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RESEARCH ARTICLE

WILEY

Effects of an 8-week pelvic core stability and nutrition community programme on maternal health outcomes

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Abstract

Introduction: Women, during the antenatal and post-partum period, report pelvic, low back pain, stress and urge urinary incontinence, colorectal dysfunction, and other co-morbidities that negatively affect health-related quality of life. Exercise and nutrition are important considerations for improving maternal health in this period.

Purpose: The purpose of this study was to examine the effects of a community-driven nutrition and exercise programme focused on pelvic floor and core stability, healthy nutrition, and breastfeeding counselling over an 8-week period on pelvic floor and urinary distress (UDI), prolapse and colorectal distress for antenatal and post-partum women with limited access to health care, and low socio-economic resources from a Midwestern Region of the United States.

Materials and methods: Purposive sample of 35 females, ages 18–44, were recruited for this prospective, preintervention to postintervention study, following ethical approval from Institutional Review Board and voluntary written consent from participants. The Health History Questionnaire, SF-36, Food Frequency Questionnaire, report of pelvic organ prolapse dysfunction (POPDI), colorectal-anal dysfunction (CRADI), and UDI as measured by the Pelvic Floor Distress Inventory (PFDI) were completed before and after intervention.

Results: Thirty-five women (n = 35) 18 to 44 years old (mean age of 22.72 ± 3.45 years) completed the study. A significant difference was found from preintervention to postintervention scores means for PFDI total scores, CRADI individual scores, and UDI individual scores (p < .05). POPDI scores decreased preintervention to postintervention but were not significant. A significant improvement in healthy nutrition and breastfeeding postintervention was also found (z = 3.21, p = .001). Further analysis showed significant, but weak, correlation between parity and POPDI (r = .366, p = .033); between parity and UDI (r = .384, p = .03); and between parity and PFDI (r = .419, p = .014).

Discussion: Our study found a significant reduction in pelvic floor dysfunction, urinary, and colorectal-anal distress symptoms and improvement in breastfeeding and

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healthy nutrition following an 8-week community-driven nutrition and exercise programme focused on pelvic floor and core stability, healthy nutrition, and breastfeeding counselling.

KEYWORDS

nutrition, physiotherapy, postpartum, prenatal

1 | INTRODUCTION

Women, during the antenatal and post-partum period, report pelvic and lumbar pain, urinary incontinence (UI), colorectal dysfunction, and other co-morbidities that may directly affect health-related quality of life (HRQOL). Exercise and nutrition are important considerations for improving maternal health during the antenatal and post-partum period (Jebakani & Sameul, 2017; Szumilewicz et al., 2017). However, limited research exists on the effects of antenatal and post-partum exercise and nutrition programmes (Shirazian, Monteith, Friedman, & Rebarber, 2010). Furthermore, limited community-driven antenatal and post-partum programmes that include detailed progression of pelvic and core stability exercises and healthy nutrition information exist for women who are socio-economically challenged. The World Health Organization's (WHO) Sustainable Development Goal continues to focus on improving maternal health during the antenatal and post-partum period for women with lower socio-economic resources and limited access to health care. Globally, only 64% of pregnant women met the minimum recommendation of visits during the period 2007–2014 (WHO, 2016). Specifically, within some resource-rich countries, such as the United States, access to prenatal and post-partum care is limited among women with low socio-economic resources (US Department of Health and Human Services, 2008). Prenatal and post-partum community-driven physiotherapy and nutrition education programmes may be one method towards increased access to physiotherapy and clinical nutrition services (Fraser, 2013; Gadson, Akpovi, & Mehta, 2017; de Jongh et al., 2016; WHO, 2016).

Women with limited resources have lower attendance rates at prenatal and post-partum visits (Bennett et al., 2013). Traditional prenatal and post-partum programmes focus on education of body changes and infant care and neglect to address the problems new mothers consider most important such as nutrition, pelvic floor dysfunction (PFDI), low back and pelvic pain, and HRQOL (American College of Obstetricians and Gynecologists, 2018; Johnson et al., 2018). Identifying co-morbidities that have a direct impact on function, HRQOL, and maternal health outcomes is an important first step in understanding how to improve maternal health and access to prenatal and post-partum services. The American College of Obstetricians and Gynecologists (2018) report stresses the importance of a comprehensive prenatal and post-partum assessment of physical, social, and psychological well-being including infant care and feeding, physical recovery, and chronic disease management to ensure good quality of life for mothers and reduced related birth complications (American College of Obstetricians and Gynecologists, 2018).

Assessment for PFDI, pelvic and low back pain, nutrition, and breastfeeding are among some of the recommendations for improvement in maternal health during the prenatal and post-partum period (Van Delft et al., 2014; Xing, Zhang, Chunyi, & Lizarondo, 2017). Reports of pain, UI, and nutritional deficits during the post-partum period are common and may negatively affect a new mother's mental, social, and physical HRQOL at home and work (Ansara, Cohen, Gallop, Kung, & Schei, 2004; Benjamin, Frawley, Shields, Van de Water, & Taylor, 2018; Kahn, Zuckerman, Bauchner, Homer, & Wise, 2002). Risk factors during labour include weakening and damage to the perineum and pelvic floor, irrespective of birth mode (Xing et al., 2017). Urinary and fecal incontinence, pelvic organ prolapse, sensory and emptying abnormalities of the lower urinary tract, colorectal-anal dysfunction (CRADI), dyspareunia, and chronic pain syndromes may be exacerbated by stretching and rupture of peripheral nerves, connective tissue, and muscle(s) (Leeman, Rogers, Borders, Teaf, & Qualls, 2016; Xing et al., 2017). Furthermore, PFDI is linked to reduced quality of life and withdrawal from fitness and exercise activities, thus adding instability to the region (Humalajarvi et al., 2014). Supervised pelvic floor exercise programmes have been shown to be effective for preventing stress UI during pregnancy but have not been tested in community-driven education programmes, and specific PFDIs have not been isolated (Sangsawang et al., 2016; Xing et al., 2017). Effectiveness of pelvic floor programmes is linked to early, consistent intervention for a recommended 8 weeks of training (Morkved & Bo, 2013). Maternal physiotherapy and nutrition community-driven public health programmes aim to improve maternal health, decrease co-morbidities, and provide cost-effective, efficient, and valuable community-driven interventions particularly for women who have limited access to physiotherapy and nutrition services.

