

## Effects of aerobic exercise training on maternal and neonatal outcome: a randomized controlled trial on pregnant women in Iran

Zahra Ghodsi, Maryam Asltoghiri

### Abstract

**Objective:** To assess the effect of aerobic exercise training on maternal and neonatal outcome

**Methods:** The case-control study was conducted between January and July, 2011. It was approved by the Research Ethics Committee of Toyserkan Azad University, and data was collected at prenatal clinics and delivery centres located in Hamedan, Iran. It comprised 80 pregnant women between 20-26 weeks of gestation randomly assigned to two equal and matching groups of cases and controls. The intervention group did exercise continuously on a bicycle ergometer for 15 minutes, three times a week; the intensity being 50-60% of maximal heart rate. The control group did not do any exercise training. All information was obtained from the clinics, delivery centres, and from the reports of delivery room midwives.

**Results:** No statistically significant difference was found between the two groups in gestational weight gain, pregnancy length, mode of delivery, first and second stage of labour, perineal tear, and 1st and 5th min Apgar score. Mean neonatal weight was significantly less in the intervention group than the control group ( $p < 0.001$ ).

**Conclusion:** Exercising on a bicycle ergometer during pregnancy seems to be safe for the mother and the neonate.

**Keywords:** Bicycle Ergometer, Pregnancy, Maternal outcome, Neonatal outcome. (JPMA 64: 1053; 2014)

### Introduction

Many pregnant women would like to start or continue to exercise during pregnancy, but there are consequences; such as premature labour<sup>1</sup> or weight-loss during pregnancy.<sup>2</sup> Results of studies on the effect of exercise during pregnancy have been different. In some studies, an increased risk of preterm birth was seen among women who had stopped exercising.<sup>1,3</sup> In contrast, some studies suggest no significant association between exercise during gestation and the risk of preterm delivery<sup>4-6</sup> others suggest it may lead to a reduced birth-weight and body mass index (BMI) of the infant<sup>7,8</sup> whereas some of researchers found that exercise during pregnancy has no effect on birth-weight.<sup>5,9</sup> The American College of Sports Medicine recommends at least 30 minutes of aerobic exercise on three or more days each week for pregnant women. Walking, cycling, swimming and other low-impact exercises can be safe for mothers to continue, even begin, during the first few weeks of pregnancy.<sup>10</sup>

The American Council on Exercise reports that exercise may help relieve fatigue, constipation, swelling of hands and feet and leg cramps associated with pregnancy.<sup>11</sup> Also, regular exercise during pregnancy prepares pregnant body for labour and delivery and may also allow

women to regain their pre-pregnancy body weight more quickly.<sup>11</sup>

It is hypothesised that regular exercise during pregnancy elicits maternal and foetal adaptations and that these adaptations have the potential for both positive and negative long-term outcomes.<sup>12</sup> Based on current evidence, these adaptations seem to be dependent on the gestational period in which exercise training is initiated and maintained.<sup>12</sup>

There is also substantial evidence that different patterns of exercise during pregnancy have diverse effects on the relationship between exercise and pregnancy outcomes.<sup>13</sup> There are some studies that show resistance training performed over the second and third trimester of pregnancy does not have a negative impact on the newborn's overall health. Babies born to exercising mothers tolerate labour well and show less behavioural or biochemical evidence of undue stress in late pregnancy and labour.<sup>14</sup> The objective of this research was to determine the impact of a home-based ergometric training during pregnancy on maternal and neonatal outcomes.

### Subjects and Methods

The case-control study was conducted between January and July, 2011. It was approved by the Research Ethics Committee of Toyserkan Azad University, and data was collected at prenatal clinics and delivery centres located

.....  
Department of Midwifery, Toyserkan Branch, Islamic Azad University, Toyserkan, Iran.

**Correspondence:** Zahra Ghodsi. Email: ghodsi2003@yahoo.com

in Hamedan, Iran. A controlled laboratory test was conducted on 80 nulliparous or primiparae healthy women, who were at 20-26 weeks of gestation. Inclusion criteria comprised all pregnant women referred to the prenatal clinic and were nonathletic healthy, nulliparous or primiparae, without any regular exercise in the past and a BMI range of 19.8-26kg/m<sup>2</sup>. The subjects were selected through convenience sampling and were randomly placed into two equal and matching groups. Women with any medical complications, recent uterine bleeding, intra-uterine growth retardation (IUGR), multiple pregnancy, obese, any problems during the workout, not wanting to continue training during the study, and communication difficulties were excluded.

