

A Study to Assess the Effect of Pelvic Floor Muscle Strengthening Exercises on Urinary Incontinence in Patients with Cervical Cancer Undergoing Radiation Therapy at a Tertiary Cancer Centre

Prathepa Jagdiish¹, Anuradha Daptardar²

¹ Tata Memorial Centre

² Tata Memorial Hospital

Funding: Intra Mural Funding received

Potential competing interests: No potential competing interests to declare.

Abstract

Objectives - The objective was to analyse the effect of pelvic floor muscle strengthening exercises on urinary incontinence in patients with cervical cancer undergoing radiation therapy at a tertiary cancer centre.

Methods - This study included 45 cervical cancer patients undergoing radiation therapy, using a non-probability convenience sampling technique and a quasi-experimental one-group pre-post design. The intervention consisted of four pelvic floor muscle strengthening exercises including a) Kegel exercise, b) Squeeze and release, c) Pelvic floor/inner thigh ball squeeze, d) Lower trunk rotation / Lying hip rotation. These exercises were demonstrated with the help of a model pamphlet and were performed four times daily. The total duration of the four exercises was 18-20 minutes, over a period of 12 weeks. Daily follow-ups were conducted and a logbook was maintained for compliance. The patients were assessed for urinary incontinence using the ICIQ UI-SF tool and a perineometer on the 8th and 12th weeks. The statistical evaluation plan involved summarising the demographic and clinical data with descriptive statistics. The primary objectives were evaluated with the Friedman test and one-way ANOVA test, while the secondary objectives were evaluated with frequency distribution and chi-square t-test.

Results of the Studies - In this study, 45 women received the intervention; however, only 43 women completed the intervention and follow-up.

The results showed that the frequency and quantity of urinary incontinence significantly reduced from the patient's baseline parameters. It was observed that the participants' ICIQ UI SF total score on the pre-test had a mean of 12.56 (SD±3.74), after 8 weeks of intervention the mean was 11.33 (SD±3.48), and after 12 weeks of intervention the mean was 8.86 (SD±2.97). The P-value was statistically significant ($p < 0.001$). There was a significant ($P < 0.001$) improvement in the quality of life of the participants. The research hypothesis was accepted. There was significant ($p < 0.001$) alleviation in urinary incontinence after pelvic floor muscle strengthening exercises in patients with cervical cancer undergoing radiation therapy. The pelvic floor muscle contractility on the perineometer on pre-intervention had a mean of 21.63 (SD±2.71), after 8 weeks of intervention the mean was 22.33 (SD±2.65), and after 12 weeks the mean

was 23.49 (SD±2.16). The pelvic floor muscle strengthening exercises statistically significantly ($p < 0.001$) proved the improvement in pelvic floor muscle strength.

Conclusion - The results of this study suggest that pelvic floor muscle strengthening exercises were effective for alleviating urinary incontinence, which improved the quality of life of patients with cervical cancer undergoing radiation therapy. It is a statistically significant intervention.

Prathepa Jagdish¹, Shilpa Bhosale², Dr. Lavanya Naidu³, Dr. Supriya Chopra⁴, Dr. Anuradha Daptardar⁵.

¹ *College of Nursing, Tata Memorial Hospital, Mumbai, India*

² *Department of Nursing, Tata Memorial Hospital, Mumbai, India*

³ *Department of Radiation Oncology, Tata Memorial Hospital, Mumbai, India*

⁴ *Department of Radiation Oncology, Tata Memorial Hospital Mumbai India*

⁵ *Department of Physiotherapy, Tata Memorial Hospital, Homi Bhabha National Institute, Mumbai, India*

Keywords: Cervical cancer, Radiation therapy, Pelvic floor muscle strengthening exercises.

Introduction

Cervical carcinoma is one of the most common and dreaded diseases of women. It accounts for 16 percent of total cervical cancer cases occurring globally. [1] Cervical cancer is the most common cause of cancer in the Indian female population. [2] The GloboCan report 2020 reported 123,907 cervix uteri cases, accounting for a 9.4% incidence. As per the report, cervical cancer ranks 3rd in India. Treatments for cervical cancer have increased survival rates and reduced complications. Cervical cancer was the main cause of cancer-related death in women. [2] In 2020, an estimated 570,000 women were diagnosed with cervical cancer worldwide and about 311,000 women died from the disease. [3] Globally, the average age at diagnosis of cervical cancer was 53 years, ranging from 44 years to 68 years. The global average age at death from cervical cancer was 59 years, ranging from 45 years to 76 years. Cervical cancer ranked in the top three cancers affecting women younger than 45 years in 146 (79%) of 185 countries. [3] Urinary Incontinence (UI) is one of the most common health problems confronting a patient with cervical cancer. The management of cervical cancer is based on the NCG guideline 2020. Cervical carcinoma is treated with surgery and/or chemo-radiotherapy. [4] Radiation therapy is the treatment of cervical cancer as adjuvant therapy, concurrent therapy, and also management of recurrent and metastatic disease. Radiation therapy can be administered as external beam radiation therapy (EBRT), brachytherapy, or combination therapy. [5] Radiation therapy can kill every last tumour cell within a given mass. This outcome is based on the following events: 1) tissue hypoxia; 2) fraction of proliferating cells vs. quiescent cells; 3) the innate radiosensitivity of the tumour cells, and 4) the repair of both sublethal and potentially lethal tumour cell damage. [6] Radical Radiation Therapy consists of external radiotherapy and brachytherapy. External beam pelvic irradiation (40-50 Gy in 4-5 weeks) is

combined with intracavitary applications, which together deliver a dose equivalent to 80Gy to point A. Inj. Cisplatin 40 mg/M2 with appropriate hydration is administered weekly during external radiotherapy. [7][8] The radiation therapy external beam radiation and intracavitary radiation have a greater effect on the pelvic floor (PF) than other treatments because they cause actinic injuries. [9][10] Early urinary complications include irritative bladder symptoms, stress incontinence, abnormal voiding function, and radiation cystitis. [11] According to a systematic review, pelvic floor dysfunction is common in gynaecological cancer patients. It includes urinary incontinence (4-76%), faecal incontinence (2-34%), urinary retention (0.4 -39%), faecal urge (3-49%), dyspareunia (12-58%), and vaginal dryness (15- 58%). [12] Urinary incontinence is the most common problem in gynaecological cancer patients. This disorder is defined by the International Continence Society as a complaint of “involuntary loss of urine”. Urinary incontinence can be categorised as follows: a. Urge incontinence, b. Stress incontinence, and c. Mixed incontinence. Previous research has revealed that potential causes of incontinence include dysfunction of the detrusor muscle or muscles of the pelvic floor, dysfunction of the neural controls of storage and voiding, and perturbation of the local environment within the bladder. [13] Urinary incontinence is not a life-threatening disease, but the loss of bladder control can affect social, psychological, familial, occupational, physical, and sexual aspects of patients' lives. [14][15] Urinary incontinence also leads to reduced quality of life, causing social isolation and lifestyle restrictions. The pelvic floor muscles are located inside the pelvis and consist of twelve striated muscles with a three-layer muscular plate supporting pelvic organs such as the urethra, vagina, and rectum. The pelvic floor muscles include the levator ani, striated urogenital sphincter, external anal sphincter, and ischiocavernosus. [16] Pelvic floor muscle strengthening exercise is beneficial for treating urinary incontinence by strengthening the pelvic floor muscle. [5][17][18][19] The rationale for the effectiveness of pelvic floor muscle strengthening exercises is that they improve muscle strength, increase blood flow to pelvic structures, and improve the functioning of sphincter muscles. [20] Therefore, pelvic floor muscle strengthening exercises are effective for urinary incontinence and are also an economic intervention. Due to their ease of application, availability, and lack of side effects, pelvic floor muscle strengthening exercises are recommended for preventing, alleviating, and decreasing the incidence of urinary incontinence and its severity in patients receiving radiation therapy. They improve the quality of life of the patient and enhance the self-confidence and self-esteem of participants. As they have proven beneficial with safety considerations, they are universally recommended as standard operating practice.

