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# SLK Triple Therapy Improves Maternal and Fetal Status and Promotes Postpartum Pelvic Floor Function in Chinese Primiparous Women

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Data Interpretation D  
Manuscript Preparation E  
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**Background:** During pregnancy, appropriate physical activity plays critical roles in maternal and fetal health. This study investigated the effects of Sophrology childbirth-Kegel-Lamaze respiratory training (SLK triple therapy) on maternal and newborn health, pelvic floor function, and quality of life.

**Material/Methods:** Single-pregnant primiparous women involved in this study were divided into the control group (n=120) and the SLK triple therapy group (n=120). SLK triple therapy was taught to and practiced by the women in the SLK triple therapy group. Data on delivery mode (natural delivery or cesarean section), postpartum complications (postpartum urinary incontinence, postpartum hemorrhage), and birth process were recorded. Apgar scores and body weight of newborns were evaluated. Pelvic floor function, postpartum emotion, and sexual functions were assessed.

**Results:** Women in the SLK triple therapy group had significantly better natural delivery rate compared to the control group ( $p<0.05$ ). SLK triple therapy significantly decreased the postpartum urinary incontinence rate and reduced the postpartum hemorrhage rate compared to the control group ( $p<0.05$ ). Birth process and postpartum hemorrhage volume in the SLK triple therapy group were also significantly lower compared to the control group ( $p<0.05$ ). Apgar scores were significantly lower and body weights were significantly higher in the SLK triple therapy group compared to the control group ( $p<0.05$ ). SLK triple therapy significantly improved pelvic floor function compared to the control group ( $p<0.05$ ). SLK triple therapy significantly decreased SDS scores and enhanced FSFI scores compared to the control group ( $p<0.05$ ).

**Conclusions:** SLK triple therapy improved maternal and fetal health by improving pregnancy outcomes, promoting postpartum pelvic floor function, reducing the incidence of depression, and enhancing sexual function. Therefore, SLK triple therapy has great utility in treating primiparous women.

**MeSH Keywords:** **Delivery, Obstetric • Pelvic Floor • Physical Education and Training • Pregnancy**

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## Background

It is important to develop a healthier lifestyle for pregnant women to improve fetal and maternal health and to avoid the risks of obesity, high blood pressure, diabetes, and the other associated health problems [1]. The sedentary lifestyle of many pregnant women during gestation can cause gestational diabetes mellitus, hypertension, and obesity, all of which increase the risks of preterm delivery, prolonged labor, postpartum hemorrhage, pre-eclampsia, cesarean section, early-neonatal death, wound infection, and other complications [2–6]. Mental stress and anxiety are common complications during the postpartum period and pregnancy. Depression, mental stress, and anxiety have been proven to be associated with low birth weight, inadequate antenatal care, preterm delivery, postpartum depression, small for gestational age infants, and placental abruption [7,8]. Previous studies [9,10] demonstrated that a healthy lifestyle, especially including physical activity, clearly alleviates mental stress and prevents obesity, diabetes, and cardiovascular diseases.

Lifestyle interventions focusing on weight control, proper diet, and a healthy lifestyle are proven to be effective in preventing obesity and diabetes [11]. However, many interventions for pregnant women mainly consist of dietary intervention without increased physical activity, and do not address mental stress and anxiety [12]. Recent studies [13] investigating the effects of lifestyle interventions have demonstrated that they are relatively ineffective in controlling total gestational weight gain.

Increased physical activity during pregnancy can prevent excessive weight gain during gestation and high birth weight [3,9,14]. Exercise training for pregnant women benefits maternal health and fetal health without any adverse effects [15]. Exercise also improves the quality of life of pregnant women and alleviates depression and anxiety [16,17]. Therefore, in the present study, we assessed and compared the effects of a lifestyle intervention vs. systematic exercise training (SLK triple therapy) on the overall birth experience of pregnant women.

Based on our clinical experience in recent years, we combined the Sophrology childbirth method training, Kegel training, and Lamaze respiratory training into a single intervention, called SLK triple therapy, provided to pregnant women for guiding psychology, breathing, and rehabilitation exercise training, as well as to improve maternal and fetal health, all of which are advantages of SLK triple therapy compared with lifestyle interventions (control group). SLK triple therapy is a technologically matured, experienced, and easily available rehabilitation training strategy, and improves maternal and fetal quality of life.

