6 and IIQ-7), which have not been published earlier. Automated e-mail reminders were sent at each measurement point to participants who had not completed the questionnaire within one week.

Measurements

A background questionnaire including questions about sociodemographic characteristics (age, number of adults and children in a family, education, employment situation, weight, height, and chronic health condition), latest childbirth (the date and mode of birth, complications during birth), and dysfunctions and symptoms related to pelvic floor and core, was developed.

Although UI can be classified into distinct types [1], this study focuses on the overall self-assessed experience of UI. The Urogenital Distress Inventory, short form (UDI-6) instrument identifies symptoms associated with UI and assesses the symptom severity. The instrument consists of six statements with four-step Likert scale. The scores of the statements are added together for a higher score reflecting more serious UI symptoms (scale 0–100). [28] The Incontinence Impact Questionnaire, short form (IIQ-7) on the other hand, is used to assess the impact of the UI symptoms on an individuaĺs life and the anxiety or harm caused by the symptoms. The instrument includes seven statements with four-step Likert scale. The total score is calculated based on the answers, and higher total score indicates more serious harm to an individual (scale 0–100). [28,29] The long versions of UDI-6 and IIQ-7 have demonstrated good validity and reliability in assessing subjective incontinence symptoms. The short versions, developed using regression analyses, show good psychometric properties and correlate strongly with the long versions (correlation coefficients IIQ-7: 0.97, UDI-6: 0.93). [28,29] Permissions for the use of UDI-6 and IIQ-7 instruments were requested from the university where the instruments were developed. The instruments were translated into xx with a double translation.

Because no validated cutoff values exist for the UDI-6 or IIQ-7, participants were classified for subgroup analyses as participants with UI symptoms (UDI-6 or IIQ-7 score = 0) or participants with UI symptoms (UDI-6 or IIQ-7 score > 0). Although previous studies have proposed various cutoff values, inclusion in this study was not based on symptom severity, and participants self-enrolled in a general postpartum recovery program. Therefore, any reported UI symptoms were considered clinically relevant for subgroup classification.

Data processing and analysis

BMI values were calculated from baseline height and weight, and time since the most recent childbirth was derived from childbirth and pre-test dates. Descriptive statistics were selected based on the distribution of each variable. Means, standard deviations (SD), frequencies (n), and percentages (%) were used to summarize the appropriate demographic data. Baseline characteristics were summarized for the full sample and separately for participants without UI symptoms (UDI-6 scores and IIQ-7 scores = 0 at baseline) and with symptoms (UDI-6 scores or IIQ-7 scores > 0 at baseline), with group differences assessed using Chi-square or Fisher's exact test as appropriate.

Dropout analyses were done twice: first, between the participants who answered pretest and posttest questionnaires and the dropouts who answered only the pretest questionnaire. The second dropout analysis was done between the participants who answered all three questionnaires and the dropouts who answered pre- and posttest questionnaires. Differences between the participants and dropouts regarding the demographic data were analyzed using the independent samples *t*-test or Mann–Whitney *U* test for continuous data and the chi-square test for nominal data. Differences related to the UDI-6 and IIQ-7 scores were analyzed using the Mann–Whitney *U* test.

UDI-6 and IIQ-7 scores were calculated according to scoring guidelines and converted to a 0 to 100 scale. Higher scores reflect stronger symptoms or effects on the respondenís life. [28] Changes over time were analyzed using linear mixed models for repeated measures. Because the mixed-model confidence intervals were very wide due to the unbalanced data structure, raw means with 95% confidence intervals were presented descriptively, while inferential statistics (overall time effect and pairwise tests) were based on the mixed model. Associations between background variables and baseline UDI-6 and IIQ-7 scores were examined using Mann–Whitney U or Kruskal–Wallis tests. Subgroup analyses were conducted for participants with UI symptoms at baseline. Changes over time were examined using Friedman's test with Wilcoxon signed-rank tests for pairwise comparisons. Associations between baseline characteristics and symptom change were analyzed using t-tests, Mann–Whitney U tests, ANOVA, or Kruskal–Wallis tests depending on distributional assumptions.

The data were analyzed using IBM SPSS Statistics® program, version 29.9 and version 31.0. The level of statistical significance was set at $p \leq 0.05$.

Ethical considerations

Ethical approval for this study was obtained from the Ethics Committee for Human Sciences at the xx in June 2021. All the participants were informed about the aims and procedures of the study. Participants had an opportunity to discuss with researchers, and they provided written informed consent for their participation. Collaboration with the company providing the intervention did not affect the conduction of this study, and the research group did not have personal affiliations with the company or its operations. The trial registration was done retrospectively to Clinicaltrials.gov (xx) in February 2024.