Materials and Methods

The study approach used in this study was a quantitative one-group pre- and post-test experimental design. The study was conducted in the Gynae radiation OPD and RT department, Tata Memorial Hospital, Mumbai. A literature review was conducted using various search engines such as PubMed, Science Direct, CINHAls, and Cochrane. The investigator reviewed various studies and articles on the topic, which helped to gain clarity about the topic under study. The study was conducted after Institutional Ethics Committee approval and CTRI registration. Patients with cervical cancer planned for radiation therapy (as per NCG guideline) had a total dose planned of 5 weeks of external beam radiation, followed by 2 weeks of brachytherapy. A total of 45 samples were selected based on the selection criteria using the non-convenience sampling technique.

Criteria for Selection of Sample

Inclusion Criteria

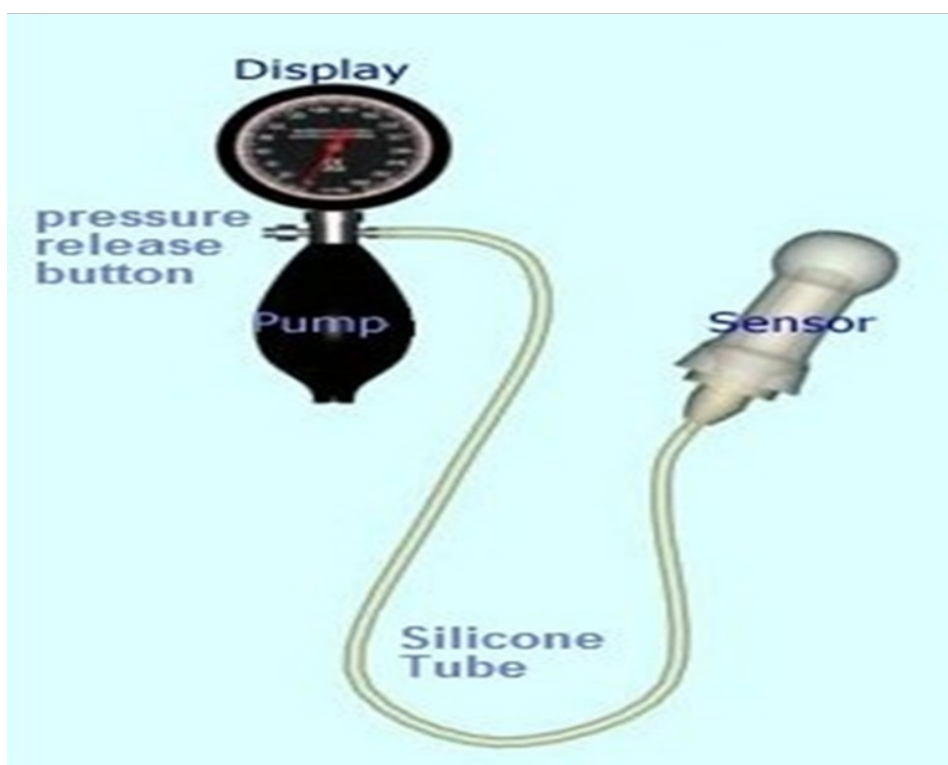
- Age >18 years and ≤ 65 years with cervical cancer.
- Patients who underwent radiation therapy as per NCG guidelines (5 weeks of EBRT +2-week brachytherapy patient).
- Patients receiving concurrent therapy.
- Patients who were able to follow and perform pelvic floor muscle strengthening exercises^[21].

Exclusion Criteria

- Cervical cancer with stage IIIC and stage IV and involvement of the urinary bladder.
- Cervical cancer participants who had undergone surgery of the female reproductive organ.
- Cervical cancer participants who were mentally unsound.

Data Collection Tool

1. **ICIQ-UI short form** (International Consultation on Incontinence Questionnaire Urinary Incontinence Short Form (ICIQ-UI SF) ^{[5][22][23][24][25]}. The ICIQ-UI Short Form provides a brief and robust measure for this purpose, as well as in epidemiological surveys, particularly when more than one measure is being used. Number of items: 4 Questions: Frequency of urinary incontinence, Amount of leakage, The overall impact of urinary incontinence, Self-diagnostic item. Interpretation of the tool was the total score of 21: Score ranges: 1-5 (slightly), 6-12 (moderate), 13-18 (severe), 19-21 (very severe). The validity and reliability of ICIQ SF were checked - it is a standardised tool.
2. **Perineometer**. A Perineometer or vaginal manometer is an instrument for measuring the strength of voluntary contractions of the pelvic floor muscles ^{[25][26]}.



The perineometer is a simple pneumatic device consisting of a vaginal sensor (vaginal probe) that records contractions in mm of Hg. The resistance chamber (vaginal sensor) measures about 2.5cm in diameter and 8cm in length and is made of silicon. The vaginal sensor is covered with a condom before it is used for the assessment. The perineometer is inserted into the vaginal canal until the full extent of the compressible portion of the device is above the level of the hymen ring. An intentional pressure of 5 mm Hg is maintained before inserting the sensor into the vagina for each woman. Once the sensor is inserted into the vagina, the digital reading is set to zero before recording the compression pressure. The women are instructed to undertake three maximal pelvic floor muscle contractions, each sustained for 5 seconds with an interval of 30 seconds. Three squeezes are recorded with a 30-second rest between efforts, and the best of the three readings is considered. Only contractions with visible inward movement of the perineum are considered to be valid. [27] The mean pelvic floor muscle squeeze pressure in nulliparous women was 31.58 mm Hg, in primiparous women it was 31.25 mm Hg, and in multiparous women, it was 26.28 mm Hg. [27][28][29][30]

Reliability of the perineometer: A reliability analysis scale (alpha) was used.

Reliability analysis of 10 samples with two variances was excellent (Alpha = 0.9606). Cronbach's $\alpha = (K/K-1)[1 - \Sigma\sigma^2y / \sigma^2x]$ where k= total items, $\Sigma\sigma^2y$ = Sum of item variances, and σ^2x =variance of total scores.

