

## The Effect of Birth Ball Exercises during Pregnancy on Mode of Delivery in Primiparous Women

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### ABSTRACT

**Background & aim:** Considering the fact that cesarean section (c-section) poses greater risks of maternal and neonatal complications, compared to vaginal delivery, scholars seek different strategies to decrease the prevalence of this surgical procedure. Birth ball exercises during pregnancy are among the proposed strategies. Thus, this study aimed to determine the effect of using birth ball during pregnancy on mode of delivery in primiparous women.

**Methods:** This clinical trial was conducted on 54 women, referring to the maternity ward of Omolbanin Hospital. Subjects were randomly assigned to intervention and control groups. The intervention group performed birth ball exercises for 4-6 weeks; on the other hand, the control group only received routine care. Data were collected using questionnaires, forms of examination and observation, and checklists for recording exercise movements on a weekly basis. Chi-square, Fisher's exact test, and Mann-Whitney U test were performed, using SPSS version 16.

**Results:** Rates of vaginal delivery and c-section in the intervention group were 92.6% and 7.4%, respectively, while the corresponding values in the control group were 66.7% and 33.3%, respectively. Chi-square showed a significant difference between the two groups in terms of mode of delivery ( $P=0.018$ ).

**Conclusion:** Considering the significance of promoting vaginal delivery among women, performing birth ball exercises is recommended as a useful, non-pharmacological, and inexpensive strategy for reducing c-section rate.

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### Introduction

Childbirth is a natural process that can be generally managed without any medical interventions. Natural delivery is promoted in many countries, given its cost-effectiveness, shorter length of hospital stay, lack of anesthetic requirement, and lower rates of infection and hemorrhage after delivery, compared to cesarean section (abbreviated as c-section) (1).

C-section may result in several maternal and neonatal complications such as hemorrhage (2), infection (3), increased mortality rate (4),

premature birth (5), and neonatal respiratory distress (6,7). Moreover, mothers' inabilities after c-section lead to unsuccessful breastfeeding and impose financial burdens on families (8). As recent evidence suggests, c-section results in postpartum depression and decreases fertility rates (9).

C-section rate is high in most countries. Rate of c-section was estimated at 32.9% (2009) in USA, 39.8% in Italy (2007), 30.6% in Australia (2007), 35.3% in Korea (2008), and 37.7% in

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Turkey (2006) (10). The estimated rates in Iran were 40.4% and 41.9% in 2005 and 2012, respectively (11, 12). Overall, according to World Health Organization (2007), c-section rate should not exceed 10-15% in any region (13).

Several factors could lead to increased c-section rate, dystocia, problems during vaginal delivery, breech presentation, fetal distress, and decreased maternal activity during pregnancy (14). Proper exercises during pregnancy strengthen the pelvic floor muscles by 90%, which is essential for natural delivery (15). Several studies have evaluated the effect of exercise on mode of delivery (15). Artal et al. (2007) showed decreased c-section rate as a result of regular exercise (16), while Kaufmann et al. (1987) showed no relationship between exercise during pregnancy and mode of delivery (17).

Birth ball is a new exercise tool, which can be used by mothers during pregnancy. This type of exercise includes different movements performed in different positions (18). Birth ball is a large firm ball, made of soft plastic and filled with air. This ball can be easily deflated or washed and is available in different diameters (35-85 cm) (supporting up to 136 Kg).

For the first time, Perz and Simkine introduced birth balls in antenatal classes. Gradually, use of this exercise tool became widespread and was recommended for improving mothers' fitness during pregnancy and postpartum period. In fact, exercise with birth ball is considered a helpful, non-pharmacological strategy (19).

The main advantages of birth ball exercise during pregnancy include postural corrections, relaxation, and muscle stretching and strengthening (20). Sekendiz et al. (2012) indicated that movements with birth ball increase the strength, resistance, flexibility, and balance of the trunk, lower back, and quadriceps (21). Chang et al. (2011) conducted a clinical trial to determine the effect of performing birth ball exercises during the final weeks of pregnancy. They showed lower c-section rate in the intervention group, compared to the control group, who did not perform any exercises (22).

Tsang et al. (2012) aimed to determine the effect of birth ball exercise during labor on delivery outcomes; as the results indicated, birth ball had no significant impact on mode of

delivery (23). Contrarily, Mathew et al. (2012) showed that using a birth ball during labor was associated with a higher rate of vaginal delivery in the intervention group, compared to the control group (24).