Results

Participants

Initially, 309 women completed the pretest questionnaire. Of these, 12 were excluded for not meeting the eligibility criteria, resulting in a final sample of 297 participants for analysis. After the intervention, 148 women completed the posttest questionnaire, and six months later, 89 participants responded to the follow-up questionnaire (Fig. 1).

The first dropout analysis showed there were no statistically significant differences between the characteristics of the participants (n = 145) who answered both the pre- and posttest questionnaires and the dropouts (n = 152) who answered only the pretest questionnaire. In addition, there were no statistically significant differences in the UDI-6 or IIQ-7 scores at the baseline.

The second dropout analysis, comparing participants who completed the pre–, post–, and 6–month follow–up questionnaires (n = 89) with those who completed only the pre– and posttest questionnaires (n = 56), showed that participants had a higher educational level than dropouts (61% vs. 35% with a master's degree or higher, p = 0.003). In addition, participants reported statistically significantly higher baseline IIQ–7 scores compared with dropouts (median (IQR) 4.8 (19.0) vs. 0.0 (9.5), p = 0.017). However, there were no statistically significant differences in median UDI–6 or IIQ–7 scores after the intervention.

The characteristics of the participants are presented in Table 2, first for the total sample and then for two subgroups: participants without UI symptoms (UDI-6 or IIQ-7 scores = 0 at baseline) and participants with UI symptoms (UDI-6 or IIQ-7 scores > 0 at baseline). Participants' ages ranged from 20 to 45 years, with a mean (SD) age of 33.1 (4.3) years. Most of the women had a bachelor's degree or higher (84.8%, n = 252), were living with a partner (96.6%, n = 287), and were at home with a child or children at the baseline of the study (70.7%, n = 210). The mean (SD) BMI was 26.4 (4.3). The mean (SD) time since the most recent childbirth was 4.5 (4.0) months. The majority had given birth vaginally