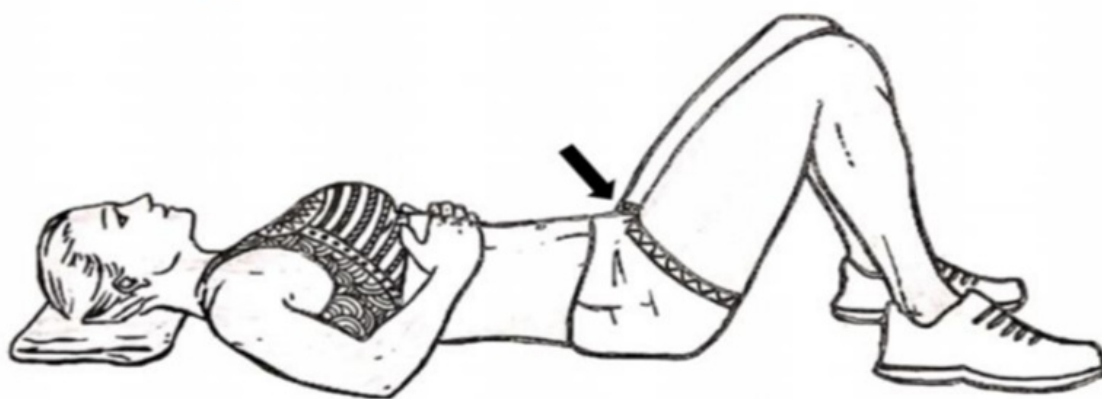
Intervention

Participants were instructed with the help of a pelvic model showing the pelvic floor muscles contraction. Demonstrations and return demonstrations were provided. A pamphlet was also issued as per the choice of the patients. The participant received 4 pelvic floor muscle strengthening exercises including a) Kegel exercise b) Squeeze and release c) Pelvic

Floor/Inner Thigh Ball Squeeze d) Lower trunk rotation / Lying hip rotation.

1. Kegel exercise [\[17\]](#)[\[18\]](#)[\[31\]](#)[\[32\]](#)[\[33\]](#)

- Lie in the supine position.
- Close your eyes and visualise the muscle that can stop urine flow.
- Tighten the muscles as much as possible.
- Hold this position for 6 seconds.
- Release the muscles and rest for 6 seconds.
- Repeat this exercise 10 times per session.
- The duration of each session is 1 minute.



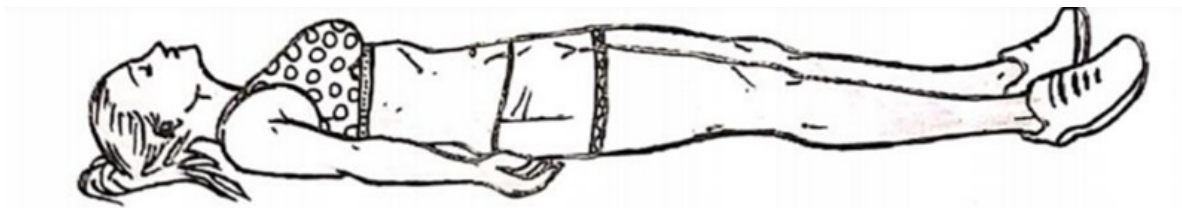
2. Squeeze and release [\[17\]](#)[\[33\]](#). This exercise involves a rapid squeeze and release of perineal muscles.

- Empty the bladder.
- Sit in a comfortable position [\[34\]](#).
- Picture the pelvic floor muscle.
- Squeeze the perineal muscle as quickly as possible and release without attempting to sustain a contraction.
- Rest for 5 seconds, repeat the movement 10-20 times (in 5min=15 cycles) of squeeze and release.
- Repeat it 4 times a day.



a. Supine position

- The same exercise is performed in the supine position (rapid squeeze and release, rest for 5 sec, repeat movement 10-20 times, {5 min = 15 cycles}).
- Repeat it 4 times a day.



b. Lateral position

- The same exercise is performed in the lateral position (rapid squeeze and release, rest for 5 sec, repeat movement 10-20 times, {5 min = 15 cycles}). The total time duration is 15 minutes.
- Perform the exercise 4 times a day.

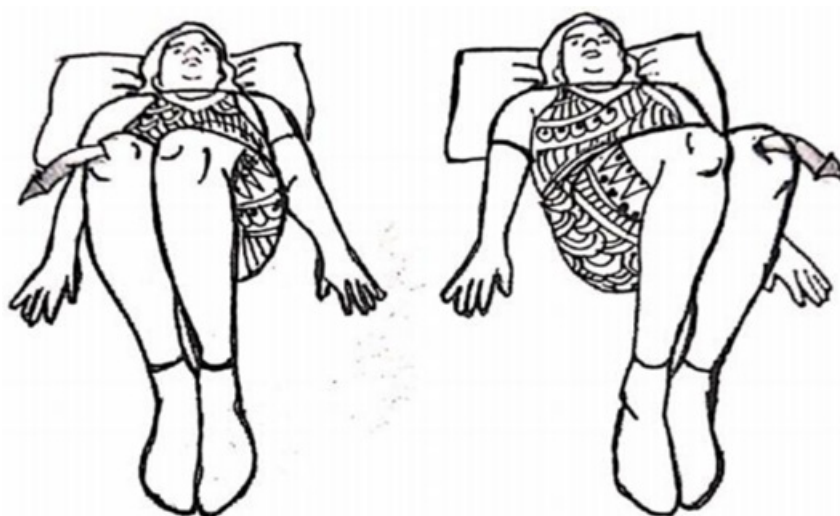


3. Pelvic Floor/Inner Thigh Ball Squeeze [\[31\]](#)[\[32\]](#)[\[23\]](#).



- This exercise can be done with a 25-30 cm sized ball.
- Lie down on your back with knees bent and feet flat on the floor.
- Place a ball between your knees, supporting it so it doesn't slip or fall.
- Inhale, relaxing the pelvic floor muscles for 5 seconds.
- Exhale – during exhalation, draw the pelvic floor muscles up and in, gently squeezing the ball.
- Place the coccyx bone (tailbone) firmly in contact with the ground.
- Contract the pelvic floor muscles for 10 seconds and release the contraction.
- Repeat the exercise 4 times per session, 4 times a day.

4. Lower trunk rotation / Lying hip rotation [\[35\]](#)[\[36\]](#)



Lie on your back with knees bent and feet flat on the ground. Keep the body firmly on the floor. Gently roll both bent knees over to the right side. Contract the perineal and anal muscles. Hold for 10 seconds. Relax the muscles. Return to

the starting position. Then gently roll the bent knees over to the left side. Contract the perineal and anal muscles. Hold for 10 seconds, and then return to the starting position. Repeat the exercise 5 times per session, 4 times every day. The total time is 1.5-2 minutes per session. All exercises should be performed 4 times every day. The total duration of the 4 items is 18-20 minutes.

Participants were followed up daily for 8 weeks. Each participant was evaluated on the 8th week and 12 weeks using the ICIQ-of tool, and perineometer. A daily logbook was maintained to record compliance. Compliance of exercise as a percentage will be calculated based on the logbook. 80-100% will be assumed as compliance by the investigator. Non-compliance to exercise is less than 80% by a logbook. The perineometer is used on day zero (0), and 12 weeks to assess the strength of perineal muscle contraction.