This study focused on providing education to a group of prenatal and post-partum women, with limited access to physiotherapy and nutrition services within a Midwestern Region of the United States. The study intervention involved 8-week, two-session (90 min each session) education programme by a licensed physiotherapist and registered dietitian on the following concepts: (a) healthy nutritional intake, (b) benefits of breastfeeding and postural education during breastfeeding to avoid pain and musculoskeletal dysfunction, (c) recognition and treatment options for urge and stress incontinence, pelvic organ prolapse, and colorectal dysfunction pelvic, and (d) implementation of a pelvic floor and core stability exercise programme. The purpose was to examine the effects of this community-driven

nutrition and exercise programme on maternal health outcomes, specifically to (a) measure preintervention to postintervention status in Pelvic Floor Distress Inventory (PFDI), CRADI, pelvic organ prolapse dysfunction (POPDI), urinary distress (UDI) scores, and other co-morbidities reported, (b) measure any correlations between HRQOL for our sample and norm scores for population norms, and (c) measure differences between preintervention and postintervention in nutritional intake and breastfeeding frequency reported.

2 | METHODOLOGY

2.1 | Subjects

This research study was a prospective, quasi-experimental, correlational design with purposive sampling (n = 35) that examined PFDI including (a) POPDI, (b) urinary dysfunction (stress and urge UI), (c) CRADI, (d) nutritional status, (e) breastfeeding patterns, and (f) HRQOL in a group of antenatal and post-partum Spanish- and English-speaking women attending Women, Infants, and Children (WIC) Program in a Midwestern Region of the United States.

Female volunteers, ages 18–44 years of age, were recruited from current attendees at WIC. Ethical approval from Institutional Review Board was obtained from Andrews University and voluntary informed written consent was given prior to data collection. Inclusion criteria included antenatal and post-partum women who volunteered to participate in the study, between the ages of 18 and 44, currently participating in the WIC programme. Women were excluded from the study if they reported any of the following issues: (a) giving birth to more than two offspring at a time, (b) history of surgery, systemic neurologic disease, or trauma affecting bowel or bladder, (c) prior or current physiotherapy for PFDI/incontinence, or (d) any condition that would exclude the subjects from participation in a nutrition, pelvic floor, or core stability exercise programme as determined by the physiotherapist and registered dietician from the health history form.

2.2 | Measurement

The independent variable was identified as the nutrition and exercise education intervention. The demographic and descriptive variables identified were age groups (18–24, 25–34, and 35–44), ethnicity, socio-economic status, educational level, body mass index (BMI), nutritional intake, and type of medical intervention. The dependent variables included the HRQOL measured by the SF-36, nutritional intake results from the Food Frequency Questionnaire, breastfeeding frequency, report of POPDI, CRADI, and UDI measured by PFDI, and co-morbidities reported through the Health History Questionnaire.

2.3 | Instruments

The PFDI measures the overall pelvic floor distress, the pelvic organ prolapse, colorectal-anal distress, and UDI based upon pelvic floor symptoms reported. Included in the PFDI is the UDI-6 index, CRADI-8 index, and POPDI-6 index. The PFDI is shown to have excellent overall test–retest reliability (intraclass correlation coefficient [ICC] = 0.93, p < .001). The test–retest reliability of specific PFDI scales (POPDI-6, CRADI-8, and UDI-6) is also reported as "good to strong" (ICC = 0.82, 0.84, 0.91, p < .001 respectively for all scales; Barber, Walters, & Bump, 2005).

The SF-36 survey questionnaire measures HRQOL across eight different domains, including general health (GH), vitality (VT), physical functioning (PF), role physical, bodily pain, social functioning (SF), role emotional (RE), and mental health (MH). The SF-36 is validated in both English and Spanish with an ICC of >0.92 (Salazar & Bernabé, 2015). The SF-36 is a generic measure and can be used in receiving GH information and quality of life of the participant from both general and specific populations. This survey is easy to use, short, acceptable, and understandable for the patient and general population and holds good reliability and content and construct validity. The SF-36 reported a strong internal consistency (Cronbach's α > .85) and strong reliability with an ICC of >0.75 for all eight domains, with the exception of SF (Salazar & Bernabé, 2015).

The purpose of this study was to provide an 8-week, two sessions of 90-min each antenatal and post-partum education intervention programme for women with socio-economical challenges and to measure the changes before and after the intervention in nutritional intake, breastfeeding frequency, urinary urge and stress incontinence, pelvic and low back pain, and HRQOL. Informed consent, health questionnaires, and all surveys and advertisements for recruiting were available in both English and Spanish. All sessions were offered both in English and Spanish, developed and supervised by a licensed physical therapist and nutrition specialist and/or dietician.

2.4 | Intervention description

Participants were recruited through WIC education programme announcement newsletters, posted flyers, and word of mouth via staff members who were instructed in the procedures of the study and confidentiality. Voluntary participants, who met the inclusion criteria, were provided with $25 vouchers for baby items.

Subjects completed two, 90-min education session interventions regarding prenatal and post-partum nutrition, breastfeeding, and exercises and were provided with in session and home exercise instruction regarding a progressive pelvic floor and core strengthening exercise programme, pelvic and transverse abdominus contraction for ADLs and lifting, healthy nutritional intake and breastfeeding frequency, and postures education. All education sessions were provided under the supervision of a licensed physical therapist with a doctoral degree in physiotherapy and public health training and a nutrition vspecialist, who was also a registered dietician with an advanced degree in nutrition and wellness. Outcomes were measured at the initiation of the study (pretest) and conclusion of the study (posttest) at 8 weeks with completion of surveys regarding nutrition, pain (PFDI), incontinence (PFDI), and HRQOL (SF-36; Appendix B).