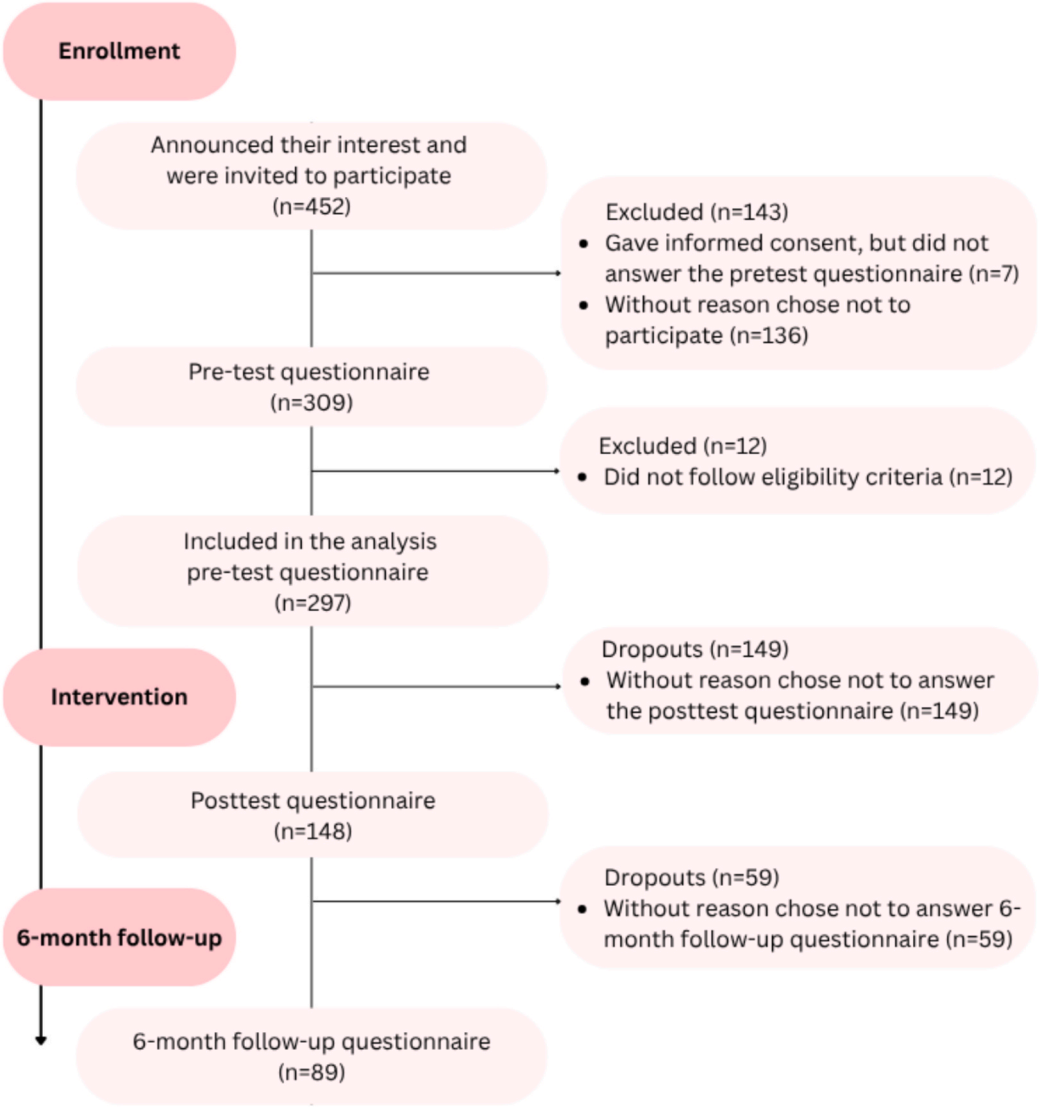

Fig. 1. Flow chart of the study.

Table 2
Characteristics of the participants.

Variable	All participants n = 297		Participants without UI symptoms n = 42 [a]		Participants with UI symptoms n = 250 [a]		Difference between participants without and with UI symptoms
	n	%	n	%	n	%	p-value
Number of children in the family							0.307[b]
1	147	49.5	23	54.8	122	48.8	
≥2	150	50.5	19	45.2	128	51.2	
Time since the most recent childbirth							**0.018**[c]
6 months or less	231	77.8	39	92.9	187	74.8	
6 to 12 months	47	15.8	3	7.1	44	17.6	
12 to 24 months	19	6.4	0	0	19	7.6	
Highest educational level							0.287[c]
Comprehensive school	2	0.7	0	0	2	0.8	
Secondary school	43	14.5	3	7.1	38	15.2	
Bachelor's degree	99	33.3	17	40.5	81	32.4	
Master's degree or higher	153	51.5	22	52.4	129	51.6	
Employment situation at the baseline							0.909[c]
Employed	68	22.9	8	19.0	60	24.0	
Unemployed	2	0.7	0	0	2	0.8	
Student	8	2.7	1	2.4	7	2.8	
Home with child or children, homemaker	210	70.7	31	73.8	174	69.6	
Other	9	3.0	2	4.8	7	2.8	
Civil status							0.633 [d]
Living with a partner	287	96.6	40	95.2	242	96.8	
Not living with a partner	10	3.4	2	4.8	8	3.2	
Body mass index at the baseline							0.165[c]
≤ 18.5	3	1.0	0	0	3	1.2	
18.6–24.9	110	37.0	19	45.2	90	36.0	
25–29.9	101	34.0	16	38.1	83	33.2	
≥ 30	45	15.2	2	4.8	43	17.2	
Missing	38	12.8	5	11.9	31	12.4	
Chronic health condition							0.389[b]
No	221	74.4	32	76.2	184	73.6	
Yes	76	25.6	10	23.8	66	26.4	
Mode of birth							**< 0.001**[b]
Vaginal birth	241	81.1	24	57.1	213	85.2	
Caesarean section	56	18.9	18	42.9	37	14.8	
Complications during birth [e]							
No complications	214	72.1	31	73.8	179	71.6	0.907[b]
Vaginal delivery by vacuum extraction	31	10.4	6	14.3	25	10.0	0.342[b]
Episiotomy	69	23.2	9	21.4	59	23.6	0.879[b]
III or IV stage rupture	12	4.0	0	0	12	4.8	0.383 [d]
Dysfunctions and symptoms related to pelvic floor and core muscles							0.203[b]
No dysfunctions	174	58.6	29	69.0	142	56.8	
Dysfunction(s)	123	41.4	13	31.0	108	43.2	

[a] n = 5 is missing from the group division
[b] Chi-square test.
[c] Chi-square test with Monte Carlo simulation
[d] Fisher's exact test.
[e] Percentages total greater than 100 because participants could choose multiple answers.

(81.1%, n = 241) and had not experienced complications during childbirth (72.1%, n = 214).

Baseline characteristics were mostly similar between participants without and with UI symptoms. Significant group differences were observed for time since the most recent childbirth and mode of birth. Among those with UI symptoms, a greater proportion was more than six months postpartum, and a higher share had delivered vaginally.