Data Analysis and Interpretation

Table I. Demographic data

Demographic Variables	n	%
Age Group (yrs)		
≤ 40	6	13.3
41 – 62	35	77.8
≥ 63	4	8.9
Total	45	100.0
Educational Level		
Basic complete	8	17.8
Basic incomplete	29	64.4
Medium complete	2	4.4
Medium incomplete	5	11.1
University	1	2.2
Parity		
Nulliparous	0	0.0
Multiparous	45	100.0
Mode of Delivery (labour)		
Normal vaginal delivery	44	97.8
Forceps delivery & LSCS	1	2.2
BMI		
Underweight (<18.5)	7	15.6
Normal (18.5 – 24.9)	25	55.6
Overweight (25.0 – 29.9)	8	17.8
Obese (≥30.0)	5	11.1
Associated risk behaviour		
Constipation	13	28.9
DM	6	13.3
Hypertension	4	8.9
Smoking	6	13.3
Nil	16	35.6
Total	45	100.0

Table I shows that 77.8% of participants were aged between 41-62 years. The education level was heterogeneous, but a maximum of 64.4% had incomplete basic education.

The results showed that 100% of participants were multiparous and a maximum of 95.6% of participants had a normal vaginal delivery. 56.6% of participants had a normal BMI, whereas 17.8% of participants were overweight, 15.6% of

participants were underweight, and 11.1% of participants were obese. Constipation was more prevalent (28.9%). 13.3% of participants had diabetes, 8.9% had hypertension, and 13.3% of the participants had a habit of smoking, whereas 35.6% of the participants had no above comorbidities. The incidence of urinary incontinence was higher in stage IIIB cervical cancer.

Table II. Effect of pelvic floor muscle strengthening exercises on urinary incontinence on ICIQUI SF (comparative week wise)

Parameter	Pre Test		8 th Week		12 th Week		Friedman Test	P- Value	Sig. at 5% Level
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median			
Average Frequency of Urinary Incontinence	2.88±1.24	3.0	2.56±1.14	3.0	1.88±0.85	2.0	29.148**	<0.001	Yes
Amount of Urine Leak	3.30±1.44	4.0	2.84±1.25	2.0	2.23±0.97	2.0	25.684**	<0.001	Yes
Impact of Urinary Incontinence on Quality of Life	6.37±1.56	6.0	5.93±1.62	6.0	4.74±1.84	5.0	34.676**	<0.001	Yes
Total Score	12.56±3.74	12.0	11.33±3.48	11.0	8.86±2.97	10.0	32.947**	<0.001	Yes

** Statistically highly significant at 0.1% level i.e., $P < 0.001$.

In this study, 45 participants were included, but 2 patients died after the pre-test as they were in the palliative stage. Therefore, 43 patients completed the 12 weeks of the study.

The study results revealed that the frequency of urinary incontinence on the ICIQ UI -SF tool observed in a participant on pre-test mean was 2.88 (SD \pm 1.24), 8 weeks mean was 2.56 (SD \pm 1.14), and 12 weeks mean was 1.88 (SD \pm 0.85). The P-value was found to be statistically significant (P-value $<$ 0.001). The quantity of urinary incontinence observed in a participant on pre-test mean was 3.30(SD \pm 1.44), 8 weeks mean was 2.84 (SD \pm 1.25), and 12 weeks mean was 2.23(SD \pm 0.97). The P-value was found to be statistically significant ($<$ 0.001). The quality of life of participants significantly improved (P $<$ 0.001). We accepted the research hypothesis that there was significant (P $<$ 0.001) control of urinary incontinence after pelvic floor muscle strengthening exercises in patients with cervical cancer undergoing radiation therapy.

Table III. Analysis of pelvic floor muscle strengthening on perineometer

Parameter	Pre Test	8 th Week	12 th Week	One Way ANOVA (Repeated)	P- Value	Sig. at 5% Level
	Mean±SD	Mean±SD	Mean±SD			
Perineometer	21.63±2.71	22.33±2.65	23.49±2.16	15.259**	<0.001	Yes

** Statistically highly significant at 0.1% level i.e., $P < 0.001$.

According to Table III, the mean pelvic floor muscle strength at preintervention, 8 weeks, and 12 weeks were 21.63

(SD±2.71), 22.33 (SD±2.65), and 23.49 (SD±2.16) respectively. The p-value was found to be <0.001. The pelvic floor strength statistically significantly improved after pelvic floor exercises. The one-way ANOVA test p-value was <0.001. Hence, the Perineometer was considered highly significant.

Table IV. Correlation between pelvic floor muscle strength (perineometer) and urinary incontinence

Variables	Value	Urinary Incontinence Total Score		
		Pre Test	8 th week	12 th week
Perineometer				
Pre Test	r	-0.127		
	P-Value	0.416		
8 th week	r		0.058	
	P-Value		0.713	
12 th week	r			-0.476*
	P-Value			0.001

*Statistically Significant at 5% level, i.e., $P < 0.05$.

r = Correlation Coefficient.

$N=43$.

Table IV illustrates that the correlation coefficient between urinary incontinence ICIQ UI SF total score and pelvic floor muscle strength (perineometer) at the 8th week of intervention was 0.058, indicating a positive correlation, and at the 12th week of intervention was -0.476, indicating a negative correlation. Thus, the contractility of the perineometer was proven by the 12th week of pelvic floor muscle strengthening.

Table V. Incidence of urinary incontinence on ICIQ UI SF tool

ICIQ UI SF SCORE (Total score 21)	Frequency	Percentages
1-5	0	00
6-12	30	66.67
13-18	9	20
19-21	6	13.33

$N=45$.

Table V shows that 30 (66.67%) participants had moderate urinary incontinence, nine (20%) participants had severe urinary incontinence, and six (13.33%) participants had very severe urinary incontinence.

Table VI. Self-diagnosis of urine leak - ICIQ UI SF tool

Types of urinary incontinence	Frequency	Percentage
No urinary incontinence	00	00
Stress urinary incontinence	03	6.6
Urge urinary incontinence	05	12
Mixed urinary incontinence	37	82

N=45.

Table VI revealed that 37 (82.2%) of participants had mixed urinary incontinence, five (12%) participants had urge urinary incontinence, and three (6.6%) participants had stress urinary incontinence.

Table VII. Comparison of the situation during urine loss

Situation during urine loss	Max Score	Pre Test	Perce. (%)	8 th week	Perce. (%)	12 th week	Perce. (%)
Never urine leak	43	0	0.0	0.0	0.0	9	20.9
Before arriving at the toilet	43	29	67.4	29	67.4	18	41.9
While coughing or sneezing	43	32	74.5	32	74.5	24	55.8
While sleeping	43	4	9.3	2	4.6	0	0.0
While physically active/exercising	43	13	30.2	14	32.6	3	7.0
While dressing after urinating	43	21	48.8	20	46.5	5	11.6
Continually	43	16	37.2	15	34.9	3	7.0

N=43.