## Material and Methods

### Patients

The control group consisted of 120 single-pregnant, primiparous women who delivered at our hospital between January 2016 and December 2016. The SLK triple therapy group consisted of another 120 single-pregnant, primiparous women who delivered at our hospital between January 2017 and December 2017. Basic characteristics, including age, first pregnancy test, BMI, and degree of education, are shown in Table 1.

This study was approved by the Ethics Committee of the Medical College of Jingtangshan University, Ji'an, China. All patients provided signed consent.

### Inclusion and exclusion criteria

Inclusion criteria were: 1) complete medical records at the first pregnancy test, with complete information until 6 months after delivery; 2) diagnosed as single-pregnant, primiparous, and had the first pregnancy test before 24 gestational weeks ( $24 \leq$  weeks); 3) normal symptoms of pregnant woman according to indications of natural childbirth; 4) able to read and write, with normal comprehension ability; 5) voluntarily accepted the prenatal health training.

**Table 1.** Basic characteristics for the patients in the SLK triple therapy group and control group.

Characteristics	Observe group (n=120)	Control group (n=120)	t/ $\chi^2$	p
Age (years)	27.5 (2.6)	28.4 (2.4)		>0.05
1 <sup>st</sup> pregnancy test (weeks)	18.8 (3.2)	18.3 (3.5)		>0.05
BMI (kg/m <sup>2</sup> )	25.6 (2.3)	25.3 (2.6)		>0.05
Degree of education (n)				>0.05
Junior middle school and below	26	25		
Senior middle school	56	55		
University and above	38	40		

Exclusion criteria were: 1) history of abortion and/or threatened premature labor; 2) hypertension, hyperglycemia, or other endocrine disorders, and high-risk pregnant woman undergoing cesarean section; 3) history of mental diseases; 4) dropped out of the study.

### Intervention methods

Control group patients received conventional physical rehabilitation treatment, including appropriate delivery guidance and perinatal health education, contraction exercise for pelvic floor muscle, and routine rehabilitation exercise training, as described in a previous study [18].

Women in the SLK triple therapy group received the same physical rehabilitation exercise as did the control group, plus SLK triple therapy. The SLK triple therapy was provided throughout the prenatal and postpartum periods for the pregnant women, along with their family members. The prenatal processes included health education (e.g., exercise training, guidance, and contents of SLK therapy) and SLK triple therapy (including 3 stages). For the first stage of SLK therapy, the Sophrology childbirth method training was conducted until 28 gestational weeks, 3–5 times per week, 30 min each time. For the second stage of SLK therapy, Kegel training was added and conducted (combining 2 methods) from 28 to 32 gestational weeks, 3 times per week, and 20 min each time for both methods (Sophrology and Kegel training). For the third stage of SLK therapy, Lamaze respiratory training was added and conducted (combining 3 methods) from 32 gestational weeks until childbirth, 3 times per week, 10–15 min each time for all 3 methods (Sophrology, Kegel training, and Lamaze respiratory training). The postpartum process was initiated at 1 week after delivery and consisted of the Sophrology childbirth method training combined with Kegel training.

### SLK triple therapy

In the Sophrology childbirth method, the pregnant women were in a comfortable and quiet environment and were positioned in supine position on a comfortable bed, with soft music playing, relaxed the whole body, and adjusted their breathing. The nurses guided the patients by placing the patients' hands on the abdomen, imagining health and happy growth of the fetus and feeling fetal movement.

The Kegel exercise was conducted as described in a previous study [19]. Briefly, with music and guidance of nurses, the patients were guided to regularly contract and relax the vaginal muscles and anal muscles. The exercise lasted for 15 min and was carried out 2 times per day. During the exercise, the patients were prompted to avoid overexertion and to keep practicing.

The Lamaze training was conducted based on a previous investigation [20]. In brief, according to the guidance and delivery characteristics, the specific breathing pattern and skills were taught and practiced to help pregnant women in successful delivery.

### Observation and evaluation indexes

**Maternal delivery:** The delivery mode (natural delivery or cesarean section), postpartum complications (e.g., postpartum urinary incontinence and postpartum hemorrhage), birth process, and postpartum hemorrhage volume were recorded. Postpartum urinary incontinence was scored according to the incontinence questionnaire female lower urinary tract symptoms (ICI-Q-F) [21]. ICI-Q-F scores less than 6 were defined as urinary incontinence. Bleeding more than 500 ml within 24 h was defined as postpartum hemorrhage.

