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European Journal of Experimental Biology, 2013, 3(2):78-85

ISSN: 2248 –9215
CODEN (USA): EJEBAU

Effect of a period of exercise during pregnancy on certain delivery parameters

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ABSTRACT

Scientific advancements, especially in medicine, have minimized pregnancy discomforts and delivery risks. However, pregnant women are always concerned with delivery and associated discomforts. This may be one of the reasons for the large number of Caesarean section in Iran. One of the methods for making delivery easier is to prepare the mother through exercises. Due to the importance of delivery, the present research is carried out to examine the effect of a period of physical exercise on certain delivery parameter such as the duration of the first (active) and second stages of labor, type of delivery, instrumental vaginal delivery, and birth weight. This study was ex post facto or causal-comparative. The subjects were 55 healthy, primiparous women who were randomly assigned to an experimental group ($N = 25$ *) and a control group (* $N = 30$ *). The training protocol involved aerobic, strengthening, and stretching exercises for 30-60 minutes, 2 days per week, and 22 weeks, beginning from the 14*th*week of pregnancy. Kolmogorov-Smirnov test and Shapiro's test were applied to examine the normal distribution of the data. Also t-test for independent samples, Mann-Whitney U test, and chi-square test were applied for data analysis at the 0.05 significance level. The results showed that the first stage of labor was significantly shorter in the experimental group than the control group. Moreover, frequency of Caesarean section significantly decreased in the experimental group. However, there were no significant differences between these groups in duration of the second stage of labor, frequency of instrumental vaginal delivery, and birth weight. Based on the results, performing a set of exercises during the second and third trimesters of pregnancy decreases the duration of the first stage of labor and the frequency of Caesarean section. It is thus recommended that medical centers invest on training courses with the proposed protocol to reduce some of the problems associated with childbirth.*

Keywords: Exercise, pregnancy, delivery

INTRODUCTION

Technological advancements in the modern age have led to sedentary lifestyles in different societies. Thus, sport and physical exercise are an essential factor in the health and vivacity of societies and their positive effects are universally accepted. Women constitute a major part of each society, and due to their distinctive conditions such as pregnancy, delivery, and breastfeeding, they must be physically and mentally fit. Childbirth is a natural phenomenon and one of the most beautiful, exciting, and critical experiences of a woman, yet it can be very challenging and demanding for women who are not physically and/or mentally prepared [1]. Scientific advancements, especially in medicine, have minimized pregnancy discomforts and delivery risks. However, pregnant women are always concerned with delivery and associated discomforts. This may be one of the reasons for the large number of Caesarean section in Iran.

The increasing frequency of Caesarean section and hard deliveries are issues often attributed to lack of physical activity during pregnancy. Post-term delivery has many complications such as uterine infection, drop in fetal heart rate, fetal acidosis, and other physical and mental problems for the mother and the child. Empirical evidence has shown that risks of infection, thromboembolic episodes, and anesthesia complications are more common and more severe in Caesarean section than vaginal delivery [2]. Abnormal fetal growth can lead to fatality or dramatic birth traumas [2]. Reduced fetal growth can lead to death, asphyxia, meconium aspiration syndrome, hypoglycemia, reduced body temperature, and abnormal neurodevelopment [3, 4]. On the other hand, increased fetal growth increases the frequency of Caesarean section and can lead to such problems as birth canal laceration, post-delivery hemorrhage, and fetal brachial plexus injury, asphyxia, and death [2, 5].

In 2002, the American Congress of Obstetricians and Gynecologists (ACOG) declared that if there are no medical and obstetrical disorders pregnant women can engage in moderate-intensity exercises for 30 minutes in certain positions and activities that are not harmful for the mother and the child[6]. The American College of Sports (ACSM) Medicine has recommended 60-90% HRmax or 50-80% VO_2max intensity for exercise during pregnancy [7].