Change in UDI-6 and IIQ-scores among all participants

There was a statistically significant reduction in UI symptoms over time ($p < 0.001$). The mean (95% CI) UDI-6 scores decreased from 18.8 (16.9, 20.7) at baseline to 13.2 (11.1, 15.4) posttest, and 14.1 (11.4, 16.9) at 6-month follow-up. Pairwise comparisons indicated a significant reduction from baseline to posttest ($p < 0.001$), with no further change from posttest to 6-month follow-up ($p = 1.00$). For IIQ-7, the overall change was not statistically significant ($p = 0.269$), and pairwise comparisons showed no significant differences between baseline and posttest ($p = 0.474$) or between posttest and the 6-month follow-up ($p =$

Table 3
UDI-6 and IIQ-7 scores over time among all participants.

Variable	UI symptoms and severity of symptoms (UDI-6) Scale 0–100			Impact of the UI symptoms on an individuaĺs life and the anxiety or harm caused by the symptoms (IIQ-7) Scale 0–100		
	Mean	95% CI	*P*	Mean	95% CI	*P*
Data collection point			**< 0.001**			0.269
Baseline pre-test (n = 297)	18.8	16.9, 20.7		8.5	6.9, 10.0	
Posttest (n = 148)	13.2	11.1, 15.4		6.6	4.7, 8.5	
6-month follow-up (n = 89)	14.1	14.1, 16.9		6.7	3.9, 9.4	

Abbreviations: IIQ-7: The Incontinence Impact Questionnaire, short form; UDI-6: The Urogenital Distress Inventory, short form; UI: Urinary incontinence.

1.00). The mean scores are presented in Table 3.

Several background characteristics were associated with baseline UDI-6 and IIQ-7 scores. Women more than 6 months postpartum had higher UDI–6 and IIQ-7 scores than those ≤ 6 months postpartum (both $p < 0.001$), indicating more bothersome symptoms. Baseline UDI-6 scores also differed across BMI categories ($p = 0.011$). Participants with BMI ≥ 30 had higher UDI-6 scores than those with BMI < 25 ($p = 0.009$), whereas no differences were observed between the BMI < 25 and BMI 25–29.9 groups ($p = 1.00$) or between the BMI 25–29.9 and BMI ≥ 30 groups ($p = 0.060$). Mode of birth was associated with both UDI-6 ($p < 0.001$) and IIQ-7 ($p < 0.001$) scores, with vaginal birth corresponding to higher scores than caesarean section. In addition, participants reporting pelvic floor or core dysfunctions had higher UDI-6 and IIQ-7 scores than those without such dysfunctions ($p < 0.001$). Group-specific descriptive statistics are presented in Table 4.

Change in UDI-6 and IIQ-scores among participants with UI symptoms at baseline

Among participants with UI symptoms, both UDI-6 and IIQ-7 scores decreased significantly over time ($p < 0.001$ for both, Table 5). Pairwise comparisons for UDI-6 scores indicated significant reductions in UI symptoms from pre-test to posttest ($p < 0.001$) and from pre-test to the 6-month follow-up ($p < 0.001$). No further significant change was observed between posttest and the 6-month follow-up ($p = 0.875$), indicating maintenance of the improvement. A similar pattern was observed for IIQ-7, with significant reductions in the impact of UI symptoms on quality of life from pre-test to posttest ($p = 0.016$) and to 6-month follow-up ($p < 0.001$), but no significant difference between posttest and 6-month follow-up ($p = 0.483$).

When examining associations between baseline characteristics and changes in UDI-6 and IIQ-7 scores, age was the only factor associated with score reductions. Participants under 30 years old experienced a greater reduction in UDI-6 scores from pre-test to posttest than those aged 30 years or older (median change 11.1, IQR 16.7 vs. 5.6, IQR 11.1; $p = 0.042$). No other baseline characteristics were associated with changes in UDI-6 from posttest to 6-month follow-up, or with changes in IIQ-7 scores at any interval.

Discussion

This study assessed the effectiveness of a six-week online exercise program on self-assessed UI and its impact on the daily life among postpartum women. UI symptoms decreased statistically significantly over the intervention period, with improvements largely maintained at the six-months, whereas changes in the perceived impact of UI on daily activities were not statistically significant. Time since childbirth, BMI, mode of birth, and dysfunctions and symptoms related to pelvic floor and core muscles, were associated with variation in UI symptoms at baseline, suggesting that responsiveness to the intervention may depend on participant characteristics.

