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Original scientific paper

Research on the Influence of Prenatal Exercise on the Type of Delivery

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Abstract: INTRODUCTION / OBJECTIVE Pregnant women were not recommended to exercise because there was a risk of preterm delivery. Prenatal exercise however may reduce the risk of preterm delivery by other mechanisms such as reduced oxidative stress or improved placental vascularization. Given that the number of cesarean deliveries is growing and that a moderate-intensity physical activity can have a beneficial effect on mother and fetus, it is necessary to determine the frequency of delivery with pregnant women who performed prenatal exercises and those who did not exercise.

METERIALS AND METHODS: One hundred and twenty pregnant women participated in the study (n = 120). Pregnant women who attended only the theoretical part were included in the control group (n = 59). By joining the experimental group, pregnant women (n = 61) participated in both the theoretical part and prenatal exercises. We followed each participant for 8 weeks, which is the duration of one cycle of psychophysical preparation.

RESULT: In the group where pregnant women practiced prenatal exercises, vaginal deliveries predominate, almost twice as many as cesarean births. On the other hand, in the group where pregnant women did not exercise there is a slight decrease in the frequency of vaginal deliveries, with a tendency to equalize the results because there is an evident increase in the cesarean sections in that group. The application of the chi-square test did not determine the presence of a statistically significant difference in terms of delivery between the group of pregnant women who practiced prenatal exercises and those who did not.

CONCLUSION: Prenatal exercise of moderate intensity has a positive impact on the type of delivery. Although no statistically significant difference was observed between pregnant women who exercised and those who did not, there is a tendency for an increase in vaginal delivery in pregnant women who performed prenatal exercise.

Keywords: prenatal exercises, pregnancy, type of delivery

INTRODUCTION

In the past, pregnant women were not recommended to exercise because there was a risk of preterm delivery. Theoretically, physical activity increases the release of catecholamines, especially norepinephrine, which can stimulate myometrial activity. In reverse, prenatal exercise may reduce the risk of preterm delivery by other mechanisms such as reduced oxidative stress or improved placental vascularization (*1*). Numerous studies emphasize the impact of regular physical activity on health before pregnancy, during pregnancy and after the delivery (*2*).

The frequency of cesarean sections during deliveries is on the rise. The data show that this number exceeds much more than the recommended 10 to 15% by the World Health Organization (*WHO*) (*3*). The number of cesarean sections is increasing in the richest regions and is directly related to higher education (*3*). One of the proposals to try changing this condition is a regular prenatal exercise.

Prenatal exercises are associated with a lower rate of cesarean delivery in nulliparous women (*3*). The results of a randomized controlled study involving 2,059 pregnant women showed that the women in the exercise group had a significantly higher incidence of vaginal delivery (73.6%) compared to those

who did not exercise (67.5%). Also, the results showed a significantly lower incidence of caesarean section (17.9%) in pregnant women who exercised compared to 22% in those who did not exercise (*1*).

Physical activity in pregnancy has many benefits, such as reducing edema in pregnant women, reducing the risk of developing gestational diabetes, smaller weight gain, relieving lower back pain, reducing the incidence of urinary incontinence etc. (*3*). One of the first sources to publish recommendations or guidelines for performing physical activity during pregnancy was the American College of Obstetricians and Gynecologists (*ACOG*). According to ACOG guidelines, in the absence of obstetric complications, moderate exerciseis recommended for pregnant women for thirty minutes a day or more, most days of the week (*4*). Exercise during pregnancy can reduce the risk of gaining weight and this will have a positive effect on the birth weight of a newborn (*5*). Birth weight over 4000 g causes a higher frequency of postpartum hemorrhage, cesarean delivery, shoulder dystocia, birth trauma as well as an increased risk of developing obesity and diabetes mellitus later in life (*6*). Fixed positions, such as certain yoga positions and supine positions with outstretched legs, should be avoided as much as possible due to the possibility of reduced venous flow and hypotension in 10-20% of all pregnant women (*4*).

The American College of Obstetricians and Gynecologists (*ACOG*) presented absolute and relative contraindications for exercise in pregnancy. Absolute contraindications for exercise in pregnancy are: cardiovascular disease, restrictive lung disease, incompetent cervix or cerclage, preterm birth, persistent bleeding in the second and third trimesters, placenta previa, premature contractions during pregnancy, rupture of fetal membranes, preeclampsia or pregnancy-inducedhypertension, severe anemia.

