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Effects of a stability ball exercise programme on low back pain and daily life interference during pregnancy

Chiu-Fang Yan, MS, CNM, RN (Clinical Instructor)[a], Ya-Chi Hung, MS (Instructor, PhD student)[b,c], Meei-Ling Gau, PhD, CNM, RN, IBCLC (Professor)[d,*,1], Kuan-Chia Lin, PhD (Professor, Statistician)[e,1]

[a] Department of Nursing, Chang-Gung University of Science and Technology, Taoyuan, Taiwan
[b] Department of Exercise and Health Science, National Taipei University of Nursing and Health Sciences, Taipei, Taiwan
[c] Department of Physical Therapy and Assistive Technology, National Yang-Ming University, Taipei, Taiwan
[d] Graduate Institute of Nurse-Midwifery, National Taipei University of Nursing and Health Sciences, No. 365, Ming-Te Road 112, Taipei, Taiwan
[e] Department of Health Care Management, National Taipei University of Nursing and Health Sciences, Taipei, Taiwan

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ABSTRACT

Background: most pregnant women experience back pain during pregnancy, a serious issue that negatively impacts life quality during pregnancy. Research into an exercise intervention programme targeting low back pain and daily life interference is lacking.
Objective: this study evaluates how a stability ball exercise programme influences low back pain and daily life interference across the second and third pregnancy trimester.
Methods: the study was non-randomised and controlled, examining a target population of low-risk pregnancy women between 20 and 22 weeks of gestation located in a regional hospital in northern Taiwan. All participants had at least minimal low back pain, no prior history of chronic low back pain before pregnancy, and no indications of preterm labour. In total, 89 individuals participated: 45 in the control group and 44 in the experimental group (who attended an antenatal stability ball exercise programme). This programme lasted 12 weeks, composed of at least three sessions per week. Fitness workouts lasted from 25 to 30 minutes. The women completed their basic personal information, the Brief Pain Inventory–Short Form, and the Family Exercise Support Attitude Questionnaire.
Results: after adjusting for demographic data and antenatal exercise status by propensity scores, experimental-group women who participated in the antenatal stability ball exercise programme reported significantly less low back pain and daily life interferences than the control group at 36 weeks of gestation.
Discussion: the inclusion of stability ball exercises during pregnancy may reduce pregnancy low back pain and boost daily life functions. This stability ball exercise programme provides health-care professionals with an evidence-based intervention.

Introduction

Pregnancy-related low back pain (PR-LBP) is one of the most commonly reported complaints among pregnant women, varying from 50% to 70% based on previous studies (Forrester, 2003; Vermani et al., 2010). In Taiwan, PR-LBP is especially prevalent (75%) (Chang et al., 2011). More than 80% of pregnant women with LBP experience daily discomfort, and consequently struggle with housework, childbearing, and job performance (Wang et al., 2004; Mogren, 2007). In about 30% of women with LBP during pregnancy, this pain adversely impacts life quality, requiring frequent periods of bed rest, and leading to work absences (Sydsjo et al., 1998; Mogren, 2007).

The most common causes of PR-LBP are hormonal, mechanical, and circulation changes, or a combination of the three (Wang et al., 2004; Ho et al., 2009a; Vermani et al., 2010). Hormonal changes cause a laxity within the joints and ligaments in the back and pelvis (Forrester, 2003; Vermani et al., 2010). Meanwhile, postural alterations in balance occur from an increase in uterine volume (Wang et al., 2004; Ho et al., 2009a). Also significant to LBP are the effects of fetus weight on the lumbosacral nerve roots and the reduction in the blood flow due to compression of the great vessels by the gravid uterus (Forrester, 2003; Wang et al., 2004; Vermani et al., 2010).

Ho et al. (2009a, 2009b) summarised previous studies and advised on current low back pain relief strategies including brief rest, low-healed shoes, avoiding certain physical activities, heat application, pain

* Corresponding author.
E-mail addresses: meeiling@ntunhs.edu.tw (M.-L. Gau), kuanchia@ntunhs.edu.tw (K.-C. Lin).
[1] Contributed equally to this paper.

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medication, exercises (core muscle strength, water gymnastics, yoga), education and ergonomic advice, acupuncture, massage, relaxation, and chiropractise treatment. Amongst these preventive and therapeutic interventions, exercises may be the most beneficial both to the mother as well as the fetus. Regarding maternal health, benefits include the prevention and treatment of gestational diabetes, the prevention of pre-eclampsia, a decrease in excessive weight gain, a decrease in common physical discomforts associated with pregnancy such as backaches, constipation, bloating, and fatigue (Lokey et al., 1991; American College of Obstetricians and Gynecologists (ACOG), 2003; Dempsey et al., 2005). In addition, exercise during pregnancy has psychological benefits, such as improved self-esteem, mental stability, and decreases in depression symptoms (American College of Obstetricians and Gynecologists (ACOG), 2003; Poudevigne and O'Connor, 2005).

Concerning the fetus health, Juhl et al. (2008) indicated that exercise during pregnancy actually reduces the risk of complications. They analysed data of over 85,000 births in Denmark to examine the relation between physical exercise during pregnancy and the risk of preterm birth. Results indicated a reduced risk of preterm births among the almost 40% of women who engaged in some kind of exercise during pregnancy compared to non-exercisers (hazard ratio=0.82, 95% confidence interval: 0.76, 0.88).