Although statistically significant reductions in UDI-6 scores were observed, the clinical significance of these changes should be interpreted in the context of baseline symptom severity. Mean baseline UDI-6 scores in the total sample (18.8, 95% CI: 16.9, 20.7) and among participants with UI symptoms (21.8, 95% CI 19.9, 23.7) were below previously suggested cutoff values for clinically relevant distress e.g. > 25.0 [30] or > 33.3 [31], indicating generally mild symptom severity. Similarly, IIQ-7 scores were close to or slightly above value of 9.5 proposed to reflect impaired quality of life [31]. Given that no minimum symptom severity was required for inclusion and participants self-enrolled in a general postpartum recovery program, even modest reductions in symptom scores may represent meaningful improvements at the individual level.

The findings of this study align with previous research [20–22] showing that structured DHI can reduce UI symptoms among women. However, unlike many earlier interventions, which have typically

Table 4
Factors associated with UDI-6 and IIQ-7 scores at baseline (n = 297).

Variable	UI symptoms and severity of symptoms (UDI-6) Scale 0–100			Impact of the UI symptoms on an individuaĺs life and the anxiety or harm caused by the symptoms (IIQ-7) Scale 0–100		
	Mean	95% CI	*P*	Mean	95% CI	*P*
Age			0.823 [a]			0.850 [a]
Under 30	19.0	14.8, 23.3		8.8	4.8, 12.7	
30 or more	18.8	16.6, 20.9		8.8	6.9, 10.7	
Number of children in the family			0.292 [a]			0.171 [a]
1	17.4	15.0, 19.8		7.8	5.5, 10.0	
2 or more	20.2	17.3, 23.1		9.8	7.3, 12.3	
Time from the latest childbirth			**< 0.001** [a]			**< 0.001** [a]
6 months or less	17.2	15.1, 19.3		7.4	5.5, 9.2	
Over 6 months	24.4	20.3, 28.5		13.6	9.8, 17.5	
Education			0.342 [a]			0.500 [a]
Secondary education or below	20.9	15.6, 26.1		10.3	5.6, 15.0	
College or university	18.5	16.4, 26.1		8.5	6.7, 10.4	
BMI			**0.011** [b]			0.061 [b]
Normal weight BMI < 25	16.6	13.8, 19.5		6.6	4.5, 8.7	
Overweight BMI 25–29.9	18.4	15.2, 21.5		9.4	6.6, 12.1	
Obese BMI ≥ 30	26.7	20.5, 32.9		12.9	7.5, 18.3	
Mode of birth			**< 0.001** [a]			**< 0.001** [a]
Vaginal birth	20.9	18.8, 23.0		10.2	8.2, 12.1	
Cesarean section	9.8	6.7, 12.8		3.0	0.6, 5.5	
Complications during birth			0.966 [a]			0.218 [a]
No complication(s)	18.7	16.5, 20.9		9.1	7.2, 11.1	
Complication(s)	19.0	15.4, 22.6		7.9	4.5, 11.4	
Dysfunctions and symptoms related to pelvic floor and core muscles			**< 0.001** [a]			**< 0.001** [a]
No dysfunction(s)	15.0	13.0, 17.0		5.3	3.7, 6.9	
Dysfunction(s)	24.1	20.8, 27.4		14.0	10.8, 17.2	

Abbreviations: BMI: Body mass index; IIQ-7: The Incontinence Impact Questionnaire, short form; UDI-6: The Urogenital Distress Inventory, short form; UI: Urinary incontinence.

[a] Mann-Whitney *U* test.

[b] Kruskal-Wallis.

Table 5
UDI-6 and IIQ-7 scores over time among participants with UI symptoms.

Variable	UI symptoms and severity of symptoms (UDI-6) Scale 0–100			Impact of the UI symptoms on an individuals life and the anxiety or harm caused by the symptoms (IIQ-7) Scale 0–100		
	Mean	95% CI	*P*	Mean	95% CI	*P*
Data collection point			**< 0.001**			**< 0.001**
Baseline pre-test (n = 250)	21.8	19.9, 23.7		9.8	8.1, 11.5	
Posttest (n = 125)	15.3	12.9, 17.6		7.8	5.6, 10.0	
6-month follow-up (n = 79)	15.2	12.3, 18.2		7.5	4.5, 10.6	

Abbreviations: IIQ-7: The Incontinence Impact Questionnaire, short form; UDI-6: The Urogenital Distress Inventory, short form; UI: Urinary incontinence.

targeted a general adult population [20–22] or relied solely on PFMT [23–25], our intervention was specifically designed for postpartum women, and it combined PFMT with broader physical exercise. This more comprehensive approach may better reflect the multifaceted recovery needs of postpartum women, who often experience co–occurring changes in pelvic floor function, core stability, and overall physical capacity, although empirical evidence supporting such combined approaches remains limited.