3 | DATA ANALYSIS

Data were collected by the coresearchers and immediately de-identified and locked in a cabinet in the primary researcher's office, with only the primary researcher having access to the key. The coinvestigator not involved in the intervention part of the study analysed the data after it was entered into SPSS, Version 22.0, by a third coinvestigator, blinded to the data collection. Wilcoxin ranked sign test was utilized to compare preintervention to postintervention survey scores. Correlations between scores on each of the surveys were compared with the individual SF-36 component scores for both mental and physical HRQOL utilizing Spearman Rho correlation coefficient. Prediction analysis was calculated using linear regression to calculate the effects of age, parity, birth mode, pelvic pain, UI, or other co-morbidities on HRQOL as measured by the SF-36 domain and component scores.

4 | RESULTS

4.1 | Demographics

Women (n = 35) between the ages of 18 and 44 with a mean age of 22.72 ± 3.45 years completed this study. Twenty-four per cent (24%) of our sample identified as Black, 6% identified as Asian/Pacific Islander, 54% identified as Hispanic or Latino, 11% identified as Caucasian, and 6% identified as multiracial (Table A1). Seventy-seven per cent (77%) reported being a full-time homemaker and/or "unemployed." Sixty five per cent (65.7%) of participants reported income as less than $20,000 USD per year, which is below poverty level for a family of three. The remaining 28.6% identified their income as between 20,000 and 40,000 USD, which is within poverty level range for families with up to eight household members and also within Medicaid eligibility range within the United States (US Department of Health and Human Services, Poverty Guidelines, 2018; Table A1).

Fifty-two per cent (52%) of subjects reported having one or more normal vaginal deliveries (NVD); 34% reported having one or more caesarean sections (CS); 11% reported mixed birth mode; and 3% reported being pregnant during the study. Thirty-seven per cent reported stress UI symptoms; 22.8% reported urge urinary UI symptoms. The total report of UI symptoms, both stress and urge incontinence, was 60%. Sixty per cent (60%) reported other complications, including pelvic or low back pain, abdominal pain, and pre-eclampsia during pregnancy. Only forty per cent (40%) reported doing some form of regular aerobic exercise (Table A1).

5 | CORRELATIONS

Significant, but weak, inverse correlations were found between BMI and physical component scores (PCS) on the SF-36, suggesting that as BMI went up, HRQOL went down (GH: r = −.383, df = 31, p = .05; VT: r = −.396, df = 31, p < .05; mental component scores [MCS]: r = −.513, df = 31, p = .01; Tables A2a and A2b). Significant, but weak, correlations were found between total Pelvic Floor Incontinence Questionnaire (PFIQ) and parity (r = .384, p < .05) suggesting parity may have a confounding influence on UDI for our sample. Significant, but weak, correlations were found between parity and POPDI total scores (r = .366, p < .05) and between parity and PFDI total scores (r = .419, p = .014; Table A3).

6 | PREINTERVENTION TO POSTINTERVENTION MEASUREMENT

Pretest to posttest mean scores for the PFDI, CRADI, and UDI decreased significantly (Tables A4 and A5). Median scores and interquartile range were also computed for the sample and showed decrease in median scores between preintervention and postintervention for the same variables. Wilcoxin ranked sign test was utilized to see if there was a difference preintervention to postintervention for the sample. A significant difference was found between the means for PFDI total scores, CRADI individual scores, and UDI individual scores, but not for POPDI scores. (Lower scores mean that participants got better after the two sessions of 90 min each session in the areas of pelvic distress, particularly related to CRADI and UDI dysfunction; p < .05.) POPDI did not show a significant difference from preintervention to postintervention for our sample (Table A4).

7 | SF-36 DOMAIN AND COMPONENT SCORES FOR SAMPLE COMPARED WITH AGE-ADJUSTED POPULATION NORMS

The sample mean reported significantly lower scores on the SF-36 than the published population norm means for the PCS, PF, role of pain, SF, VT, RE, and MH denoting "less quality of life" for the women in this sample when comparing with the population norms in the United States for both physical and MH areas. MCS was also reported below the norm data. The GH sample scores were higher than the norm, though not significant, suggesting that GH of the individuals may be independent of the physical health and pain problems they reported (Tables A6a, A6b, and A7).

8 | NUTRITION INTAKE AND BREASTFEEDING OUTCOMES

Nutritional intake of vegetables preintervention to postintervention increased and was significant (p < .001). An increase in fruit consumption and a slight decrease in snack consumption were reported preintervention to postintervention, but they were not statistically significant. Seventy-five per cent of our sample reported breastfeeding, with slight increased report of breastfeeding posteducation intervention session. However, there was no significant difference between prereport and postreport for either breastfeeding or nutritional intake for other foods. Within the sample, 62.5% of those who identified

themselves as Black reported breastfeeding their children; 100% of Asian; 89.5% of Hispanic or Latino; 50% of the multiracial group; and 75% of the Caucasian postintervention.

9 | DISCUSSION

Our study aims were to examine the effects of a 2- to 90-min session physiotherapy and nutrition educational intervention on PFDI, CRADI, POPDI and UDI symptoms, nutritional intake, and breastfeeding frequency for women living with socio-economic challenges and lack of access to these services within the community. Our study also sought information on HRQOL for this sample of women compared with overall HRQOL normative data means. Overall, we found a significant difference from preintervention to postintervention in PFDI, UDI, and CRADI but did not find a difference for POPDI scores, detailed below. Our sample also reported significant differences between HRQOL in every domain except GH, bodily pain, and PCS. Significant increases in healthy food were noted, and a high report of breastfeeding frequency was found.