Table VII reveals that the percentage of participants experiencing urine loss before reaching the toilet, based on the ICIQ UI SF tool, was 67.4% in the pre-test, 67.4% in the 8th week, and 41.9% in the 12th week.

Urine leakage while coughing or sneezing was observed in 74.5% of participants in the pre-test, 74.5% in the 8th week, and 55.8% in the 12th week.

Urine leakage while sleeping was observed in 9.3% of participants in the pre-test, 4.6% in the 8th week, and 0% in the 12th week.

Urine leakage while being physically active or exercising was observed in 30.2% of participants in the pre-test, 32.6% in the 8th week, and 7.0% in the 12th week.

Urine leakage while dressing after urinating was observed in 48.8% of participants in the pre-test, 46.5% in the 8th week, and 11.6% in the 12th week.

Continuous urine leakage was observed in 37.2% of participants in the pre-test, 34.9% in the 8th week, and 7.0% in the 12th week.

Table VII A. Association between urinary incontinence and demographic data

Demographic Variables	Urinary Incontinence					Chi- square Test	P- Value	Sig. at 5% level
	Slightly (1 — 5)	Moderate (6 — 12)	Severe (13 — 18)	Very Severe (19 — 21)	Total			
Age Group (yrs.)								
≤ 40	0	5	0	1	6	4.588	0.332	Not
41 – 62	0	23	8	4	35			
≥ 63	0	1	2	1	4			
Total	0	29	10	6	45			
Educational Level								
Basic complete	0	5	2	1	8	6.406	0.602	Not
Basic incomplete	0	17	8	4	29			
Medium complete	0	1	0	1	2			
Medium incomplete	0	5	0	0	5			
University	0	1	0	0	1			

N=43.

According to the table, it was observed that there was no significant association between the age of cervical cancer patients undergoing radiation therapy and the degree of urinary incontinence (P-value 0.332). Also, there was no significant association between the educational level of cervical cancer patients undergoing radiation therapy and the degree of urinary incontinence (P-value 0.602).

Table VII B. Association between urinary incontinence and clinical data

Demographic Variables	Urinary Incontinence					Chi- square Test	P- Value	Sig. at 5% level
	Slightly (1 — 5)	Moderate (6 — 12)	Severe (13 — 18)	Very Severe (19 — 21)	Total			
Parity								
Nulliparous	0	0	0	0	0	-	-	-
Multiparous	0	29	10	6	45			
Mode of Delivery (labor)								
Normal vaginal delivery	0	29	10	5	43	2.643	0.267	Not
Forceps delivery & LSCS	0	1	0	1	2			
BMI								
Underweight	0	3	3	1	7	5.520	0.479	Not
Normal	0	16	6	3	25			
Overweight	0	6	0	2	8			
Obese	0	4	1	0	5			
Stage of Disease								
IA	0	1	0	1	2	9.658	0.140	Not
IIA	0	0	0	1	1			
IIB	0	12	4	2	18			
IIIB	0	16	6	2	24			
Total	0	29	10	6	45			

N=43.

Table VII B reveals that there was no association between the parity of cervical cancer patients undergoing radiation therapy and the degree of urinary incontinence. There was also no significant association between the mode of labour of cervical cancer patients undergoing radiation therapy and the degree of urinary incontinence. Furthermore, no significant association was found between the body mass index of a cervical cancer patient undergoing radiation therapy and the degree of urinary incontinence.

There was no association between the stage of disease and the degree of urinary incontinence (P-value 0.140).

Discussion

Urinary incontinence following cervical cancer treatment, such as radiation therapy, emerged as a significant adverse effect. This quasi-experimental study aimed to assess the effect of pelvic floor muscle strengthening exercises on urinary

incontinence in patients with cervical cancer undergoing radiation therapy. Forty-five samples were selected through the convenience sampling method, from which two samples died during intervention due to disease aggravation and non-treatment and follow-up. In our study, the intervention consisted of four types of pelvic floor exercises, i.e., Kegel, squeeze and release, Pelvic Floor/Inner Thigh Ball Squeeze, Lower trunk rotation / Lying hip rotation, for 18-20 minutes, four times daily, and daily follow-up for 12 weeks. Assessments were done at the 8th and 12th weeks with the International Consultation Incontinence Questionnaire on urinary incontinence - short form and perineometer.

Cinara Sacomori (2020) showed that there was no significant change from baseline to post-radiation therapy in muscle strength, EMG records, and incontinence ($p > 0.05$). The median of PFM strength was equal at baseline and after intervention (median = 2; IQR = 1). Pre-rehabilitation teaching PFMEs might be a protective factor for preserving PFM strength and preventing incontinence one month after radiation therapy. It is a feasible intervention [5]. According to Sirils LT (2019), minimal important differences for ICIQ-UI SF were recommended at 24 months [83]. In our study, participants' ICIQ UI SF total score observed that on pre-test mean was 12.56 (SD±3.74), 8 weeks mean was 11.33 (SD±3.48), and 12 weeks mean was 8.86 (SD±2.97). There was a significant ($p < 0.001$) reduction of urinary incontinence after 12 weeks of PFMSE.

According to a previous study by Andrea Marques (2010), pelvic floor muscle exercises were found to be effective in improving pelvic muscle strength, endurance, and coordination [84]. In our study, pelvic floor contractibility significantly improved ($P < 0.001$) after 12 weeks of pelvic floor muscle strengthening exercises. According to a Lancet report by Marc Arbyn (2018), the average global age at diagnosis of cervical cancer was 53 years, ranging from 44 to 68 years [2]. Our study results showed that 77.8% of women's ages ranged from 41 to 62 years. According to Cinara Sacomori (2020), most of the women were married or living with partners (42.8%). Only 17.9% were nulliparous [5]. In our study, 100% of participants were married. There was heterogeneity regarding education levels. A maximum of 64.4% of participants had basic incomplete education. 95.6% had normal vaginal delivery. 55.6% of women had a normal body mass index.

Ramaseshan AS (2018) found the pre-treatment prevalence of stress UI and urgency UI to be 24-29% and 8-18% respectively, and the post-treatment prevalence to be 4-76% and 4-59% respectively [12]. In our study, 82.2% of participants had mixed urinary incontinence, 11.11% of participants had urge urinary incontinence, and 6.6% of participants had stress urinary incontinence. 66.67% of participants had moderate urinary incontinence; 20% of participants had severe urinary incontinence, whereas 13.33% of participants had very severe urinary incontinence.

According to Kristine A. Donovan (2014), 36.5% of survivors reported constipation in patients with cervical and endometrial cancer [86]. In our study, constipation was more prevalent (28.9%). 53% of the participants were at stage III B and 40% of participants were at stage IIB of the disease. 97.8% of the participants had received concurrent therapy. Parivash Jamrasi (2018) suggested that seventy percent is the highest prevalence of urinary incontinence among gynaecologic [17]. Pelvic floor muscle exercise for more than 4 weeks resulted in improved pelvic floor muscle strength and mitigated the symptoms of urinary incontinence among patients with gynaecologic cancer.

This study showed that most participants complained of mixed urinary incontinence, followed by urge UI and stress UI. In this present study, none of the participants experienced pain, tiredness, etc., related to exercise, as well as pain,

discomfort, bleeding related to the perineometer.