Comparisons with previous postpartum studies are challenging due to substantial methodological heterogeneity. Some studies have been based on relatively small samples [23], or included face-to-face PFMT instruction alongside digital components, making it difficult to isolate the effects of remote delivery [23–25]. In contrast, the present intervention was fully online, with no in–person instruction or supervision. Despite this, statistically significant reductions in UI symptom severity (UDI-6) were observed in the full sample, while reductions in the impact of UI on daily life (IIQ-7) reached statistical significance only among participants with baseline UI symptoms. These findings suggest that a self–guided, postpartum–specific online program may be both acceptable and effective.

Our findings add to existing evidence that regular and progressive PFMT is central to successful UI treatment [4,16]. Although the intervention was not supervised, the structured weekly modules, reminders, and educational materials may have facilitated adherence and correct technique, factors known to influence outcomes. The observed improvements are comparable to those reported in earlier interventions combining PFMT with core training [14,15]. Given the practical barriers postpartum women face in accessing in-person PFMT, including childcare responsibilities, time constraints, and limited availability of specialized services [12,13], DHIs offer a promising and accessible alternative [17–19]. Together with evidence from freely available PFMT applications such as the Tät® app [22], these findings suggest that structured online PFMT-based programs could complement existing postpartum care pathways by offering an accessible option for early rehabilitation.

Consistent with previous research [2], higher BMI and vaginal birth were associated with more severe UI symptoms and greater impact on daily life. Women more than six months postpartum reported more bothersome symptoms than those closer to childbirth, suggesting that UI may persist or re-emerge over time, emphasizing the value of early symptom recognition in routine postpartum care. Pelvic floor and core dysfunctions, based on participants self-reported perceptions, were likewise linked to higher symptom severity, supporting their central role in continence mechanisms [2]. Together, these findings confirm established risk factors and expand understanding by indicating that both postpartum timing and dysfunctions of pelvic and core muscles may contribute to persistent UI, underscoring the importance of timely identification and guidance.

This study has limitations that should be considered when interpreting the findings. The quasi-experimental design without a control group limits the ability to draw firm causal conclusions about the effectiveness of the intervention. Although a power analysis was performed, it was not based on UDI-6 or IIQ-7, which may have reduced statistical power for these outcomes. Furthermore, although the required sample size was achieved at the immediate post–intervention measurement, attrition at the six–month follow–up meant that statistical power was not maintained for the later time point. Dropout analyses showed minimal differences between participants and dropouts; however, women who completed all three measurement points had higher educational levels and slightly higher baseline IIQ-7 scores, suggesting some selection toward a more highly educated and health-motivated subgroup. In addition, adherence to the intervention, including the frequency of logins or completion of training sessions, or the correctness of training technique could not be verified. Consequently, the extent to which participants engaged with the program remains unknown. Improvements in symptoms therefore cannot be attributed solely to the intervention, as natural recovery or additional exercise or PFMT outside the program may also have contributed to the outcomes. Participants were asked at posttest to self-report how often they performed the program's exercises each week; however, these adherence data have been analyzed and published previously [xx] and are therefore not repeated in the present manuscript.

The characteristics of the study population further limit generalizability. The sample was homogenous, consisting of highly educated and motivated women who were willing and able to purchase access to the commercial online exercise program. This inclusion criterion likely excluded women with lower socioeconomic status and may have resulted in a sample with stronger health literacy, higher baseline motivation, and potentially greater ability to benefit from a structured digital intervention. Consequently, the observed improvements may not fully reflect outcomes that would be expected in a more diverse or randomly selected postpartum population. In addition, the UDI-6 and IIQ-7 scores were relatively low even at the baseline. Despite these limitations, the study has several strengths. Validated and reliable instruments were used to assess UI symptoms and their impact on daily life, enhancing the accuracy and comparability of the findings. Data were collected at three time points allowing evaluation of both immediate and longer-term changes. The intervention was also described using the TIDieR framework, which improves the clarity, transparency, and reproducibility of complex interventions (Supplement 1).

Conclusion

This study suggests that a six-week, self-directed online exercise program may support the reduction of postpartum UI symptoms, with improvements largely sustained at six months. Changes in the perceived impact of UI were more modest, likely reflecting the low baseline burden of activity limitations in the full sample. Individual characteristics, including time since childbirth, BMI, mode of birth, and dysfunctions of pelvic and core muscles, were associated with symptom severity and appeared to influence responsiveness to the program. These factors should be considered when planning postpartum rehabilitation and identifying individuals who may benefit from additional support, and they also provide important guidance for further refinement of the intervention. Overall, the findings indicate that structured online exercise programs could represent a feasible component of postpartum UI management, although further controlled studies are needed to confirm effectiveness and to clarify for whom and under what circumstances such interventions are the most beneficial.