Many researchers have found that for women who regularly exercise during pregnancy the duration of the second stage of labor was considerably shorter [8-11] and that they less frequently needed Caesarean section [1, 7, 12]. It has also been reported that physical activity can affect fetal growth by increasing the plasma volume and cardiac output of the mother and the fetus and increasing placental-fetal circulation [13, 14].The inconsistency in the results can be attributed to differences in type, volume, and intensity of exercise, the time of starting the protocol, and the experience of the subjects. Nonetheless, there is limited information regarding the effects of exercise during pregnancy, while exercise can undoubtedly affect certain delivery parameters. Due to the sparse literature on the subject, the fact that many of the studies are descriptive and have led to contradictory results, and due to the importance of childbirth, more studies need to be carried out to positively suggest exercise for pregnant women. Thus, the purpose of the present research is to study the effect of a period of exercise in the second and third trimesters on the duration of the first and second stages of labor, type of delivery, instrumental vaginal delivery, and birth weight.

MATERIALS AND METHODS

This study was ex post facto or causal-comparative during the six-month period from April 2011 to September 2011. The population consisted of the pregnant women who visited the hospitals of Torbat-e Heydarieh County in Razavi Khorasan Province, Iran. The subjects (18-33 yrs., 155-170 cm) were all healthy and were medically eligible to perform exercises during pregnancy.

At first, 64 pregnant women were randomly selected and assigned to an experimental group ($N = 32$) and a control group ($N = 32$). However, during the period of study some subjects were excluded due to their failure to regularly perform the exercises or attend the medical centers and their pelvic incompatibility for vaginal delivery. The final evaluation involved 55 subjects with 25 women in the experimental group and 30 women in the control group. The criteria for entering the study was 12-14week, singleton, primiparous pregnancy and the subject must have been non-athletes. The subjects completed the International Physical Activity Questionnaire (IPAQ) and a consent form. The weight and height of the subjects were measured using Beurerstadiometer and scale (made in Germany). The subjects' weight gain was controlled from the 14^{th} week of pregnancy until childbirth based on BMI graphs and they were given nutritional recommendations.

The experimental group participated in the training protocol (aerobic exercise with music, and strengthening and stretching exercises that involved abdominal, pelvic, and back muscles). The protocol was designed based on the guidelines of ACOG and lasted for 22 weeks with 2 sessions per week. The duration of exercise increased from 30 minutes in the early sessions to 60 minutes in later sessions. To prevent potential physical problems, the protocol was performed at 110-140 bpm. After the exercises, the subjects consumed water or juice. The control group, on the other hand, was not given any training protocol and they were instructed to report any instance of regular exercise during the research period.

Chi-square test was applied to compare type of delivery and instrumental vaginal delivery between the two groups and Mann-Whitney U test was used to compare the two groups in terms of duration of the first and second stages of labor and birth weight at $P < 0.05$ significance level.

RESULTS

Kolmogorov-Smirnov test and Shapiro's test showed that the distribution of data is not normal except for the variable of height. Table 1 provides the characteristics of the subjects.

Table 1) Subjects' characteristics

Variables \ Statistics		M±SD	min	max
Mother Age (year)	control	24.30±4.22	18	33
	experimental	23.80±4.06	18	33
Mother Weight (Kg)	control	60.63±10.17	41	78
	experimental	59.31±9.54	45	88
Mother Height (cm)	Control	161.38±4.42	155	169
	experimental	161.12±4.41	155	168
BMI ($Kg.m^{-2}$)	control	22.78±2.88	19.53	30.06
	experimental	22.83±4.03	16.94	32.57
Systolic Blood Pressure(mmHg)	control	102.5±7.85	80	120
	experimental	98.2±5.75	85	110
Diastolic Blood Pressure(mmHg)	control	68.17±7.01	50	80
	experimental	59.20±7.17	50	70
Standing Time (S)	control	29.67±7.10	20	45
	experimental	31.17±9.57	15	60

Based on Tables 2 and 3, no significant difference was observed between the two groups in the intervening variables.

Table 2) Comparison of the experimental and the control group (t-test)

Statistics Variable	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Mother Height	0.220	53	0.827	0.26	1.19

Table 3) Comparison of the experimental and the control group (Mann-Whitney U test)

Statistics Variable	Mann-Whitney U	Wilcoxon W	Z	Sig. (2-tailed)
Mother Age(Yrs)	345.500	670.500	-0.501	0.616
Mother Weight (Kg)	370.000	695.000	-0.085	0.933
BMI($Kg.m^{-2}$)	365.500	690.500	-0.161	0.872

Duration of the first (active) stage of labor

Mann-Whitney U test was applied to compare the groups in terms of the duration of the active stage of labor. According to Tables 4 and 5 as well as Figure 1, there was a significant difference between the experimental group and the control group in the duration of the active stage of labor ($p = 0.002$).