Sirls LT (2015) recommended minimal important differences for ICIQ-UI SF 4 at 24 months. Our study showed that significant for ICIQ -UI SF at 8 weeks and 12 weeks [83].

According to a systematic review previously conducted by Agnieszka Radzimska (2018) on the impact of pelvic floor muscle training on the quality of life of women with urinary incontinence, the result was that PFMT is an effective treatment for UI in women [85]. PFMT significantly improves the QoL of women with UI, which is an important determinant of their physical, mental, and social functioning.

In a previous study by Price N, Dawood R (2010), there was evidence of benefits in using pelvic floor muscle exercises (PFMEs) to prevent UI, as an international recommendation.

Rutledge TL (2014), Yang EJ (2012) conducted a few studies testing PFMEs in cervical cancer survivors after radiation treatment, including only women with PFD. They showed that PFMEs are useful to improve PFD and the quality of life of cervical cancer patients [37][38].

Our study showed improved quality of life of participants with cervical cancer in various aspects such as social, psychological, familial, occupational, physical, and sexual aspects of patients' lives.

There was no association found between urinary incontinence and demographic data and clinical characteristics.

According to Cinara Sacomori (2020), the attrition rate was more than 42.8%, but our study's attrition rate is 4.5%^[5].

The barrier related to this intervention was the difficulty in following up with participants. They needed reinforcement of the importance of continuing daily exercise and follow-up during the COVID-19 pandemic. Some participants had difficulty performing PFMEs while receiving chemotherapy. All participants did not perform PFMEs while receiving brachytherapy. However, complaints were above 80%.

Future studies should explore the randomized control trial.

Conclusion

This study was undertaken to assess the effect of pelvic floor muscle strengthening exercises on urinary incontinence in patients with cervical cancer undergoing radiation therapy. Patient quality of life and comfort are important in nursing, and the findings of this study suggest that pelvic floor muscle strengthening exercises could effectively reduce urinary incontinence in patients with cervical cancer undergoing radiation therapy. This study also suggests that simple nursing intervention in reducing patient urinary incontinence and strengthening of pelvic floor muscle can be clinically effective and cost-effective. Also, it helps to improve the quality of life of patients with cervical cancer undergoing radiation therapy.

Other References

- Salian, S. C., & Ved, P. (2018). Reliability and validity of new instrument measuring pelvic floor muscle squeeze pressure. *International Journal of Advanced Scientific Research*, 3(5), 01-09.
- Price, N., Dawood, R., & Jackson, S. R. (2010). Pelvic floor exercise for urinary incontinence: a systematic literature review. *Maturitas*, 67, 309–315.
- Tritsch, J. M., et al. (1998). Application of King's theory of goal attainment and the Carondelet St. Mary's case management model. *Nursing Science Quarterly*, 11(2), 69-73.
- Hampton, D. C. (1994). King's theory of goal attainment as a framework for managed care implementation in a hospital setting. *Nursing Science Quarterly*, 7(4), 170-3.
- Alligood, M., & Tomey, A. (2010). *Nursing theorists and their work*, seventh edition. Maryland Heights: Mosby-Elsevier.
- Haylen, B. T., et al. (2009). An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourology and Urodynamics*, 29, 4–20.
- Chopra, S. J., Mathew, A., Maheshwari, A., Bhatla, N., Singh, S., & Rai, B. (n.d.). National Cancer Grid of India Consensus Guidelines on the Management of Cervical Cancer. *Journal of Global Oncology*.
- Ngoma, M., & Autier, P. (2019). Cancer prevention: cervical cancer. *Cancer Medical Science*, 13, 952.
- Ernst, H. (2018). Pelvic floor exercises. In R. Nall (Ed.). Retrieved from www.curejoy.com/content/exercises-for-urinary-incontinence/.
- Kegel, A. H. (1948). Progressive resistance exercise in the functional restoration of the perineal muscles. *American Journal of Obstetrics and Gynecology*, 56, 238–249.
- Waggoner, S. E. (2003). Cervical cancer. *Lancet*, 361, 2217–2225. [https://doi.org/10.1016/S0140-6736\(03\)13778-6](https://doi.org/10.1016/S0140-6736(03)13778-6)
- Bodean, O. M., Marcu, R. D., Spinu, D. A., Socea, B., Diaconu, C. C., Munteanu, O., et al. (2018). Pelvic floor disorders in gynaecological malignancies. An overlooked problem? *Journal of Mind Medical Sciences*, 5(1), 46–52.
- Dobberfuhr, A. D. (2019). Evaluation and treatment of female stress urinary incontinence after pelvic radiotherapy. *Neurourology and Urodynamics*, 38(Suppl 4), S59-S69.
- Viswanathan, A. N., & Lee, L. J. (2014). Complications of pelvic radiation in patients treated for gynecologic malignancies.
- Naughton, M. J., Donovan, J., & Badia, X. (2004). Symptom Severity and QOL Scales for Urinary Incontinence. *Gastroenterology*, 126, S114–S123.
- Senra, C., & Pereira, M. G. (2015). Quality of life in women with urinary incontinence. *Revista da Associação Médica Brasileira*, 61(2), 178-83.
- Pizzol, D., et al. (2020). Systemic review and meta – analysis on Urinary Incontinence and quality of life: a systematic review and meta-analysis.
- Ramaseshan, A. S., Felton, J., Roque, D., Rao, G., Shipper, A. G., & Sanses, T. V. D. (2018). Pelvic floor disorders in women with gynecologic malignancies: a systematic review. *International Urogynecology Journal*, 29(4), 459–476.
- Thomas, S. G., Sato, H. R. N., Glantz, J. C., Doyle, P. J., & Buchsbaum, G. M. (2013). Prevalence of symptomatic pelvic floor disorders among gynecologic oncology patients. *Obstetrics & Gynecology*, 122(5), 976-980.
- Krhut, J., Gartner, M., Mokris, J., Horcicka, L., Svabik, K., & Zchoval, R. et al. (2018). Effect of severity of urinary