The conditions of newborns were evaluated using Apgar scoring according to a previous study [22]. Apgar scoring consists of 6 items, including activity (A), pulse (p), grimace (g), appearance (a) and respiration (r). The body weight of newborns was also recorded.

**Recovery of pelvic floor function:** The pelvic functions were examined at 1 week prior to the expected date of childbirth and at 6 months postpartum, according to a previously published study [23]. Briefly, the examiner put the middle and index fingers 2 cm into the vagina and identified the levator ani muscle. The 2 fingers were separated and pressed on the 2 sides of the levator ani muscle, while the abdominal muscles were pressed by another hand to make the muscles relax. The grading and scores for the pelvic floor muscle strength were according to the Modified Oxford Scale [24]. Grade 0 indicated a perineal muscle that cannot contract (recorded as 0 points). Grade I indicated a perineal muscle only appears to tremble (recorded as 1 point). Grade II indicated a perineal muscle that can contract 2 times, 1 s/time (recorded as 2 points). Grade III indicated a perineal muscle that can conduct the complete contraction 3 times, 3 s/time (recorded as 3 points). Grade IV indicated a perineal muscle that can conduct the complete contraction for 4 s, following light resistance (recorded as 4 points). Grade V indicated a perineal muscle that can perform the complete contraction for more than 5 s, following strong resistance (recorded as 5 points).

Emotion was evaluated at the initial pregnancy test, at 1 week prior to the expected date of childbirth, and at 6 months postpartum, by using the Symptom Distress Scale (SDS) [25]. Sexual function was evaluated at 6 months postpartum, according to the Female Sexual Function Index (FSFI) [26]. An SDS score more than 53 was defined as depression. An FSFI score less than 25 was defined as sexual dysfunction.

**Table 2.** The condition of postpartum delivery in early maternal period [n, (%)/ $\bar{x}\pm s$ ].

Groups	Natural labor (%)	Cesarean section (%)	Postpartum urinary incontinence (%)	Postpartum hemorrhage (%)	Birth process (h)	Postpartum hemorrhage volume (ml)
Observe group (n=120)	83 (69.2)	37 (30.8)	3 (2.5)	2 (1.7)	9.2±1.6	204.4±36.7
Control gorup (n=120)	68 (56.7)	52 (43.3)	12 (10.0)	9 (7.5)	13.5±1.5	324.5±25.5
<i>t/χ<sup>2</sup></i>	4.018	4.018	5.760	4.668	21.477	29.439
<i>p</i>	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05

**Statistical analysis**

Data in this study were analyzed using professional SPSS software (version: 19.0, SPSS, Inc., Chicago, IL, USA). Quantitative variables were represented as mean ± standard deviation (SD) and compared using the *t* test between 2 groups. Categorical variables were represented as percentages (%) or counts (n) and compared using the chi-square test. Tukey’s post hoc test was used to validate ANOVA for comparing measurement data (pelvic floor function score, SDS score, and FSFI score) among multiple groups. Statistical significance was defined as *p*<0.05.

**Results**

**SLK triple therapy improved natural delivery rate**

The natural delivery rate (69.2%) in the SLK triple therapy group was significantly higher than in the control group (56.7%) (Table 2, *p*<0.05), and the cesarean section rate was significantly lower in the SLK triple therapy group compared the control group (30.8% vs. 43.3%) (Table 2, *p*<0.05).

**SLK triple therapy improved postpartum delivery in primiparous women**

The postpartum urinary incontinence rate (2.5%) in the SLK triple therapy group was significantly lower compared to that in the control group (10.0%) (Table 2, *p*<0.05). SLK triple therapy (1.7%) also significantly reduced the rate of postpartum hemorrhage compared to that in the control group (5.8%) (Table 2, *p*<0.05). Moreover, the birth process (9.2 h vs. 13.5 h) and postpartum hemorrhage volume (204.4 ml vs. 324.5 ml) in the SLK triple therapy group were significantly lower than in the control group (Table 2, *p*<0.05)

**SLK triple therapy improved conditions of newborns**

To evaluate the effects of SLK triple therapy on newborn condition, Apgar scores and body weight were analyzed. The results

**Table 3.** The condition of newborns in the 2 groups ( $\bar{x}\pm s$ ).

Groups	Apgar scores	Body weight (kg)
Observe group (n=120)	9.29±1.9	4.5±0.6
Control group (n=120)	8.15±1.8	3.6±0.7
<i>t</i>	4.771	10.693
<i>p</i>	<i>p</i> >0.05	<i>p</i> <0.05

showed that Apgar scores were significantly lower in the SLK triple therapy group (8.15) compared to the control group (9.29) (Table 3, *p*<0.05). SLK triple therapy also significantly improved the body weights of newborns compared to those in the control group (4.5 kg vs. 3.6 kg) (Table 3, *p*<0.05).