Relative contraindications for exercise in pregnancy are: anemia, maternal arrhythmia, chronic bronchitis, poorly controlled type 1 diabetes, extreme obesity, extreme underweight (*BMI <12*), extremely sedentary lifestyle, IUGR in current pregnancy, poorly controlled hypertension, orthopedic limitation, poorly controlled hyperthyroidism, heavy smokers.

Physiological responses to exercise, such as changes in heart rate, cardiac function, ventilation and energy expenditure during pregnancy, may become more pronounced as the pregnancy progresses. In addition, during pregnancy, hormonal changes increase the joint laxity, which can increase the risk of injuries. In order to reduce the risk of injury for both mother and child, it is necessary to adjust prenatal exercises in terms of duration, intensity as well as the type of exercise (*7*).

Given that the number of cesarean births is growing, and on the other hand medium-intensity physical activity can have a beneficial effect on mother and fetus, it is necessary to determine the frequency of delivery (cesarean section or vaginal delivery) in pregnant women who performed prenatal exercises and pregnant women who did not exercise.

METERIALS AND METHODS

One hundred and twenty pregnant women (n = 120) participated in the study.

The participants in the study were pregnant women from the northwestern part of Bosnia and Herzegovina who attended birth preparation program for delivery in the period from January to June 2020. They joined the program at the earliest in the 20th week of gestation, and at the latest in the 32nd week of gestation. We followed each participant for 8 weeks, which lasted one cycle of psychophysical preparation for delivery.

The study was approved by the Ethics Committee of the Medical Faculty in Banja Luka. Participants received verbal information on how the study was conducted, and read the Information for the Participant for the mentioned research. Theparticipants who voluntarily agreed to participate in the research signed an informed consent form. The study was conducted in accordance with the ethical rules of the Declaration of Helsinki.

Criteria for inclusion in the study

Criteria for inclusion in the study were: age of pregnant women from 20 to 40 years, normal pregnancy confirmed by a gynecologist, duration of pregnancy from 20 to 32 weeks of pregnancy, BMI before pregnancy <25 kg / m2, single gestation.

Criteria for non-inclusion in the study

Criteria for non-inclusion in the study were: multiple pregnancy, diagnosis of placenta previa, acute or chronic diseases, cerclage, extreme obesity, extreme malnutrition, diabetes mellitus, hypertension, smoking in pregnancy.

Criteria for exclusion from the study

Criteria for exclusion from the study were: bleeding in the second or third trimester, premature birth in the current pregnancy, rupture of the amniotic sac, preeclampsia or pregnancy-induced hypertension, IUGR in the current pregnancy, anemia and exclusion from the study at the pregnant woman's own request.

After the gynecological examination, the gynecologist included the pregnant women in the prenatal program, which included theoretical classes about delivery and prenatal exercises. The respondents were divided into two groups: control and experimental group. Pregnant women who attended only the theoretical part were included in the control group. Pregnant women from the control group participatedin the theoretical part for 60 minutes three times a week where they received pieces of advice from gynecologists on pregnancy, delivery, the advantages of vaginal delivery over cesarean delivery, positions taken during the delivery, diet, breastfeeding etc.

By joining the experimental group, pregnant women participated in both the theoretical part and prenatal exercises. The experimental group exercised three times a week for 45 minutes at agreed times. Prenatal exercises were led by the therapist for physical activities in pregnancy, according to the exercise program made in compliance with the recommendations of the American College of Obstetricians and Gynecologists (*4*) and the guidelines of HUFZŽ (*Croatian Association of Physiotherapists for Women's Health)* (*8*,*9*).

During the study, pregnant women did not exercise further in other places. The recommendation was to eat normally, not to eat or drink anything for an hour before exercise, except water. During the exercise, pregnant women were well hydrated, wore light clothing, and avoided high heat and humidity to protect themselves from heat stroke. The room in which they practiced was air-conditioned, and the room temperature did not exceed 24 ° C.

The exercise program comprised: static and dynamic breathing exercises, muscle stretching exercises and muscle strength exercises, exercises to strengthen the abdominal wall muscles, exercises to strengthen the thigh muscles - quadriceps femoris (*lat. musculus quadriceps femoris*), to strengthen gluteal muscles, exercises to increase pelvic mobility, exercise to improve circulation, as well as pelvic floor muscle training with relaxation techniques.

During the prenatal exercises, we monitored the exercise intensity for pregnant women based on the subjective feeling of exertion. The applied physical activity was of medium intensity, using the *Borg Rate of Perceived Exertion (RPE) Scale* (*4*) as a reference when explaining to pregnant women that they should stop doing it when they subjectively feel it is "moderately difficult". Another way to measure the exertion is to use "*The talk test*". It is believed that as long as a pregnant woman can have a conversation during the exercise, she is probably not overexerted (*4*).