Contradictory results and insufficient information have been reported regarding the effect of special pelvic exercises by birth ball on mode of delivery. Therefore, the present study aimed to determine the effect of performing birth ball exercises during the final weeks of pregnancy on mode of delivery in primiparous women.

## Materials and Methods

This clinical trial was conducted on 54 primiparous women, referring to Mashhad Omolbanin Hospital from September to March 2013. Sample size was calculated as 54 subjects, based on an article by Mathew et al. (2011) ( $\alpha=0.05$  and  $\beta=0.2$ ) (24). The ethics committee of Mashhad University of Medical Sciences (MUMS) approved this study (approval code: 920056), and written informed consents were obtained from the subjects. Ethical considerations were taken into account throughout the study.

The subjects were selected, using accessible sampling. The inclusion criteria were as follows: 1) age range of 18-35 years; 2) gestational age of 34 weeks; 3) primiparity and singleton pregnancy; 4) cephalic presentation; 5) maternal height of 150 cm or above; 6) body mass index (BMI) of 19.8-30 kg/m<sup>2</sup> before pregnancy or the first 12 weeks of pregnancy; 7) lack of regular physical activity during pregnancy; 8) non-use of cigarettes, hookah, or narcotics; 9) fetal heart rate of 120-160 bpm; 10) lack of diagnosed fetal malformations in sonography; 11) mother's inclination towards vaginal delivery; 12) no medical problems at the beginning of the study; and 13) no musculoskeletal deformities or defects for doing birth ball exercises.

The exclusion criteria were as follows: 1) medical problems or pregnancy-related complications during the study; 2) abnormal fetal presentation (during the study or labor); 3) childbirth before 36 weeks or after 42 weeks of gestation; 4) maternal weight of  $\geq 90$  kg during the study or labor; 5) neonatal weight of either  $\geq 4000$  g or  $< 2500$  g; 6) diagnosis of cephalo-pelvic disproportion; and 7) not exercising more than 3 sessions (in the intervention group).

Participants were randomly divided into intervention (birth ball exercise) (27) and control groups (27). At the beginning of sampling, weekdays were coded from 1 to 6. Then, 3 days were allocated to the control group, using computerized random numbers. Data were collected using a questionnaire and forms for recording birth ball exercises, examination results, and observations. In order to confirm the validity of the questionnaire and forms, content validity was used. Reliability of the questionnaire ( $r=0.87$ ), birth ball exercise form ( $r=0.95$ ), and examination and observation forms ( $r=0.89$ ) was confirmed by assessing inter-rater reliability.

Birth ball exercises included 10 movements in 4 positions (sitting, standing, kneeling, and squatting). Mothers were given face-to-face instructions and were provided with film presentations (20 minutes during a 1-hour session). An educational CD and an instructive booklet were given to mothers in the intervention group. The intervention group performed the movements weekly under the researcher's supervision at the hospital and 3 times a week at home with the help of a trained participant.

Participants performed birth ball exercises during 16-24 sessions (20 minutes per session). After the instructional sessions and performing exercise movements, Borg scale was applied to determine the intensity of exercise movements; this scale is a vertical line graded from 6 to 20. In the current study, 14 was the maximum severity of exercises. If participants performed heavy exercises or did not perform the movements, they were excluded from the study. The subjects were allowed to leave the study at any point.

Both intervention and control groups received routine hospital care. The two groups

were instructed to inform the researcher and refer to Omolbanin Hospital (if necessary), in case they experienced any contractions. The researcher visited the hospital, controlled subjects' uterine contractions (at referral and every hour after admission), and performed vaginal examinations every 2 hours for determining dilatation and descent of the fetal head. Data related to fetal presentation, maternal status, labor progression, and neonatal status were recorded in examination and observation forms in both groups. Finally, rates of vaginal delivery and c-section were compared between the two groups.

At first, 57 participants were introduced to the study. However, 1 mother from the intervention group (for not doing exercises more than 3 sessions) and 2 women from the control group (given her willingness to leave the study) were excluded from the study. Chi-square, Fisher's exact test and Mann-Whitney U test were performed, using SPSS version 16. P-value less than 0.05 was considered statistically significant.

## Results

The two groups were matched in terms of maternal age, based on Mann-Whitney U test ( $P=0.176$ ). They were also similar regarding BMI and receiving prenatal care, based on Student's t-test ( $P=0.245$  and  $P=0.865$ , respectively) (Table 1).

According to Mann-Whitney U test, the two groups were similar in terms of education level ( $P=0.769$ ); they were also matched regarding occupational status, based on Chi-square test ( $P=0.843$ ). According to Chi-square test results, the two groups were also similar in terms of monthly income ( $P=0.54$ ) and referrals for receiving prenatal care ( $P=0.976$ ) (Table 2).