Our sample reported a slightly higher mean frequency report of UDI symptoms, including both stress and urge UI symptoms, pelvic prolapse, and colorectal symptoms, with 60% of women in our sample reporting some form of distress compared with previous studies with reports of 32–64% prevalence (Haylen, de Ridder, & Freeman, 2010; Milsom, Altman, Lapitan, et al., 2009; Morkved & Bo, 2013). Parity also played a role regarding incidence and impact of symptoms reported for our sample, with significant, but weak, correlations found between parity and BMI, parity and urinary incontinence (PFIQ), and parity and PFDI (total scores). We would have expected stronger correlations between parity and PFIQ, PFDI, CRADI, and UDI scores because of the traumatic process of birth and the incidence of UDI and colorectal distress reported in the literature. A previous study showed increased hiatal dimensions after the first delivery, but no correlation by parity after first delivery (Kamisan Atan, Gerges, Shek, & Dietz, 2015). However, other studies show similar results with parity playing a role in PFDI in younger women (Alperin, Cook, Tuttle, Esparza, & Lieber, 2016).

Studies across the literature consistently report three main enablers to maternal exercise and physical activity during the prenatal and post-partum period, including (a) availability of pregnancy-related programmes for exercise, (b) patient understanding of maternal and fetal health benefits of exercise, and (c) social support (Harrison, Taylor, Shields, & Frawley, 2018). The results of our study reinforce the idea of these enablers and indicate that an 8-week, two-session, 90-min each community-driven pelvic floor and core stability exercise and nutrition education programme have positive effects on reducing UDI, pelvic floor distress, colorectal-anal dysfunction, and pelvic pain, while improving HRQOL.

Pretest to posttest intervention showed significant differences in CRADI index, UDI index, and total PFDI index scores and indicating positive effects from the community-driven physiotherapy pelvic floor/core stability programme and nutrition and breastfeeding education programme. This is similar to a study by Jebakani and Sameul (2017) who showed a 4-week individualized physiotherapist administered pelvic floor programme in the post-partum period to be effective for treatment of urinary stress incontinence (Jebakani & Sameul, 2017). Similar decreases in UDI findings were found in an eight-session individualized physiotherapy programme intervention (Dumoulin, Bourbonnais, Morin, Gravel, & Lemieux, 2010). Our study found similar results as Bø et al. (2015) regarding the lack of significant change in POPDI index with a pelvic floor programme, suggesting alternative protocols for pelvic floor may need to be used in future studies directed at mechanically correcting for pelvic floor prolapse of Grades I or II (Grade III being surgically indicated).

Improvement in healthy eating habits and increased breastfeeding frequency are also reported in the literature with a prenatal and post-partum education programme (Parry, Tully, Moss, & Sullivan, 2017). Subjects in our study improved infrequency report of breastfeeding and in healthy eating habits. However, our study showed a significantly high proportion of women who began the programme already breastfeeding and reporting fair to good nutritional habits. Changes postintervention included an improvement in posture related to breastfeeding and confidence in lactation production, overall. A significant difference from preintervention to postintervention in healthy nutritional intake of fruit was reported for our study, along with an increase in vegetable consumption and a decrease in unhealthy snack consumption were also found but were not significant. Breastfeeding incidence for this study was already reported high at 75% for the beginning of the study and increased in frequency across the sample from pretest to posttest, as well. Though our study did not focus on effects of birth mode on breastfeeding patterns, subjects who reported NVD or assisted vaginal delivery reported greater percentage of breastfeeding than those who reported CS, which is similar to previous studies reporting greater likelihood of breastfeeding by mothers who had NVD compared with CS delivery (Arora et al., 2017).

Overall, our study indicates that there are positive effects of an 8-week, two-session, 90-min each community-driven pelvic floor and core stability programme on UDI, colorectal distress, overall PFDI, breastfeeding patterns and postures, and improvement in healthy eating habits. This community-driven physiotherapy and nutrition public health programme may be an efficient and cost-effective alternative to bridge the access gap in antenatal and post-partum care for women living with socio-economic challenges and limited access to individualized physiotherapy and dietician services.

10 | LIMITATIONS OF THE STUDY

Limitations of the study include small sample size and lack of control group for comparison. One of the limitations of the study was the 46% attrition rate. Transportation to and from the data collection site was one barrier our subjects reported for the second session postintervention completion. Two subjects phone numbers changed and we were unable to contact them regarding follow-up for postintervention failure to show. Transportation is often a barrier in research

involving subjects with lower socio-economic status and was the norm for "no show" rates within the community centre we affiliated with for data collection.

11 | DIRECTIONS FOR FUTURE RESEARCH

Future research suggests a larger sample size, control group, and consideration of the chronic post-partum symptoms and long-term effects of such programmes. We also recommend one on one follow-up for post-intervention transportation arrangements to address the attrition rate of the study. Future research may also consider a weekly education programme and specific dietary indicators, such as Vitamin D3, essential fatty acid intake, and vitamins B6 and B12 intake to be studied for effects on post-partum morbidities and physical and mental HRQOL.

12 | IMPLICATIONS FOR PHYSIOTHERAPY PRACTICE

Our study found a significant reduction in PFDI, UDI, and CRADI symptoms after 8-week, 2- to 90-min sessions of a physiotherapy and nutrition education programme. A significant increase in healthy nutritional intake, increased breastfeeding frequency, and improvement in HRQOL for prenatal and post-partum women were also reported post-intervention. Decreased reported HRQOL for the women in our sample compared with overall normative data published for the SF-36 was also found in PCS, PF, role of pain, SF, VT, RE, MH, and MCS scores. Correlations between HRQOL and significant, but weak, correlations were found between parity and PFIQ and between PFDI and POPDI scores suggesting parity may also share in related symptoms but may be positively affected by a community-driven, 2- to 90-min-focused session programme to reduce the overall pelvic load distress. This study suggests that a community-driven physiotherapy and nutrition public health education programme may offer an effective and cost-efficient means to improve maternal health and decrease co-morbidities for prenatal and post-partum women living with limited access to physiotherapy and nutrition services. Further research should include a larger cohort across multiple sites, control group comparison, and specific nutritional indicators, as well as follow-up on the long-term effects for such community-driven programmes.