Participants in intervention group took part in a cycling programme on a bicycle ergometer for 15 minutes 3 times per week, with an intensity of 50-60% of maximal heart rate. The participants carried on with the programme at their respective homes. They were asked to stop the exercise immediately in case of any problem, and to notify the researchers. A weekly visit with all participants was made by researchers and regular exercise was maintained until at least 38 weeks of gestation. The researcher collected mothers' weight changes through prenatal clinic records. The gestational age at the time of delivery, delivery mode, labour stages lengths, perineal tears, the results of Apgar, and neonatal weight were obtained from the delivery centres, and the reports of delivery room midwives. The control group was visited twice; at the beginning and end of the study.

Data collection tools included a two-part questionnaire; an exercise Sheet, an exercise booklet, and a maternal and newborn weighing scale. The first part of the questionnaire included demographic characteristics and the latter section included information about the consequences of pregnancy. An exercise sheet was given to the participants in order to record the duration and time of programme. Exercise booklet included notifications that participants had to follow before and after the exercise. Gestational weight gain, lengths of labour, and neonatal weight in the two groups were compared using Mann-Whitney test, while gestational age, perineal tear, Apgar score, and delivery mode were compared using Mann-Whitney and Chi-Squared tests. Data was analysed using SPSS 17.0, and the level of significance was set at  $p \leq 0.05$ .

## Results

The 80 subjects in the study were divided into two groups of 40(50%) each. There were not statistically significant differences in the characteristics of the subjects that could

**Table-1:** Maternal and neonatal outcome.

Variable Value	Intervention	Comparison	P	
	Mean(SD)	Mean(SD)	Range	
Gestational weight gain	9.40±2.07	10.67±3.43	6-18	P=0/14
<b>Labour length</b>				
First stage	299.6±126.87	384.7±147.8	220-490	P=0.07
Second stage	29.5±13.99	32.5±13.68	20-58	P=0.94
Neonatal weight (gram)	3095±339.45	3255±349.68	2400-4100	P=0.00

**Table-2:** Maternal and neonatal outcome.

Variable	Intervention Number (%)	Comparison Number (%)	P Value
Mode of delivery (NVD)	35(87.5)	35(87.5)	P=1.00
<b>Gestational length</b>			
Preterm	3(7.5)	1(2.5)	P=0/09
Term	36(90)	37(92.5)	P=0/09
Post term	1(2.5)	2(5)	P=0/09
<b>Apgar (7-10)</b>			
First Minute	38(95%)	39(97.5%)	P=0.13
Fifth Minute	40(100%)	40(100%)	P=0.31

influence the main study outcome.

The overall age range was 15-35 years. The mean age of the cases was 23.40±3.69 years and of the controls 23.28±3.94 years. Mean weight was 59.30±5.75kg for the cases and 60.23±8.03kg for the controls. At the time of the initiation of the study, the mean gestation was 22.66±1.85 weeks in the intervention group and 22.30±12.59 weeks in the control group. Likewise, the mean BMI was 22.66±1.85kg/m<sup>2</sup> for the cases and 22.70±1.99kg/m<sup>2</sup> for the controls. P value was statistically insignificant for all these characteristics.

There was statistically significant relationship between the two groups in the length of the first stage and gestational weight gain. However, the mean of the length of first stage was 85.1 minutes shorter in the intervention group, and gestational weight gain was less in the intervention group than the control group. The mean of the length of the second stage in the intervention group was 3 minutes shorter than in the comparison group, but no significant difference was observed between the two groups. Neonatal weight was found to be significantly less in the intervention group (Table-1).

No relationship was found between exercise training and gestational age (Table-2). The number of caesarean section was similar in both groups. Further analysis found no significant difference between the first or fifth minute Apgar score between the two groups.

There was no statistical differences in the number of intact perineum, episiotomies, or first and second degree tears ( $\chi^2 = 5/90$ ,  $df = 3$ ,  $p < 0.11$ ). There was a reduced risk of a second degree tear in the intervention group and an increased risk for intact perineum in the intervention group. Two (5%) subjects in the control group had a third-degree tear.