Pregnant women were warned to stop the activity if they feel dizzy, short of breath, pain, muscle weakness, difficulty with breathing on exertion, if they bleed or notice the signs of the onset of labor, or if they notice reduced fetal movements. Also, they were additionally warned to be careful when stretching to avoid injuries.

Pregnant women were required to attend 80% of prenatal exercise classes in order to remain included in the study. In addition, they could leave the research at their own request. The respondents in both groups filled out a questionnaire during the study from which we obtained the following data: age, height and body weight before pregnancy. From the medical records of the pregnant women who brought them for inspection, we obtained the data on the week of pregnancy. After the delivery, we sent a postnatal questionnaire electronically to the participants from both groups, from which we obtained the data on the type of delivery (vaginal or caesarean section).

The data were processed by methods of descriptive and parametric statistics using the program SPSS 20.

RESULTS

A total of 135 pregnant women were included in the prenatal exercise program of which 120 pregnant women successfully completed the program (88.9%), while 15 pregnant women (11.1%) left the program (Chart 1).

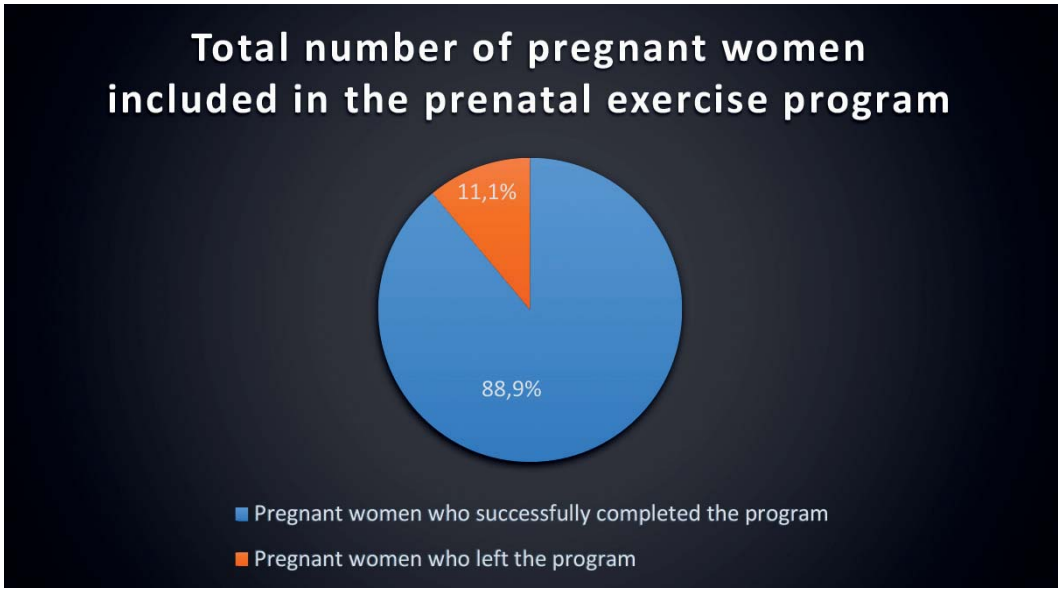

Chart 1. Total number of pregnant women included in the prenatal exercise program

At the beginning of the study, 135 pregnant women participated however 15 pregnant women left the study for the following reasons: miscarriage (1 pregnant woman from the control group), premature birth (1 from the control group, 1 from the experimental group), pregnancy-induced hypertension (2 pregnant women from the control group)), leaving the study at their own request (1 pregnant woman from the control group, 2 pregnant women from the experimental group), failure to meet the minimum number of visits to the program (1 pregnant woman from the control group, 2 pregnant women from the experimental group), not being in contact after the study and incomplete data (4 pregnant women). As a result, 120 pregnant women participated in a study examining the impact of prenatal exercise on the type of delivery. There were 61 pregnant women in the experimental group (n = 61) while there were 59 pregnant women in the control group (n = 59).

In the experimental group, pregnant women began training with breathing exercises,a warm-up consisting of moderate walking for about 5 minutes, followed by strength and stretching exercises for about 30 minutes. The training ended with relaxation techniques for about 10 minutes. The exercises were performed in a standing, sitting, kneeling and side position, with or without props (balls, ribbons, weights, etc.). The exercises performed in a supine position with bent knees during this study did not last more than 5 min, thus avoiding a reduction in venous flow. In the supine position, pregnant women performed the stretching exercises for the gluteal, paravertebral and lumbosacral muscles, as well as the exercises to strengthen the abdominal wall muscles, thigh muscles and pelvic floor muscles. The exercises were performed in two to three sets, with ten to twelve repetitions. During the 8 weeks of the monitoringwhile the study lasted, in the first four weeks pregnant women performed prenatal exercises in two series, and the next four weeks in three series.