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APPENDIX A

TABLES

TABLE A1 Baseline characteristics of the study population (n = 35)

Demographics	N (%)
Age (years)	8 (29)
• 18–24	17 (48)
• 25–34	10 (29)
• 35–44	
Birth mode	
• Normal vaginal	18 (52)
• Caesarean section	12 (34)
• Mixed birth mode	4 (11)
Ethnicity	
• Black	8 (23)
• Hispanic	19 (54)
• Asian	2 (6)
• Caucasian	4 (11)
• Multirace identity	2 (6)
Occupation	
• Homemaker (unemployed)	(27) (77)
• Employed	(23) (66)
Annual income (US dollars)	
• <20,000	(23) (66)
• 20,000–40,000	(10) (28)
• >40,000	(2) (6)
Urinary incontinence (UI)	
• Stress UI	13 (37.1)
• Urgency UI	8 (22.9)
• Overall report of UI	21 (60)
Other co-morbidities	21 (60)
Exercise in pregnancy	14 (40)

TABLE A2B Correlation of BMI with SF-36 component scores using Spearman Rho correlation coefficient

	SF-36 component score correlations	
Variables	PCS	MCS
BMI	−.019 (p = .925)	**−.513 (p = .007)

Abbreviations: BMI, body mass index; MCS, mental component scores; PCS, physical component score.

**Significant differences p < .001 level.

TABLE A3 Correlations of parity with PFIQ, POPDI, and PFDI (n = 16) using Spearman Rho correlation coefficient

	Outcome measures (r)		
Variables	PFIQ	POPDI	PFDI
BMI	*.385	*.366	*.419

Abbreviations: PFDI, pelvic floor distress; PFIQ, Pelvic Floor Incontinence Questionnaire; POPDI, pelvic organ prolapse.

*p < .05.

TABLE A4 Preintervention to postintervention mean (SD) for pelvic floor and nutrition

Measurement tool	Pretest mean (SD)	Posttest mean (SD)
PFDI total score	38.18 ± 4.74	*9.25 ± 4.36
CRADI-8	11.07 ± 4.88	*4.48 ± 3.07
POPDI-6	8.32 ± 3.32 SD	3.82 ± 1.45 SD
UDI-6	18.78 ± 5.24 SD	*9.86 ± 4.34 SD
FFQ-fruits	2.2 ± 1.29 SD	3.2 ± 1.34 SD
FFQ-vegetables	1.4 ± 1.15 SD	**3.2 ± 1.17
FFQ-snacks (unhealthy)	2.1 ± 1.13 SD	2.17 ± 1.28

Abbreviations: CRADI, colorectal-anal dysfunction; FFQ, Food Frequency Questionnaire; PFDI, Pelvic Floor Distress Inventory; POPDI, pelvic organ prolapse dysfunction; UDI, urinary distress.

*Significant differences between premeasurement and postmeasurement (p < .05).

**Significant differences between premeasurement and postmeasurement (p < .001).

TABLE A2A Correlations of BMI with SF-36 components (n = 30/35) using Spearman Rho correlation coefficient

	Subcomponents of SF-36 (r)							
Variables	GH	VT	PF	RP	BP	SF	RE	MH
BMI	*−.383 (p = .05)	*−.396 (p = .045)	.011 (p = .953)	−.244 (p = .248)	−.074 (p = −.074)	−.192 (p = .35)	−.196 (p = .34)	−.489 (p = .011)

Note. Subcomponents of SF-36: General health (GH), vitality (VT), physical functioning (PF), role physical (RP), bodily pain (BP), social functioning (SF), role emotional (RE), and mental health (MH).

Abbreviation: BMI, body mass index.

*p < 0.05.

TABLE A5 Preintervention to postintervention median (IQR) for pelvic floor and nutrition (n = 16)

Measurement tool	Pretest median (IQR)	Posttest median (IQR)
PFDI total score	Median = 8 (8)	Median = 0 (5.67)
CRADI-8	Median = 6 (5)	Median = 2.9 (2.25)
POPDI-6	Median = 8 (3)	Median = 3.0 (2)
UDI-6	Median = 13 (8)	Median = 7.05 (7)
FFQ-fruits	Median = 2 (2)	Median = 2 (2)
FFQ-vegetables	Median = 2 (1)	Median = 3 (2)
FFQ-snacks (unhealthy)	Median = 2 (2)	Median = 2 (2)

Abbreviations: CRADI, colorectal-anal dysfunction; FFQ, Food Frequency Questionnaire; PFDI, Pelvic Floor Distress Inventory; POPDI, pelvic organ prolapse dysfunction; UDI, urinary distress.

TABLE A6A Comparison of study sample mean (SD) on SF-36 domains and composite scores to normative scores (n = 32/35)

SF-36 domain	Study sample mean (SD)	Normative mean (SD)
Physical function (PF)	*43.44 ± SD 11.62	50.68 ± SD 14.48
Role pain (RP)	*43.8 ± SD 9.08	49.47 ± SD 14.71
Bodily pain (BP)	49.3 ± SD 7.14	50.66 ± SD 16.28
General health (GH)	52.1 ± SD 8.93	50.10 ± SD 16.87
Vitality (VT)	*49.17 ± SD 12.14	53.71 ± SD 15.35
Social function (SF)	47.85 ± SD 9.59	51.37 ± SD 13.93
Role emotional (RE)	*43.47 ± SD 11.77	51.44 ± SD 13.93
Mental health (MH)	*49.28 ± SD 12.74	54.27 ± SD 13.28
Mental composite (MCS)	*48.82 ± SD 11.02	53.78 ± SD 13.14
Physical composite (PCS)	47.03 ± SD 8.15	49.22 ± 15.13

*Significant differences were found on one-way t test comparison between study sample mean and published SF-36 norms for PF, RP, and RE domains only (Maglinte, Hays, & Kaplan, 2012).

TABLE A6B One way t test comparison of means with norm mean values published

SF-36 domain	t value	p value	df
PF	−3.33	*.002	31
RP	−3.54	*.001	31
BP	−.276	.785	31
GH	1.271	.213	31
VT	−2.083	*.046	31
SF	−2.045	.050	31
RE	−3.772	*.001	31
MH	−2.178	*.037	31
PCS	−1.494	.146	31
MCS	−2.506	*.018	31

Abbreviations: BP, bodily pain; GH, general health; MCS, mental composite; MH, mental health; PCS, physical composite; PF, physical function; RE, role emotional; RP, role pain; SF, social function; VT, vitality.