## Discussion

The study shows that ergometric training during pregnancy has no effect on the weight gain process, but it had little effect in preventing excess weight. In one study there was not statistically significant difference between the two groups, but maternal weight gain was less in the intervention group.<sup>15</sup> Some studies found no significant effect of exercise training on gestational weight gain.<sup>12,16</sup> In contrast, others suggest weight increase in women who engage in exercise during pregnancy.<sup>17,18</sup> It could be low compliance, high dropout rates and inadequate number of participants in some of the studies, as well as differences in the mode, frequency, intensity and duration of the exercise training.

Results of the current study showed that ergometric training did not alter the risk for preterm delivery. Preterm birth leads to neonatal morbidity and mortality in the world.<sup>19</sup> Furthermore, this study showed no significant differences between the groups associated with post-term delivery. Some studies suggest no significant association between exercise and gestational age and risk of preterm delivery.<sup>4-6</sup>

We found no statistically significant relationship between ergometric training and the first stage and second stage of delivery in the two groups. Some studies showed no difference in duration of the first stage of labour.<sup>20</sup> One study observed a shorter length of second stage of labour that could be due to focus on special pelvic exercises.<sup>21</sup>

The results of the study showed no exercise effect on the perineum. A slight non-significant benefit was demonstrated in the intervention group in increasing intact perineum (20% difference) and reducing second-degree perineal tears (17% difference). However, first-degree tear increased. In a population of 531 primiparae women delivering vaginally, no significant difference was observed between the groups.<sup>22</sup> In contrast, one study reported significant benefit was found in the massage perineum group.<sup>23</sup>

The study suggests that maternal exercise does not affect Apgar score which is an important characteristic for neonatal health. There are some studies that show exercise during pregnancy having no effect on the Apgar

score.<sup>3,24,25</sup> One study found no statistically significant difference in the first and fifth minute Apgar score between groups that had started exercise in the second trimester, but the first minute Apgar score was higher among the group that started exercises from first trimester.<sup>18</sup> In another study in Iran, first and fifth minute Apgar scores were more in the training group that had started exercise from 8 to 12 weeks of pregnancy.<sup>16</sup> These different effects could be due to initiation time of exercise in pregnancy.

According to results of the present study, exercise regimen affected neonatal weight changes between the two groups. There was a reduction of 160 gram in birth weight mean values in the intervention group. However, all newborns were born in a normal range of weight (2500-4000 grams). A study<sup>7</sup> reported more reduction in birth weight (207g). Another reached similar results.<sup>18</sup> Some researchers found that exercise during pregnancy had no effect on birth weight,<sup>5,9</sup> whereas others reported an increase in birth weight of 260g.<sup>14</sup> The differential effects may be caused by the ability of physically fit women to maintain a more intense exercise regimen during pregnancy.

The strength of the current study was its randomised trial nature. Also, a good step in this study was separate exercises type as well as intensity. Aspects of the study design should be considered. The study had a small sample size and all participants were from the same geographic location. Besides, due to some limitations, we could not supervise exercises during the period.

## Conclusion

Exercising on a bicycle ergometer during pregnancy seems to be safe for the mother and the neonate. Further studies are recommended to assess the impact of first trimester exercise training on pregnancy outcome, and on multipara pregnant women. Similar studies are recommended in larger samples, diversified populations and with a wider geographical range.

## Acknowledgment

We are grateful to president and vice-president of research, Islamic Azad University, Toyserkan branch, Dr. S. Jamebozorgi and Dr. M. Hokmabadi, for their cooperation.

## References

1. Duncombe D, Wertheim EH, Skouteris H, Paxton SJ, Kelly L. Factors related to exercise over the course of pregnancy including women's beliefs about the safety of exercise during pregnancy. *Midwifery* 2009; 25: 430-8.
2. Gibbs RS, Karlan BY, Haney AF. Exercise and pregnancy. *Epileptic seizures: Dan forth's obstetrics and gynecology*, Philadelphia: Pa, Lippincott Williams & Wilkins, 2008.