**Table 1.** Frequency distribution of the quantitative characteristics of participants in the two groups

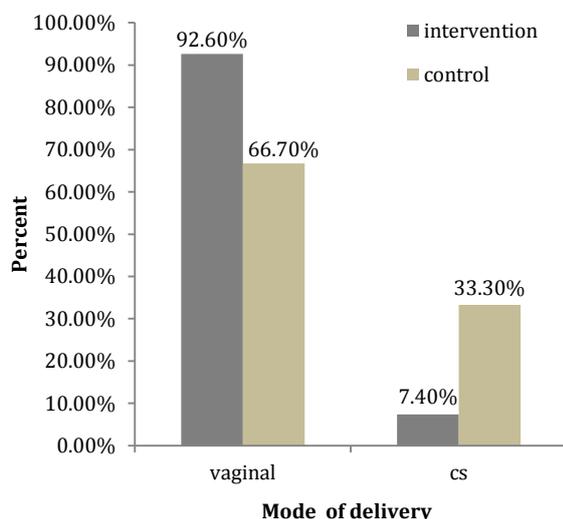
Variables	Intervention group Mean $\pm$ SD	Control group Mean $\pm$ SD	Test results
Age	23.27 $\pm$ 4.65	23.07 $\pm$ 4.05	z= -1.245 P=0.176 T=1.265
BMI	26.34 $\pm$ 1.84	25.65 $\pm$ 2.01	Df=48 P=0.245 t= 0.187
Frequency of referrals for prenatal care	7.74 $\pm$ 1.48	7.46 $\pm$ 2.24	Df=48 P=0.865

**Table 2.** Frequency distribution of the qualitative characteristics of participants in the two groups

Groups	Intervention N (%)	Control n (%)	Test results
<b>Education</b>			
Ability to read and write	2(7.40)	3(11.1)	
Middle school	7(25.9)	10(37)	z= -0.136
Secondary school	14(51.8)	12(44.4)	P=0.769
High school	4 (2.7)	2(7.4)	
<b>job</b>			
Housewife	23(85.1)	21 (77.7)	
Student	2(7.4)	3 (11.1)	df=2
Employee	2 (7.4)	3 (11.1)	P=0.843
<b>Income</b>			
Less than enough	8 (29.6)	10(37)	x <sup>2</sup> =0.045
Enough	16 (59.2)	13 (48.1)	P=0.54
More than enough	3(11.1)	4(14.8)	
<b>Referral for prenatal care</b>			
Doctor's office	21(77.7)	19(70.3)	
Healthcare center	3(11.1)	4(14.8)	x <sup>2</sup> =0.167
Doctor's office and healthcare center	3(11.1)	4(14.8)	P=0.976

**Table 3.** Comparison of the descent and rotation of fetal head at the beginning of the active phase in two groups

Groups	Intervention N (%)	Control N (%)	Test results
Descent of fetal head into the pelvis	19(70.4)	11(40.7)	
Lack of fetal head descent into the pelvis	8(29.6)	16(59.3)	P=0.028
Complete rotation of the fetal head (OA)	17(63.0)	9(33.3)	
Incomplete rotation of the fetal head (OT, OP)	10(37)	18(66.7)	P=0.029

**Figure 1.** Frequency distribution of mode of delivery in participants

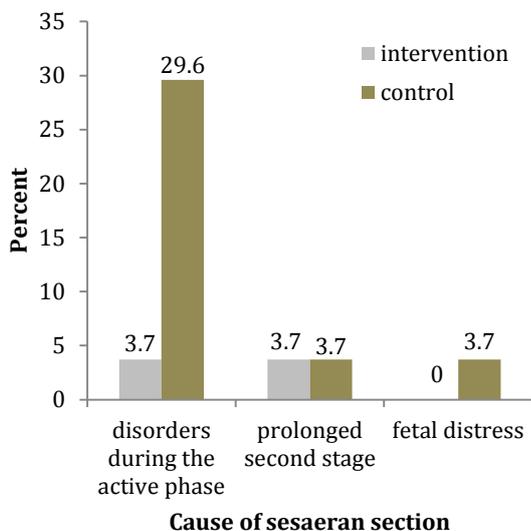
Chi-square test showed a significant difference between the two groups in terms of

fetal head descent and rotation at the beginning of the active phase (dilatation: 3-5 cm) and second stage of labor ( $P < 0.05$ ) (Table 3).