- incontinence on quality of life in women. *Neurourology and Urodynamics*, 37(6), 1925–30.
- Brennen, R., Lin, K. Y., Denehy, L., & Frawley, H. C. (2020). The Effect of Pelvic Floor Muscle Interventions on Pelvic Floor Dysfunction After Gynecological Cancer Treatment: A Systematic Review. *Physical Therapy*, 100(8), 1357-1371.
 - Rutledge, T. L., Rogers, R., Lee, S. J., & Carolyn, Y. et al. (2014). A pilot randomized control trial to evaluate pelvic floor muscle training for urinary incontinence among gynecologic cancer survivors. *Gynecologic Oncology*, 132(1), 154–158. <https://www.ncbi.nlm.nih.gov/entrez/eutils/elink.fcgi?dbfrom=pubmed&retmode=ref&cmd=prlinks&id=24183730>
 - Dumoulin, C., Cacciari, L. P. C., & Hay-Smith, E. J. C. (2018). Pelvic floor muscle training versus no treatment, or inactive control treatments, for urinary incontinence in women. *Cochrane Database of Systematic Reviews*, 2018(10).
 - Bernard, S., Moffet, H., Plante, M., & Ouellet, M. P. (2017). Pelvic-Floor Properties in Women Reporting Urinary Incontinence After Surgery and Radiotherapy for Endometrial Cancer. *Physical Therapy*, 97(4), 438-448.
 - Di Benedetto, P., Coidessa, A., & Floris, S. (2008). Rationale of pelvic floor muscles training in women with urinary incontinence. *Minerva Ginecologica*, 60(6), 529-541.
 - Vyas, R., Hande, D., Nishad, P., & Barot, H. (2018). Effects of pelvic floor muscle training vs an assisted pelvic floor muscle training among rural perimenopausal women with urinary incontinence: A comparative study. *International Journal of Yoga, Physiotherapy and Physical Education*, 3, 121-124.
 - Park, S. H., Kang, C. B., Jang, S. Y., & Kim, B. Y. (2013). Effect of Kegel exercise to prevent urinary and fecal incontinence in antenatal and postnatal women: systematic review. *Korean Academy of Nursing*, 43(3), 420-430.
 - Theofrastous, J. P., Wyman, J. F., Bump, R. C., McClish, D. K., Elser, D. M., Bland, D. R., & Fantl, J. A. (2002). Effects of pelvic floor muscle training on strength and predictors of response in the treatment of urinary incontinence. *Neurourology and Urodynamics*, 21(5), 486-490.
 - Shishido, K., Peng, Q., Jones, R., Omata, S., & Constantinou, C. E. (2008). Influence of pelvic floor muscle contraction on the profile of vaginal closure pressure in continent and stress urinary incontinent women. *Journal of Urology*, 179(5), 1917-1922.
 - Flandin-Crétinon, S., Roelens, I., Sellier, Y., Bader, G., Carbonnel, M., & Ayoubi, J-M. (2019). Assessment of pelvic floor muscle training programs and urinary incontinence in women: A literature Review. *Gynecologie Obstetrique Fertilité & Senologie*, 47(7-8), 591-598.
 - Nygaard, I. E., & Shaw, J. M. (2016). Physical activity and the pelvic floor. *American Journal of Obstetrics and Gynecology*, 214(2), 164-171.
 - Park, S-H., & Kang, C-B. (2014). Effect of Kegel Exercises on the Management of Female Stress Urinary Incontinence: A Systematic Review of Randomized Controlled Trials. *Advances in Urology*, 2014, Article ID 640262.
 - International Consultation on Incontinence. (2021). International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF). Retrieved December 4, 2020, from <https://icq.net/icq-ui-sf>.
 - Chevalier, F., Fernandez-Lao, C., & Cuesta-Vargas, A. I. (2014). Normal reference values of strength in pelvic floor muscle of women: a descriptive and inferential study. *BMC Women's Health*, 14, 143.
 - Lee, B. A., Kim, S. J., Choi, D. K., Kwon, O., Na, H. R., & Cho, S. T. (2017). Effects of Pelvic Floor Muscle Exercise on Urinary Incontinence in Elderly Women With Cognitive Impairment. *International Neurourology Journal*, 21(4), 295–301.
 - Rahmani, N., & Mohseni-Bandpei, M. A. (2011). Application of perineometer in the assessment of pelvic floor muscle

- strength and endurance: a reliability study. *Journal of Bodywork and Movement Therapies*, 15(2), 209-14.
- Hundley, A. F., Wu, J. M., & Visco, A. G. (2005). A comparison of perineometer to brink score for assessment of pelvic floor muscle strength. *American Journal of Obstetrics and Gynecology*, 192(5), 1583-91.
 - Gandhe, S., & Ganvir, S. (2016). Perineometer as a strength assessment & training tool for pelvic floor muscles in stress urinary incontinent elderly women. *Indian Journal of Basic and Applied Medical Research*, 5(4), 406-410.
 - Timmermans, L., Falez, F., & Mélot, C. (2016). Use of the International Consultation on Incontinence Questionnaire-Urinary Incontinence-Short Form (ICIQ-UI-SF) for an objective assessment of disability determination according to the Modified Katz Scale: a prospective longitudinal study. *Minerva Urology and Nephrology*, 68(4), 317-23.
 - Thompson, J. A., O'Sullivan, P. B., Briffa, N. K., & Neumann, P. (2006). Assessment of voluntary pelvic floor muscle contraction in continent and incontinent women using transperineal ultrasound, manual muscle testing and vaginal squeeze pressure measurement. *International Urogynecology Journal and Pelvic Floor Dysfunction*, 17(6), 624-30.
 - Avery, K., Donovan, J. L., et al. (2004). ICIQ: A brief and robust measure for evaluating the symptoms and impact of urinary incontinence. *Neurourology and Urodynamics*, 23(4), 322-30.
 - Sharma, S. K. (2018). *Nursing Research and Statistics* (3rd ed.). Elsevier India.
 - Polit, D. F., & Beck, C. T. (2004). *Nursing Research: Principles and Methods* (7th ed.). Lippincott Williams and Wilkins.
 - Hajebrahimi, S., Nourizadeh, D., Hamedani, R., & Pezeshki, M. Z. (2012). Validity and reliability of the International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form and its correlation with urodynamic findings. *Urology Journal*, 685-90.
 - Swaminathan, S. (2016). Consensus document for the management of cancer cervix. *Indian Council of Medical Research*.

References

1. [^] Srivastava, A. N., & Misra, J. S. (2018). *Cervical cancer screening in rural India: Status & current concepts*. *Indian Journal of Medical Research*, 148(6), 687-696.
2. ^{a, b, c} Arbyn, M., & Weiderpass, E. (2020). *Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis*. *Lancet Global Health*, 8, e191–203.
3. ^{a, b} Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., & Jemal, A. (2018). *Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries*. *CA: A Cancer Journal for Clinicians*, 68(6), 394-424.
4. [^] Pushpalatha, K. (2015). *Prevalence of Urogynaecological Symptoms in Survivors of Cervical Cancer in a Tertiary Care Gynaecologic Oncology Clinic of a Developing Country*. *WHOJ*, 1(1), 8-12.
5. ^{a, b, c, d, e, f} Sacomori, C., & Araya-Castro, P. (2019). *Pre-rehabilitation of the pelvic floor before radiation therapy for cervical cancer: a pilot study*. *International Urogynaecology Journal*.
6. [^] Haylen, B. T., et al. (2009). *An International Urogynaecology Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction*. *Neurourology and Urodynamics*, 29, 4–20.
7. [^] Greear, G., Lefkowitz, C., Parrillo, L. M., et al. (2016). *Incontinence, voiding dysfunction, and other urologic*