*Significant differences were found on one-way t test comparison between study sample mean and published SF-36 norms for PF, RP, and RE domains only (Maglinte et al., 2012).

TABLE A7 Median SF-36 domain scores and IQR (n = 32/35)

SF-36 domain	Study sample median (IQR)
Physical function (PF)	44.40 (14.7)
Role pain (RP)	43.4 (14.08)
Bodily pain (BP)	51.1 (7.14)
General health (GH)	52.9 (14.3)
Vitality (VT)	52.1 (18.7)
Social function (SF)	45.9 (16.3)
Role emotional (RE)	44.20 (19.5)
Mental health (MH)	50 (28.2)
Mental composite (MCS)	49.1 (22.6)
Physical composite (PCS)	48.8 (8)

APPENDIX B

STUDY INTERVENTION PROTOCOL

A two session physiotherapy and nutrition education programme took place over several sessions in both English and Spanish and included the following:

- Pelvic floor anatomy and function education
- Education on stress versus urge urinary incontinence
- Instruction on basic "Kegel" programme for slow twitch and fast twitch fibres
  - Progression from gravity eliminated to antigravity
  - Progression up to 90–120 kegels per day (with stability exercises)
  - "Elevator progression" (Levels 1–10 up training and down training)
- Beginning level stability exercises with "kegel" (total of 15 exercises)
- Functional activities and incorporation of pelvic floor stability and TrA contraction
- Down training and relaxation exercises for pelvic floor
- Nutritional education for prenatal and post-partum period on healthy eating patterns and the recommended daily allowance for food groups during prenatal, post-partum, and breastfeeding periods
- Second session included a review of these principles and addition of intermediate lumbo-pelvic stability and dynamic movement exercises integration with pelvic core stability programme.*
- Healthy eating and nutrition recommendations for each trimester
- Optimal breastfeeding positioning and education

Stabilization protocol sample

- Figures 1.1 and 1.2
  - Start in quadraped

FIGURE 1.1 Hump

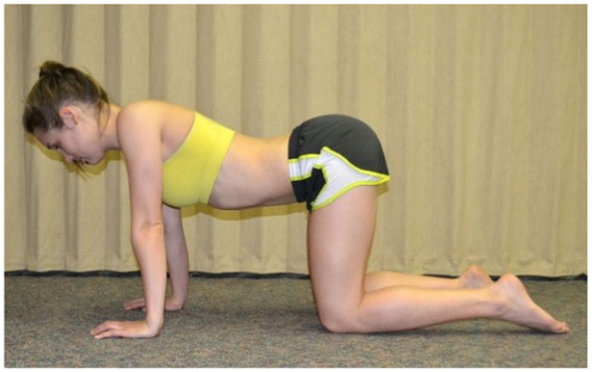


FIGURE 1.2 Slump

  - Active range of motion: Practice each movement five times, hold each position 5–10 s
  - Hump and slump: Flexion/extension, anterior/posterior pelvic tilt

- Figures 1.3 and 1.4: Pelvic sway
  - Hips move from one side to the other allowing sacral and lumbar rotation

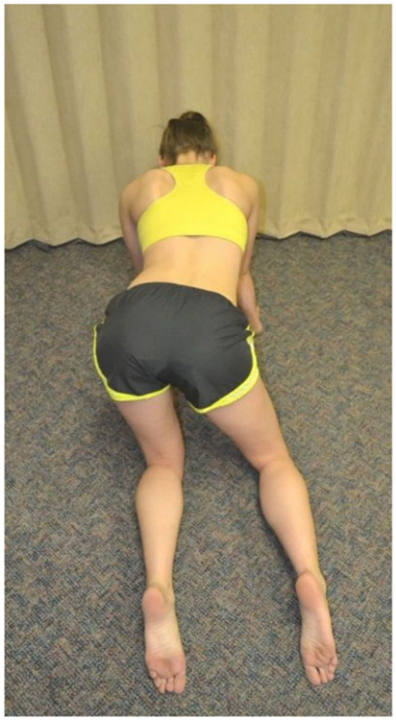


FIGURE 1.3 Pelvic sway (1)

*See sample of exercises in pictures posted in Figures 1.1–2.0.

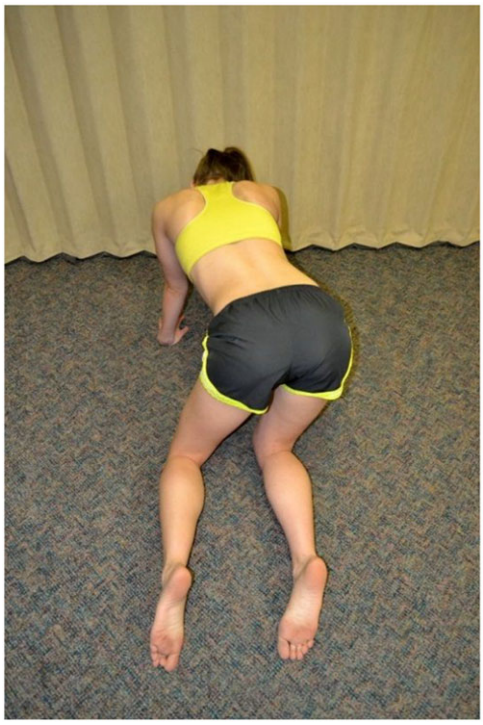


FIGURE 1.4 Pelvic sway (2)