In the intervention group, 92.6% ( $n=25$ ) of women underwent vaginal delivery and 7.4% ( $n=2$ ) had c-section; however, these rates were 66.7% ( $n=17$ ) and 33.3% ( $n=10$ ), respectively in the control group. Chi-square showed a significant difference between the two groups in terms of mode of delivery ( $P=0.018$ ) (Chart 1).

In the intervention group, c-section was performed in 3.7% ( $n=1$ ) of women due to active phase disorders and in 3.7% ( $n=1$ ) due to prolonged second stage of labor. In the control group, 29.6% ( $n=8$ ), 3.7% ( $n=1$ ), and 3.7% ( $n=1$ ) of the subjects underwent c-section due to active phase disorders, prolonged second stage of labor, and fetal distress, respectively. The two groups showed a significant difference in terms of the cause of c-section, based on Chi-square test results ( $P=0.018$ ) (Chart 2).

According to the finding, 70.37% of the neonates (19) in the intervention group and 62.96% of the infants in the control group (17) weighed between 3200 and 3400 g. Head circumference ranged between 36 and 37 cm in 66.6% and 74.07% of the neonates (18) in the intervention and control groups, respectively (20). Chi-square test showed no significant difference between the two groups in terms of weight ( $P=0.265$ ) or head circumference ( $P=0.456$ ).



**Figure 2.** Frequency distribution of the cause of c-section in the two groups

## Discussion

The present study aimed to determine the effect of birth ball exercise on mode of delivery in primiparous women. The obtained results showed a significantly higher vaginal delivery rate in mothers performing birth ball exercises at the end of pregnancy, compared to the control group ( $P=0.018$ ) (Chart 1). The two groups were also significantly different regarding the cause of c-section ( $P=0.018$ ) (Chart 2).

Chang (2011) in his study showed that performing birth ball exercises during the last weeks of pregnancy and labor decreases c-section rate (22). Similarly, Lewis (2008) found that c-section rate was lower in women, who did regular exercises; also, fetal distress was less reported during labor in fetuses of these mothers (25). Moreover, Mathew et al. (2012) showed a significant relationship between using birth ball

during labor and mode of delivery. In fact, in the intervention group, 95% of the participants underwent spontaneous vaginal delivery, while this rate in the control group was 65% (24).

Tsang et al. (2012) conducted a non-randomized, clinical trial to determine the effect of birth ball on delivery outcomes. The results showed that using birth ball had no effect on vaginal delivery rate (23). This discrepancy with our findings could be due to some factors. Firstly, in the present study, the birth ball exercise program was performed regularly during pregnancy for 4-6 weeks, while in Tsang's study, birth ball was applied only during labor within a limited amount of time. Secondly, in the current research, participants were randomly selected, while in Tsang's study, subjects were allocated to groups, based on their own personal decision. Thirdly, in Tsang's study, the exercise techniques, positions, and movements were not clearly determined; this might have affected the results.

The results of this study showed a significant difference between the two groups in terms of descent and rotation of fetal head. Generally, exercise movements with birth ball in different positions strengthen pelvic floor muscles, increase pelvic diameters, and consequently help with fetal descent into the vaginal outlet (26-28). In the current study no significant difference was found between two groups in terms of weight or head circumference.

In the current study, exercise with birth ball during pregnancy had no undesirable effects on neonatal outcomes; neonatal weight, which could be considered an intervening factor for mode of delivery, was similar in the two groups. Ghodsi et al. (2012), with the purpose of evaluating the effect of regular exercise on neonatal outcomes, found no significant difference between control and intervention (who did regular exercise during 22-26 weeks' gestation) groups in terms of neonatal weight (29).

The present study had some limitations. Firstly, it was impossible to apply a double-blinded study design. Secondly, personal reactions of subjects to uterine contractions and labor progression were different; random selection could control these limitations to some extent.

This study was conducted in two steps and participants were controlled weekly; the pregnancy status of subject in both groups was controlled, as well. The above-mentioned points could be the strengths of this study. It is recommended that future studies focus on the comparison between the effects of birth ball exercise during pregnancy and other exercise programs.

## Conclusion

This study showed that performing birth ball exercises for 4-6 weeks at the end of pregnancy could increase the rate of vaginal delivery. Therefore, birth ball exercise could be applied as a non-pharmacological, inexpensive method for increasing the prevalence of vaginal delivery among women. Mothers should be advised to perform birth ball exercises during prenatal classes and consultation sessions.

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## Conflicts of interest

Authors declared no conflicts of interest.

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