3. Barakat R, Lucia A, Ruiz JR. Resistance exercise training during pregnancy and newborn's birth size: a randomized controlled trial. *Int J Obesity* 2009; 33: 1048-57.
4. Duncombe D, Skouteris H, Wertheim EH, Kelly L, Fraser V, Paxton SJ. Vigorous exercise and birth outcomes in a sample of recreational exercise: a prospective study across pregnancy. *Aust N Z J Obstet Gynaecol* 2006; 46: 288-92.
5. Orr TS, James ShA, Garry J, Prince CB, Newton ER. Exercise and pregnancy outcome among urban, low-income, black women. *Ethn Dis* 2006; 16: 933-7.
6. Barakat R, Stirling JR, Lucia A. Does exercise training during pregnancy affect gestational age? A randomized controlled trial. *Br J Sports Med* 2008; 42: 674-8.
7. Marquez-Sterling S, Perry AC, Kaplan TA, Halberstein RA, Signorile JF. Physical and psychological changes with vigorous exercise in sedentary primigravidae. *Med Sci Sports Exerc* 2000; 32: 58-62.
8. Hopkins SA, Baldi JC, Cutfield WS, McCowan LS, Hofman PL. Exercise training in pregnancy reduces offspring size without changes in maternal insulin sensitivity. *J Clin Endocrinol Metab* 2010; 95: 2080-8.
9. Memari A, Ramim T, Amini M, Mehran A, Ajorlu A, Shakibae P. Effect of aerobic exercise on pregnancy outcome. *Iran J Tehran Uni Med Sci (Hayat)* 2006; 12: 35-41.
10. Shelby Scott. Exercise during Pregnancy. *ACSM's Health and Fitness Journal* 2006; 10: 37-9.
11. American Council on Exercise. Exercise and Pregnancy. (Online) 2013 (Cited 2011, Sep). Available from URL: <http://WWW.acefitness.org>.
12. Hopkins SA, Cutfield WS. Exercise in Pregnancy: Weighing Up the Long-Term Impact on the Next Generation. *Exerc Sport Sci Rev* 2011; 39: 120-7.
13. Kramer MS, McDonald SW. Aerobic exercise for women during pregnancy. *Cochrane Database Syst Rev* 2006; 3: CD000180.
14. Clapp JF, Kim H, Burciu B, Lopez B. Beginning regular exercise in early pregnancy: Effect on fetoplacental growth. *Am J Obstet Gynecol* 2000; 183: 1484-8.
15. Motaharitari N, Mirdar SH, Khaledan A, Ahmad Shirvani M. The Effect of Aerobic Exercise on Pregnancy Outcomes. *Iran J Babol Uni Med Sci* 2010; 12: 36-43.
16. Zand S, Zamani A. The effect of exercises and correct daily activity on pregnancy outcome. *J Gynecol Obstet Infertility Iran* 2009; 25: 49-54.
17. Lochmuller EM, Friese K. Pregnancy and Sports. *MMW Fortschritte der Medizin* 2005; 147: 28-31.
18. Sedaghati P, Aghaalienejad H, Arjmand A. The Effect of a period of Aerobic Exercise on Pregnancy Outcomes. *Olympic Iran J* 2006; 14: 63-72.
19. Bernal A, Overview L. Preterm labor: mechanisms and management. *BMC Pregnancy Childbirth* 2007; 7: 18.
20. Wang TW, Apgar BS. Exercise during Pregnancy. *Am Fam Physician* 1998; 57: 1846-57.
21. Stamp G, Kruzins G, Crowther C. Perineal massage and prevention of perineal trauma: randomized controlled trial. *Br Med J* 2001; 322: 1277-80.
22. Bodner-Adler B, Bodner K, Mayerhofer K. Perineal massage during pregnancy in primiparous women. *Int J Gynecol Obstet* 2002; 78: 51-3.
23. Labreque M, Eason E, Marcoux S. Randomized trial of perineal massage during pregnancy. *Am J Obstet Gynecol* 1999; 180: 593-600.
24. Kardel K, Kase T. Training in pregnant women: effects on fetal development and birth. *Am J Obstet Gynecol* 2009; 178: 280-6.
25. Ghodsi Z, Asltoghiri M. Maternal exercise during pregnancy and neonatal outcomes in Iran. *Proc Soc Behav Sci* 2012; 46: 2877-81.