- Figure 1.5: Prayer stretch
  - Patient arches back up into a posterior pelvic tilt, sits back on heels to restore lumbar myofascial length and flexion ROM
- Figures 1.6 and 1.7: Pelvic tilts on ball
  - Anterior and posterior pelvic tilts
- Figures 1.8 and 1.9: Pelvic sway: hips to one side then another on ball
  - Progress to standing as tolerated by the patient
  - See progression for exercises in Appendix (pp. 50–58)
- Breathing, respiratory diaphragm
  - Patient is sidelying to reduce the activity of muscle groups
  - Place one hand over ribcage and the other over the abdomen
  - Instruct patient to breathe through nose allowing the belly to rise and the ribcage to expand

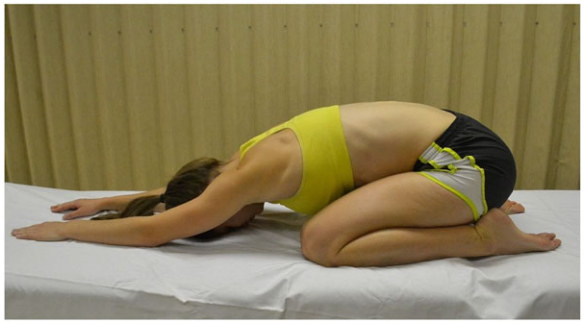


FIGURE 1.5 Prayer stretch

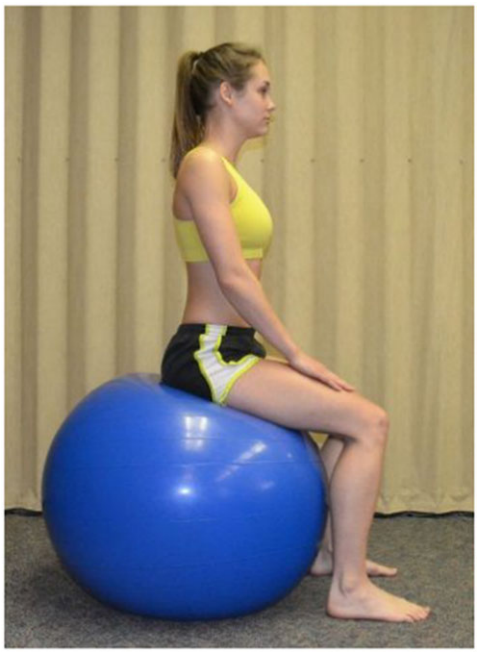


FIGURE 1.6 Anterior pelvic clit

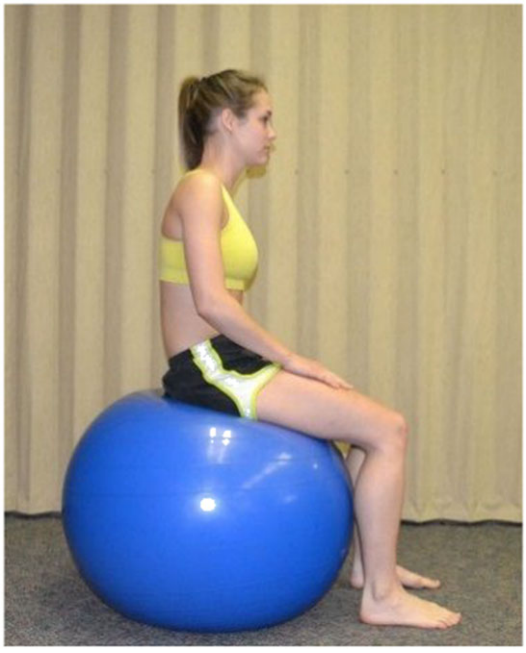


FIGURE 1.7 Posterior pelvic tilt

  - Instruct the patient to exhale through their mouth without contracting the superficial abdominal muscles (let the air fall out of your mouth)
  - Progress to breathing while leaning over a therapy ball
  - Consider using a Thera-band around the ribcage for HEP.
- Proprioception
  - Folded towel technique: Using a chair, sit on a folded towel with your perineum touching the towel. Contract muscles where towel is touching.

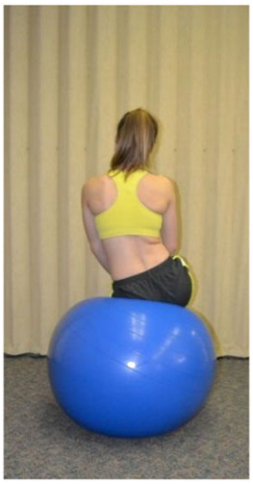


FIGURE 1.8 Pelvic sway right

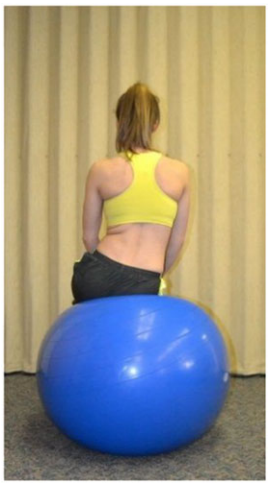


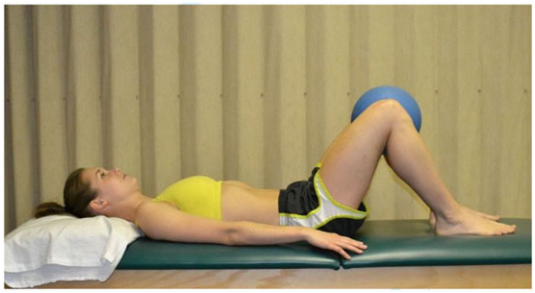
FIGURE 1.9 Pelvic sway left

- Small ball technique: Using a chair, sit on a small ball with your perineum touching the towel. Lift muscles off of ball.