**SLK triple therapy improved pelvic floor function**

At the first pregnancy examination, there was no significant difference in pelvic floor function between the SLK triple therapy group vs. the control group (2.5 vs. 2.3) (Table 4, *p*>0.05). At 1 week before the expected date of childbirth, and at 6 months postpartum, the pelvic floor function scores in the SLK triple therapy group (3.2 and 3.5, respectively) were significantly higher than in the control group (2.3 and 2.4, respectively) (Table 4, *p*<0.05). Pelvic floor function was significantly improved at 1 week before expected childbirth compared to the first pregnancy examination (3.2 vs. 2.5, respectively), and was also significantly improved at 6 months postpartum compared to 1 week before expected childbirth (3.5 vs. 3.2, respectively) in the SLK triple therapy group (Table 4, *p*<0.05). However, there were no significant improvements in pelvic floor function at first pregnancy examination and 1 week before expected childbirth (*p*>0.05), until 6 months postpartum (Table 4).

**SLK triple therapy decreased SDS scores**

To assess emotion, the SDS scores were used. The results indicated that for the first pregnancy examination, there was

**Table 4.** Recovery of postpartum pelvic floor function, postpartum mood, and sexual function ( $\bar{x}\pm s$ ). #  $p<0.05$  vs. pre-operation within group. \*  $p<0.05$  vs. the same time points in control group.

Groups	Time points	Pelvic floor function (scores)	SDS (scores)	FSFI (scores)
Observe group (n=120)	First pregnancy examination	2.5±0.4	48.3±2.4	–
	One-week before expected date of childbirth	3.2±0.6 <sup>#,*</sup>	41.5±6.4 <sup>#,*</sup>	–
	Six-month postpartum	3.5±0.4 <sup>#,*</sup>	38.7±3.6 <sup>#,*</sup>	25.5±3.5*
Control group (n=120)	First pregnancy examination	2.3±0.6	47.3±2.7	–
	One-week before expected date of childbirth	2.4±0.3	49.4±7.2	–
	Six-month postpartum	2.6±0.2 <sup>#</sup>	45.5±5.2	22.6±3.1
$F_{\text{between groups}}$	–	21.635	19.635	6.794
$F_0$	–	11.527	25.206	–
$F_{\text{between groups} \times \text{time points}}$	–	33.985	48.934	–
$P_{\text{between groups}}$	–	0.000	0.000	0.002
$P_{\text{time points}}$	–	0.000	0.000	–
$P_{\text{between groups} \times \text{time points}}$	–	0.000	0.000	–

#  $p<0.05$  vs. pre-operation within group. \*  $p<0.05$  vs. the same time points in control group.

no significantly difference in SDS scores between the SLK triple therapy group and the control group (2.5 vs. 2.3) (Table 4,  $p>0.05$ ). At 1 week before the expected date of childbirth (41.5 vs. 49.4) and at 6 months postpartum (38.7 vs. 45.5), SDS scores in the SLK triple therapy group were significantly lower compared to the control group (Table 4,  $p<0.05$ ). In the SLK triple therapy group, the SDS scores were significantly lower after the first pregnancy examination at 1 week before expected childbirth and at 6 months postpartum (Table 4,  $p<0.05$ ). However, there were no significant improvements in SDS scores between the first pregnancy examination and at 1 week before expected childbirth ( $p>0.05$ ), except for at 6 months postpartum (Table 4).

### SLK triple therapy promoted sexual function

To evaluate sexual function postpartum, the FSFI scores of patients at 6 months postpartum were assessed, showing that the FSFI scores in the SLK triple therapy group were significantly higher than in the control group (Table 4,  $p<0.05$ ).