According to the centre of gravity theory, which posits that during pregnancy the centre of gravity moves forward and thus requiring strong core muscles to maintain the stability of lumbar spine and the pelvic girdle (Borg-Stein and Dugan, 2007). Previous studies have shown that strengthening the body's core muscles during pregnancy reduces the chance of back injury (Petrofsky et al., 2005, 2008) and diminishes back pain (Dumas et al., 1995). Because these muscle groups stabilise the trunk, core strength enhances the body's balance. Traditionally, this has been accomplished through relatively stable benches and floors or, more recently, via the incorporation of more unstable platforms, e.g. Swiss Balls, which are effective due to their inherent instability. Unstable training environments reportedly enhance training effects through increased activation of stabilisers and core muscles, in turn improving neuromuscular co-ordination. Vera-Garcia et al. (2000) compared the abdominal muscle response during curl-ups on both stable and labile surfaces in eight men with good health and no history of LBP. Performing curl-ups on labile surfaces was shown to have much higher amplitude of abdominal muscle activity than stable bench exercises. The authors suggest a much higher demand on the motor control system, which may be desirable for LBP treatment. Previous studies also confirm evidence of the role of stabilisation exercises in LBP. Marshall and Murphy (2006) evaluated 20 patients with LBP over the course of a 12-week rehabilitation programme using the Swiss ball. They found this modality of exercise may successfully improve the functional capacity of patients with chronic non-specific LBP, attributing the reduction in disability to the improvement of the flexion relaxation response of the erector spinae. Shen et al. (2009) investigated the biomechanical impact of Swiss ball training on the stability of lumbar vertebra in patients with intervertebral disc herniation. After four weeks of Swiss ball training, researchers assessed pain, abdominal and back muscle strength, with lumbar traction compared to a control group that only utilised lumbar traction. Among the experiment group, they found that abdominal and back strength increased significantly and pain level decreased significantly, concluding that the stability of the lumbar vertebra increased significantly with the use of Swiss ball and lumbar traction exercises.

Previous studies have suggested that many factors may decrease muscle strength, which accounts for LBP. These factors included age (Owino et al., 2001), parity (Mogren and Pohjanen, 2005; Albert et al., 2006), body mass index (Mogren and Pohjanen, 2005), occupational status (Mogren and Pohjanen, 2005; Chang et al., 2012) and habitual exercise (Ostgaard et al., 1994). Educational level (Chang et al., 2012) and social support (van Dijk et al., 2006) were associated with pain and pain interference. These findings may be due to the possibility that people with lower educational levels may have less self-care knowledge. Moreover, those with higher social support may have access to a higher level of personal assistance that reduces the need to perform daily activities, in turn reducing their pain interference perceptions (Chang et al., 2012). Perceived social support has also been described as a significant factor associated with exercise behaviour (Resnick et al., 2002). Social support related to exercise behaviour may be instrumental, informational, emotional, or appraisal. These different types of support suggest that social influences may have a direct effect on exercise behaviour (Albright et al., 2005; Thornton et al., 2006).

In sum, factors previously identified in the literature as associated with LBP and exercise behaviour include: age, parity, education, body mass index, occupational status, habitual exercise, and social support. Using this research as a foundation to adjust for confounding variables, this study evaluated how stability ball exercise programme influence low back pain and daily life interference across the second and third pregnancy trimester.

Methods

Design

This was a non-randomised controlled experimental study, with data collected from January to December 2010. In reverence to Chinese culture and tradition, some participants may have been discouraged from exercising during pregnancy due to concerns of interfering with '*Tai-Shen*' or '*Tai-Qi*' (spirit of fetus), an undesirable outcome that is believed to lead to spontaneous abortion or preterm labour (Sung, 1996). For this reason, participants were permitted to select their preferred group.

Study participants

Female inclusion criteria were as follows: (1) primigravida at 22–24 weeks of gestation, (2) age ≧18 years, (3) no major obstetric nor medical pregnancy complications based on antenatal charting, (4) singleton pregnancy, (5) at least minimal LBP present, (6) normal extremities and capable of regular physical activity, and (7) able to listen, speak, read and write in Chinese. Participants with chronic LBP associated with sciatica before pregnancy, or any signs of preterm labour were excluded.

A statistical power analysis was used to calculate the required sample size; α=0.05, power=0.8 and effective size=0.3 were assumed. On the basis of G*Power (Germany; version 3.1.1, Fual et al., 2007), a one-tailed test and an effect size value detected the changes in pain level between groups. The sample size was determined to be optimal at 41 participants per group. The authors permitted an attrition rate of 20%. The suggested attrition rate was estimated from previous longitudinal studies ranging from 6.8 to 27.4% (To and Wong, 2003; Mogren, 2007; Chang, 2011).

Initially, the principle investigator (PI) contacted 375 pregnant women, of which 102 participants were recruited: 51 in the experimental group and 51 in the control (Fig. 1). However, some participants (n=13) withdrew for the following reasons: (1) unable to be contacted (n=3), (2) preterm labour (n=5), (3) bleeding (n=1), and (4) frequent uterine contractions (n=4). Six participants from the experimental group and seven participants from the control group were removed from the original sample number,