- complications after radiotherapy for gynecologic malignancies. *Current Bladder Dysfunction Reports*, 11, 88–97.
8. [^]Erekson, E. A., Sung, V. W., DiSilvestro, P. A., & Myers, D. L. (2009). Urinary symptoms and impact on quality of life in women after treatment for endometrial cancer. *International Urogynecology Journal and Pelvic Floor Dysfunction*, 20(2), 159–163.
 9. [^]Ramaseshan, A. S., Felton, J., Roque, D., et al. (2018). Pelvic floor disorders in women with gynaecologic malignancies: a systematic review. *International Urogynecology Journal*, 29, 459–76.
 10. [^]Aoki, Y., Brown, H. W., Brubaker, L., Cornu, J. N., Daly, J. O., & Cartwright, R. (2018). Urinary incontinence in women. *HHS Public Access, PMC*.
 11. [^]Leroy, L. da S., & Lopes, M. H. (2012). Urinary incontinence in the puerperium and its impact on the health-related quality of life. *Revista Latino-Americana de Enfermagem*, 20, 346–53.
 12. ^{a, b}Mallah, F., Montazeri, A., Ghanbari, Z., & Tavoli, A. (2014). Effect of Urinary Incontinence on Quality of Life among Iranian Women. *Journal of Family and Reproductive Health*, 8(1), 13–19.
 13. [^]Tortora, G. J., & Derrickson, B. (2014). *Principles of ANATOMY & PHYSIOLOGY (14th ed.)*. John Wiley & Sons, Inc.
 14. [^]Jamrasi, P., Lee, K.-H., & Song, W. (2018). Effect of Pelvic Floor Muscle Training on Urinary Incontinence in Gynaecologic Cancer: A Review. *Exercise Science*, 27(4), 260-267. <https://doi.org/10.15857/ksep.2018.27.4.260>.
 15. [^]Cavkaytar, S., Kokanali, M. K., Topcu, H. O., Aksakal, O. S., & Doğanay, M. (2015). Effect of home-based Kegel exercises on quality of life in women with stress and mixed urinary incontinence. *Journal of Obstetrics and Gynaecology Research*, 35(4), 407-410.
 16. [^]Nygaard, I. E., Kreder, K. J., Lopic, M. M., Fountain, K. A., & Rhomberg, A. T. (1996). Efficacy of pelvic floor muscle exercises in women with stress, urge, and mixed urinary incontinence. *American Journal of Obstetrics and Gynecology*, 174(1), 120-125.
 17. ^{a, b, c, d}Bø, K., Mørkved, S., Frawley, H., & Sherburn, M. Evidence for benefit of transversus abdominis training alone or in combination with pelvic floor muscle training to treat female urinary incontinence: A systematic review.
 18. ^{a, b}Rutledge, T., et al. (2014). A pilot randomized control trial to evaluate pelvic floor muscle training for urinary incontinence among gynecologic cancer survivors. *Gynecologic Oncology*, 132, 154-158.
 19. [^]Yang, E. J., Lim, J. Y., Rah, U. W., & Kim, Y. B. (2012). Effect of a pelvic floor muscle training program on gynecologic cancer survivors with pelvic floor dysfunction: A randomized controlled trial. *Gynecologic Oncology*, 125, 705-711.
 20. [^]Nygaard, I. E., Kreder, K. J., Lopic, M. M., Fountain, K. A., & Rhomberg, A. T. (1996). Efficacy of pelvic floor muscle exercises in women with stress, urge, and mixed urinary incontinence. *American Journal of Obstetrics and Gynecology*, 174(1), 120-125.
 21. [^]Petignat, P., & Roy, M. (2007). Diagnosis and management of cervical cancer. *BMJ*, 335(7623), 765–768.
 22. [^]Liberman, D., Mehus, B., & Elliott, S. P. (2014). Urinary adverse effects of pelvic radiotherapy. *Translational Andrology and Urology*, 3(2), 186–195.
 23. ^{a, b}Sacomori, C., Berghmans, B., Mesters, I., et al. (2015). Strategies to enhance self-efficacy and adherence to home-based pelvic floor muscle exercises did not improve adherence in women with urinary incontinence: a randomised trial. *Journal of Physiotherapy*, 61, 190.

24. [^]Karmakar, D., Mostafa, A., & Abdel-Fattah, M. (2017). New validated score for detecting patient-reported success on postoperative ICIQ-SF: a novel two-stage analysis from two large RCT cohorts. *Urogynecology Journal*, 28(1), 95-100.
25. ^{a, b}Isherwood, P. J., & Rane, A. (2000). Comparative assessment of pelvic floor strength using a perineometer and digital examination. *BJOG: An International Journal of Obstetrics & Gynaecology*, 107(8), 1007-11.
26. [^]Miguel, T. P., & Laurienzo, C. E. (2020). Chemoradiation for cervical cancer treatment portends high risk of pelvic floor dysfunction. *PLoS One*, 15(6), e0234389.
27. ^{a, b}Bø, K. (2004). Pelvic floor muscle training is effective in treatment of female stress urinary incontinence, but how does it work? *International Urogynecology Journal*, 15(2), 76-84.
28. [^]Shah, Z., & Rathod, P. (n.d.). Effects of home based pelvic floor muscle training based on severity of incontinence on pelvic floor muscle strength in women with stress urinary incontinence. *Journal of Scientific and Innovative Research*.
29. [^]Angelo, P. H., Varella, L. R. D., & de Oliveira, M. C. E. (2017). A manometry classification to assess pelvic floor muscle function in women. *PLoS One*, 12(10), e0187045.
30. [^]Kurz, J., & Borello-France, D. (2017). Movement System Impairment Guided Approach to the Physical Therapist Treatment of a Patient with Postpartum Pelvic Organ Prolapse and Mixed Urinary Incontinence: Case Report. *Physical Therapy*, 97, 464–477.
31. ^{a, b}American Council on Exercise. (n.d.). *The Pilates Ball Core-strengthening Workout*.
32. ^{a, b}Hull, R., Mbele, M., et al. (2020). Cervical cancer in low- and middle-income countries. *Oncology Letters*, 20, 2058-2074.
33. ^{a, b}Price, N., Dawood, R., & Jackson, S. R. (2010). Pelvic floor exercise for urinary incontinence: a systematic literature review. *Maturitas*, 67(4), 309-315.
34. [^]Viswanathan, A. N., Lee, L. J., Eswara, J. R., Horowitz, N. S., Konstantinopoulos, P. A., Mirabeau-Beale, K. L., et al. (2014). Complications of pelvic radiation in patients treated for gynaecologic malignancies. *Cancer*, 120(24), 3870–83.
35. [^]Jordre, B., & Schweinle, W. (2014). Comparing Resisted Hip Rotation With Pelvic Floor Muscle Training in Women With Stress Urinary Incontinence: A Pilot Study. *Journal of Women's Health Physical Therapy*, May 2014, 81-89.
36. [^]Basavanthappa, B. T. (2007). *Nursing research*. New Delhi: Jaypee Brothers Medical Publishers.
37. [^]Ptak, M., Ciećwież, S., Brodowska, A., Starczewski, A., & Nawrocka-Rutkowska, J. (2019). The Effect of Pelvic Floor Muscles Exercise on Quality of Life in Women with Stress Urinary Incontinence and Its Relationship with Vaginal Deliveries. *BioMed Research International*, 2019.
38. [^]Lindgren, A., Dunberger, G., & Enblom, A. (2017). Experiences of incontinence and pelvic floor muscle training after gynaecologic cancer treatment. *Supportive Care in Cancer*, 25(1), 1-10.