CRediT authorship contribution statement

Iina Ryhtä: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Susanna Likitalo:** Writing – review & editing, Writing – original draft, Validation, Investigation, Conceptualization. **Lotta Hamari:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. **Hannakaisa Niela-Vilén:** Writing – review & editing, Validation. **Anna Axelin:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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References

[1] Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, et al. The standardisation of terminology in lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. Urology 2003;61:37–49. https://doi.org/10.1016/S0090-4295(02)02243-4.

[2] Dai S, Chen H, Luo T. Prevalence and factors of urinary incontinence among postpartum: systematic review and meta-analysis. BMC Pregnancy Childbirth 2023;23:761. https://doi.org/10.1186/s12884-023-06059-6.

[3] Moossdorff-Steinhauser HFA, Berghmans BCM, Spaanderman MEA, Bols EMJ. Prevalence, incidence and bothersomeness of urinary incontinence in pregnancy: a systematic review and meta-analysis. Int Urogynecol J 2021;32:1633–52. https://doi.org/10.1007/s00192-020-04636-3.

[4] Chen L, Han Y, Wang L, Zhang H, Zheng Y, Zhang R, et al. Conservative interventions for urinary incontinence on postpartum women: a systematic review and meta-analysis. J Midwife Womens Health 2024;69:663–71. https://doi.org/10.1111/jmwh.13653.

[5] Leroy LDS, Lopes MHBDM. Urinary incontinence in the puerperium and its impact on the health-related quality of life. Rev Latino-Am Enfermagem 2012;20:346–53. https://doi.org/10.1590/S0104-11692012000200018.

[6] Radzimińska A, Strączyńska A, Weber-Rajek M, Styczyńska H, Strojek K, Piekorz Z. The impact of pelvic floor muscle training on the quality of life of women with urinary incontinence: a systematic literature review. CIA 2018;13:957–65. https://doi.org/10.2147/CIA.S160057.

[7] Curillo-Aguirre CA, Gea-Izquierdo E. Effectiveness of pelvic floor muscle training on quality of life in women with urinary incontinence: a systematic review and meta-analysis. Medicina 2023;59:1004. https://doi.org/10.3390/medicina59061004.

[8] Gallego-Gómez C, Rodríguez-Gutiérrez E, Torres-Costoso A, Martínez-Vizcaíno V, Martínez-Bustelo S, Quezada-Bascuñán CA, et al. Urinary incontinence increases risk of postpartum depression: systematic review and meta-analysis. Am J Obstet Gynecol 2024;231:296–307.e11. https://doi.org/10.1016/j.ajog.2024.02.307.

[9] Pinheiro Sobreira Bezerra LR, Britto DF, Ribeiro Frota IP, Lira Do Nascimento S, Morais Brilhante AV, Lucena SV, et al. The impact of urinary incontinence on sexual function. A Systematic Review Sexual Medicine Reviews 2020;8:393–402. https://doi.org/10.1016/j.sxmr.2019.06.009.

[10] Erkal Aksoy Y, Akın B, Dereli YS. Urinary incontinence experiences of pregnant women: a qualitative study. Urologia 2021;88:140–7. https://doi.org/10.1177/0391560320974880.

[11] Gonzales AL, Barnes KL, Qualls CR, Jeppson PC. Prevalence and treatment of postpartum stress urinary incontinence: a systematic review. Female Pelvic Med Reconstr Surg 2021;27:e139–45. https://doi.org/10.1097/SPV.0000000000000866.

[12] Lim S, Tan A, Madden S, Hill B. Health professionals' and postpartum women's perspectives on digital health interventions for lifestyle management in the postpartum period: a systematic review of qualitative studies. Front Endocrinol 2019;10:767. https://doi.org/10.3389/fendo.2019.00767.

[13] Makama M, Awoke MA, Skouteris H, Moran LJ, Lim S. Barriers and facilitators to a healthy lifestyle in postpartum women: a systematic review of qualitative and quantitative studies in postpartum women and healthcare providers. Obes Rev 2021;22:e13167. https://doi.org/10.1111/obr.13167.

[14] Diz-Teixeira P, Alonso-Calvete A, Justo-Cousiño LA, González-González Y, Cuña-Carrera ID. Update on physiotherapy i postpartum urinary incontinence. a systematic review. Archivos Españoles de Urología 2023;76:29. https://doi.org/10.56434/j.arch.esp.urol.20237601.2.

[15] Ryhtä I, Axelin A, Parisod H, Holopainen A, Hamari L. Effectiveness of exercise interventions on urinary incontinence and pelvic organ prolapse in pregnant and postpartum women: umbrella review and clinical guideline development. JBI Evidence Implementation 2023;21:394–408. https://doi.org/10.1097/XEB.0000000000000391.