## Discussion

During pregnancy and postpartum, many risk factors, including inappropriate diet, obesity, maternal stress, hyperglycemia, and physical inactivity, can influence postpartum delivery or newborns and cause chronic diseases and subsequent metabolic

alterations [27–29]. Physical activity during pregnancy and postpartum can improve pelvic floor functions, alleviate labor pains, increase neonatal weight, prevent excessive maternal weight gains, reduce postpartum hemorrhage, and control cardiometabolic disorders [30–32]. By performing appropriate exercise, the adverse effects or complications, such as pelvic floor dysfunction, postpartum urinary incontinence, and sexual dysfunctions, can be effectively limited [33–36]. Therefore, in this study, the complications associated with pelvic floor dysfunction (including pelvic floor dysfunction, postpartum urinary incontinence, and postpartum hemorrhage) were compared between the SLK triple therapy and the control group.

In recent years, SLK triple therapy has been shown to be an efficient training strategy using prenatal and postpartum exercises. The Sophrology childbirth method is a type of psychological guidance training for natural delivery, and enhances cognitive levels of pregnant women in the natural delivery process in a comfortable environment [37]. The Sophrology childbirth method also reduces the nervousness of pregnant women [37]. Lamaze respiratory training mainly teaches respiratory frequency coordination in the natural delivery process by enhancing skills for strengthening the myodynamics of labor-associated muscle groups and autonomous control ability [38]. Therefore, compared with the traditional intervention method [39], Sophrology childbirth method and Lamaze respiratory training have more advantages for preventing depression and promoting natural delivery. Kegel training can

enhance pelvic floor muscle myodynamics and promote pelvic blood circulation, and helps with natural delivery. Kegel training also prevents postpartum urinary incontinence and postpartum vaginal relaxation, and improves postpartum sexual life [40,41].

This study combined the above 3 training methods to generate SLK triple therapy, which was taught to and practiced by pregnant women in the SLK triple therapy group. We found that SLK triple therapy has several advantages compared with the control group therapy. SLK triple therapy significantly increased the rate of natural delivery (i.e., decreased the rate of cesarean section) of primiparous women, which was higher than in the control group and higher compared to the interventions conducted in a previous study [42]. The SLK training can help primiparous women recognize the importance of natural delivery and master processes and key points of natural delivery, all of which also allow them to cooperate better with midwifery nurses.

In this study, the SLK training also reduced postpartum urinary incontinence and postpartum hemorrhage in natural delivery of primiparous women compared to that in the control group. Previous studies [43,44] also demonstrated the effects of physical activity on inhibiting urinary incontinence and hemorrhage at delivery, but the effects were inferior to the those seen in SLK triple therapy. Because the women undergoing SLK training performed sufficient exercise, the birth process was significantly shorter compared to that in the control group, which is consistent with the results of a previous study [45]. SLK triple therapy significantly decreased the SDS scores, which suggests that SLK triple therapy can inhibit postpartum depression in primiparous women. SLK triple therapy helped the pregnant women feel important and feel support from family members, as well as reducing fear of delivery. Repeated SLK exercise also enhanced the concentration of pregnant women, strengthened their emotional management ability, and helped

avoid depression. A previous study [46] also assessed the effects of exercise on postpartum depression, but did not assess the effects of exercise on the sexual function of pregnant women. Our findings showed that SLK triple therapy significantly increased the FSFI scores of pregnant women, suggesting that it improved sexual functioning of pregnant women. Improvement of sexual functioning might be correlated with the reduction of depression and mental stress triggered by SLK training [47]. Our results are also consistent with previous studies reporting that Kegel exercise [48] and Lamaze training [49] improve sexual functioning.

According to a previous study [50], improved sexual functioning is associated with improved postpartum pelvic floor function. In the present study, SLK triple therapy remarkably increased pelvic floor scores, which suggests that SLK improved the pelvic floor functions. Although a previous study [51] also reported that physical exercise enhances postpartum pelvic floor functions, the present study shows that SLK triple therapy can also benefit the conditions of newborns. We also proved that SLK triple therapy can significantly increase Apgar scores and enhance the body weight of newborns, which is consistent with a previous study [52] showing the beneficial effects of exercise during pregnancy on neonatal outcomes.

## Conclusions

SLK triple training, as a physical rehabilitation therapy, can improve maternal and fetal health by improving pregnancy outcomes, promoting postpartum pelvic floor function, preventing depression, and enhancing sexual function. We found that SLK triple therapy greatly benefits primiparous women.

## Conflict of interest

None.

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