In the experimental group from a total of 61 pregnant women who exercised, 42 pregnant women (68.9%) gave birth vaginally while 19 pregnant women (31.1%) gave birth by caesarean section (Chart 2).

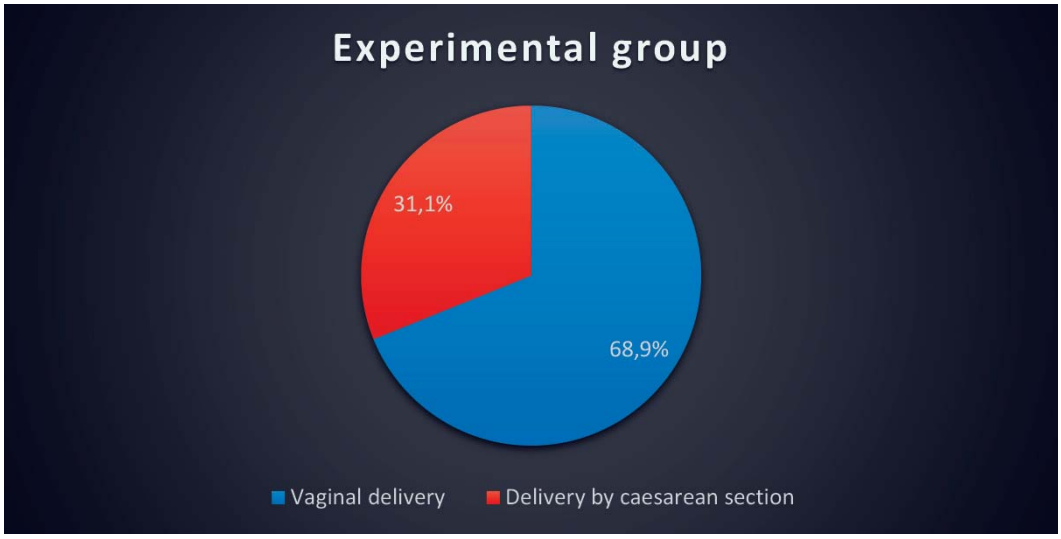

Chart 2. The delivery method in the experimental group

In the control group from a total of 59 non-exercising pregnant women, 31 pregnant women (52.5%) gave birth vaginally while 28 pregnant women (47.5%) gave birth by caesarean section (Chart 3).

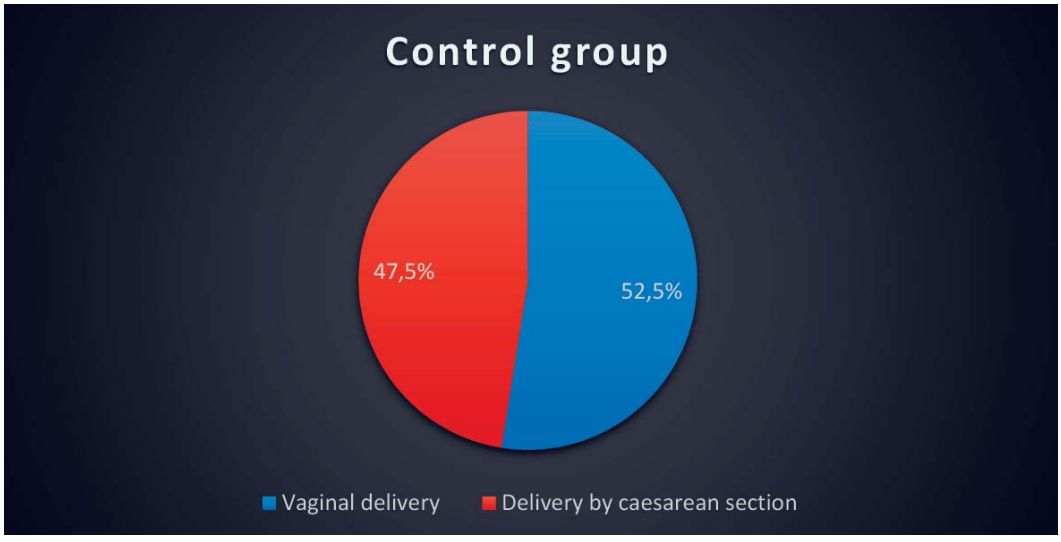

Chart 3. The delivery method in the control group

Descriptive analysis of the results shows that in the group where pregnant women practised prenatal exercises, vaginal births predominate, almost twice as many as cesarean births.