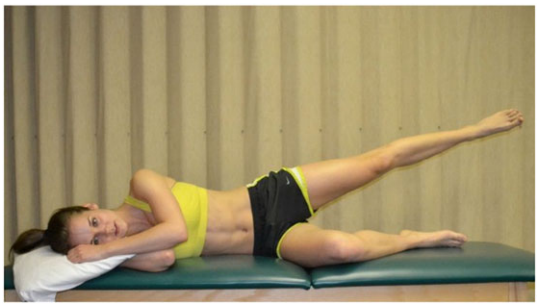
- PFM training
  - Correct performance of contraction
  - Fast twitch and slow twitch training
  - Maximal intensity
  - Three sets a day with high repetition total (90–120 per day)
  - Six days a week

Stabilization exercise progression (may be made available upon request)

- Progression
  - Unloaded to loaded
  - Simple to complex
  - Neutral to articulated
  - Stable to unstable base of support
  - No resistance to resistance
- Progression of stabilization exercises
  - Supine
    - Neutral spine
    - Squeeze ball in between knees



    - Knee lift
    - Heel slide
    - Arm raise
    - Opposite arm and leg raise
    - Bent knee fall out
    - Hip abduction; add Thera-band
  - Sidelying
    - Hip abduction

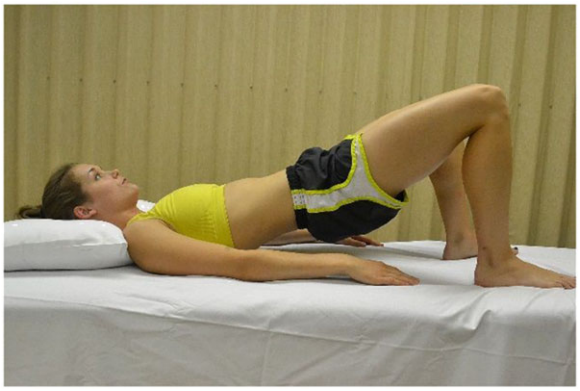


    - Leg press with Thera-band (abduct, then extend hip and knee)

    - Circle hip with knee extended

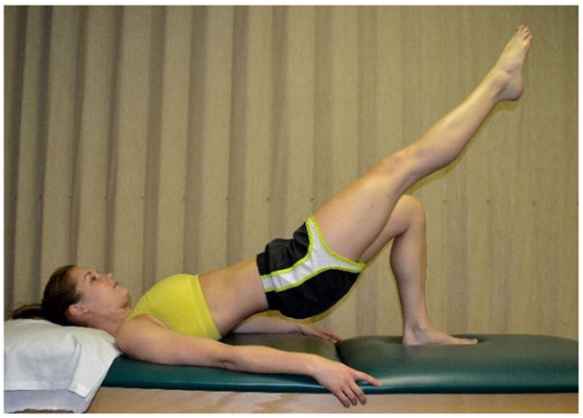
- Bridge

Neutral



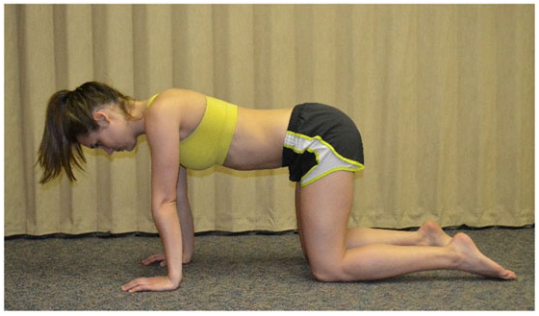
Articulated

- Bridge with leg extension

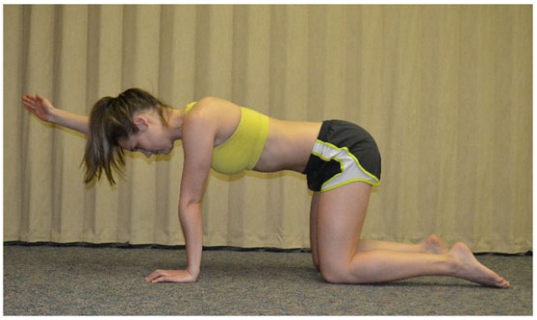


- Bridge on ball

- Quadruped
  - Abdominal drawing in manoeuvre

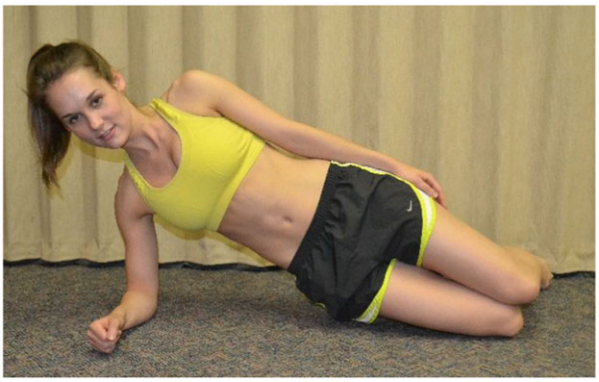


  - Add arm raise

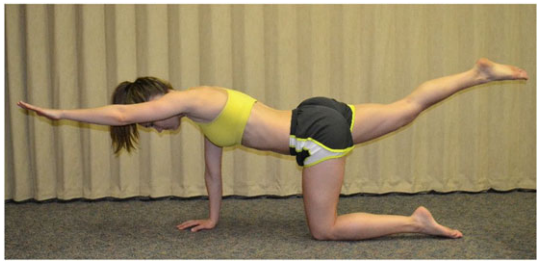


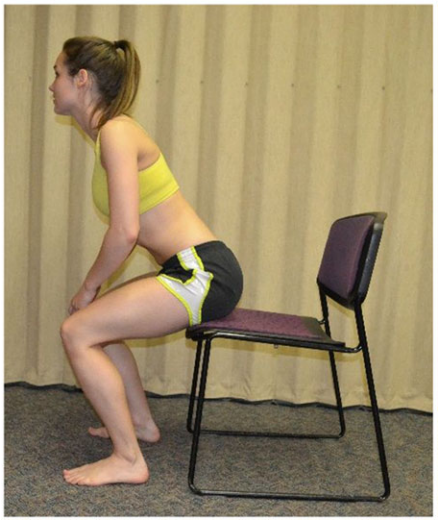
  - Closed chain leg extension: keep foot on floor (a ball may be used)

- Raise opposite arm with closed chain leg extension (a ball may be used)



- Raise arm with open chain leg extension (a ball may be used)





- Plank position with knees straight or bent
- Side plank