[16] Brown WJ, Hayman M, Haakstad LAH, Lamerton T, Mena GP, Green A, et al. Australian guidelines for physical activity in pregnancy and postpartum. J Sci Med Sport 2022;25:511–9. https://doi.org/10.1016/j.jsams.2022.03.008.

[17] Adusei-Mensah F, Muthelo L, Ngwenya MW, Mphasha M, Kauhanen J. Digital health interventions for pregnant women and mothers with under 5-year-olds in low- and middle-income countries: a scoping review. Global Health Journal 2025;9:113–23. https://doi.org/10.1016/j.glohj.2025.06.008.

[18] Mohamed H, Ismail A, Sutan R, Rahman RA, Juval K. A scoping review of digital technologies in antenatal care: recent progress and applications of digital technologies. BMC Pregnancy Childbirth 2025;25:153. https://doi.org/10.1186/s12884-025-07209-8.

[19] Van Den Heuvel JF, Groenhof TK, Veerbeek JH, Van Solinge WW, Lely AT, Franx A, et al. eHealth as the next-generation perinatal care: an overview of the literature. J Med Internet Res 2018;20:e202.

[20] Araujo CC, Marques ADA, Juliato CRT. The adherence of home pelvic floor muscles training using a mobile device application for women with urinary incontinence: a randomized controlled trial. Female Pelvic Med Reconstr Surg 2020;26:697–703. https://doi.org/10.1097/SPV.0000000000000670.

[21] Asklund I, Nyström E, Sjöström M, Umefjord G, Stenlund H, Samuelsson E. Mobile app for treatment of stress urinary incontinence: a randomized controlled trial. Neurourol Urodyn 2017;36:1369–76. https://doi.org/10.1002/nau.23116.

[22] Rygh P, Asklund I, Samuelsson E. Real-world effectiveness of app-based treatment for urinary incontinence: a cohort study. BMJ Open 2021;11:e040819. https://doi.org/10.1136/bmjopen-2020-040819.

[23] Jaffar A, Mohd Sidik S, Foo CN, Muhammad NA, Abdul Manaf R, Suhaili N. Preliminary effectiveness of mhealth app-based pelvic floor muscle training among pregnant women to improve their exercise adherence: a pilot randomised control trial. IJERPH 2022;19:2332. https://doi.org/10.3390/ijerph19042332.

[24] Kinouchi K, Ohashi K. Smartphone-based reminder system to promote pelvic floor muscle training for the management of postnatal urinary incontinence: historical control study with propensity score-matched analysis. PeerJ 2018;6:e4372.

[25] Wang X, Xu X, Luo J, Chen Z, Feng S. Effect of app-based audio guidance pelvic floor muscle training on treatment of stress urinary incontinence in primiparas: a randomized controlled trial. Int J Nurs Stud 2020;104:103527. https://doi.org/10.1016/j.ijnurstu.2020.103527.

[26] Shadish WR, Cook TD, Campbell DT. Experimental and quasi-experimental designs for generalized causal inference. Boston: Houghton Mifflin; 2001.

[27] Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: building an international community of software platform partners. J Biomed Inform 2019;95:103208. https://doi.org/10.1016/j.jbi.2019.103208.

[28] Uebersax JS, Wyman JF, Shumaker SA, McClish DK. Short forms to assess life quality and symptom distress for urinary incontinence in women: the incontinence impact questionnaire and the urogenital distress inventory. Neurourol Urodyn 1995;14:131–9. https://doi.org/10.1002/nau.1930140206.

[29] Shumaker SA, Wyman JF, Uebersax JS, McClish D, Fantl JA. the Continence Program in Women (CPW) Research Group. Health-related quality of life measures for women with urinary incontinence: the incontinence impact questionnaire and the urogenital distress inventory. Qual Life Res 1994;3:291–306. https://doi.org/10.1007/BF00451721.

[30] Gafni-Kane A, Zhou Y, Botros SM. Predictive modeling and threshold scores for care seeking among women with urinary incontinence: the short forms of the pelvic floor distress inventory and urogenital distress inventory. Neurourol Urodyn 2016;35:949–54. https://doi.org/10.1002/nau.22833.

[31] Skorupska K, Grzybowska ME, Kubik-Komar A, Rechberger T, Miotla P. Identification of the urogenital distress inventory-6 and the incontinence impact questionnaire-7 cutoff scores in urinary incontinent women. Health Qual Life Outcomes 2021;19:87. https://doi.org/10.1186/s12955-021-01721-z.