On the other hand, in the group where pregnant women did not exercise, a slight decrease in the frequency of vaginal delivery is observed, with a tendency to equalize the results because there is an evident increase in cesarean sections in that group (Table 1).

Table 1. The delivery methods in pregnant women who exercised prenatal exercises and pregnant women who did not exercise.

DELIVERY METHOD	EXPERIMENTAL GROUP EG (n=61)	CONTROL GROUP CG (n=59)
VAGINAL	42 (68.9%)	31 (52.5%)
CAESAREAN SECTION	19 (31.1%)	28 (47.5%)
IN TOTAL (n=120)	61	59

The application of the chi-square test did not determine the presence of a statistically significant difference in terms of the delivery between the group of pregnant women who practised prenatal exercises and those who did not ($\chi^2 = 3.349$, df = 1, p = 0.067). When using the chi-square test, the statistical significance $p < 0.05$ was marked as a significant difference, while $p > 0.05$ was considered insignificant.

DISCUSSION

In the study, 135 pregnant women were included in the prenatal exercise program, of which 120 pregnant women successfully completed the program (88.9%). In a study by da Silveira and co-authors out of a total of 97 pregnant women, 66 pregnant women (68%) successfully completed the program (*3*).

In the experimental group, 68.9% of pregnant women had a vaginal delivery, while 31.1% had a caesarean section. The results of examining the impact of the exercise during pregnancy on the type of delivery show that pregnant women who exercised with low and medium intensity had a higher rate of vaginal delivery. In a study by da Silveira et al. in the experimental group, the percentage of vaginal completion was 67.6% and cesarean section 32.4%. (*3*). Also, a study by Bovbjerg et al. states that exercise strengthens the abdominal muscles, which facilitates the second phase of delivery and avoids possible shoulder dystocia or excessive prolongation of delivery, which would indicate the need for a caesarean section (*10*). The results of a meta-analysis that included twenty-eight randomized controlled studies showed that higher volume and duration of exercise was associated with lower weight gain in pregnancy (*5*). The results of a controlled randomized study showed that pregnant women who did not exercise were 1.5 times more likely to gain excess weight during pregnancy than those who exercised, making it difficult to give birth naturally (*11*). Therefore, it is considered that women who exercise regularly during pregnancy are more likely to gain anadequate weight accordingly, and in turn have an adequate newborn birth weight, which would reduce the frequency of cesarean deliveries (*5*).

However, it has to be mentioned that there are several studies linking moderate-intensity exercise in early pregnancy with an increased probability of cesarean delivery (*12*).

In the study, 52.5% of pregnant women who did not exercise had a vaginal delivery, while 47.5% of pregnant women gave birth by caesarean section. In the control group of the study by da Silveira et al., the percentage of vaginal delivery was 37.9%, while 62.1% of pregnant women gave birth by caesarean section (*3*).

Bungum et al. studied primiparous women who exercised during pregnancy and did not find a statistically significant difference in the type of delivery between the group that exercised and the one that did

not, which corresponds to the results of our study in which p = 0.067 (*13*). However, they observed that those pregnant women who remained inactive throughout pregnancy were about twice as likely to give birth by caesarean section (*13*).

In our research there are several limitations that also affected the results which concern the fact that the participants were not randomly selected, then giving up exercising in some part of the program, or giving incomplete data on doing exercises elsewhere.

In the study, all pregnant women attended the training classes that highlight the advantages of vaginal delivery over cesarean section, which increases their motivation to give birth naturally and certainly reduces the differences in the way of delivery between the group of pregnant women who exercised and those who did not.

The described birth preparation program was developed for the purpose of promoting physical activity during pregnancy and the position and breathing techniques as a means of non-pharmacological pain relief. This program also reduces anxiety, fear of pain during the delivery, which could increase the possibility of a caesarean section as type of delivery. Qualitative evaluation of the results showed that prenatal exercises and the use of breathing techniques during pregnancy and delivery improved the self-control of pregnant women and reduced the fear of pain, as one of the possible causes of caesarean section (*14*).

Taking into account the conflicting results of the studies on this topic, further research with a larger number of samples in controlled randomized studies is necessary.

CONCLUSION

Prenatal exercise of moderate intensity has a positive effect on the type of delivery. Even though no statistically significant difference was observed between the groups of pregnant women who exercised and those who did not, the study showed a tendency to increase vaginal delivery in pregnant women who performed prenatal exercise. A natural birth rate increase is achieved with an appropriate prenatal exercise program.

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