Table 4) Ranks in the experimental and the control group

variable	group	N	Mean Rank	Sum of Ranks
active stage of labor	control	21	28.67	602.00
	Experimental	23	16.87	388.00
	total	44		

Table 5) Mann-Whitney U test statistics

Statistics Variable	Mann-Whitney U	Wilcoxon W	Z	Sig. (2-tailed)
active stage of labor	112.000	388.000	-3.057	0.002

Duration of the second stage of labor

Mann-Whitney U test was applied to compare the duration of the second stage of labor in the experimental and control groups. Considering Tables 6 and 7 as well as Figure 2, there was no significant difference between these groups in the duration of the second stage of labor ($p = 0.785$).

Table 6) Ranks in the experimental and the control group

variable	group	N	Mean Rank	Sum of Ranks
second stage of labor	control	21	21.95	461.00
	Experimental	23	23.00	529.00
	total	44		

Figure 1) Duration of the first stage of labor

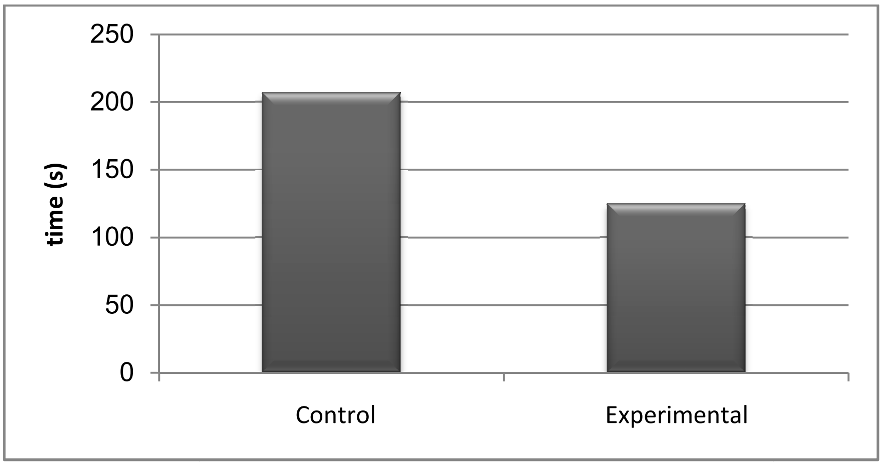
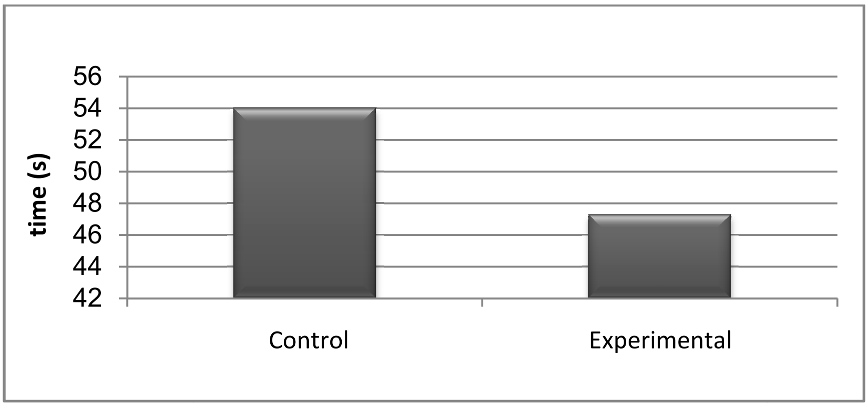


Table 7) Mann-Whitney U test statistics

Statistics Variable	Mann-Whitney U	Wilcoxon W	Z	Sig. (2-tailed)
second stage of labor	230.000	461.000	-0.273	0.785

Figure 2) Duration of the second stage of labor



Type of delivery

The data for this variable were measured based on frequency. Therefore, chi-square test was applied to compare the groups. Tables 8 and 9 and Figure 3 suggest that the frequency of Caesarean section is significantly lower in the experimental group ($p = 0.043$).

Table 8) Cross tabulation

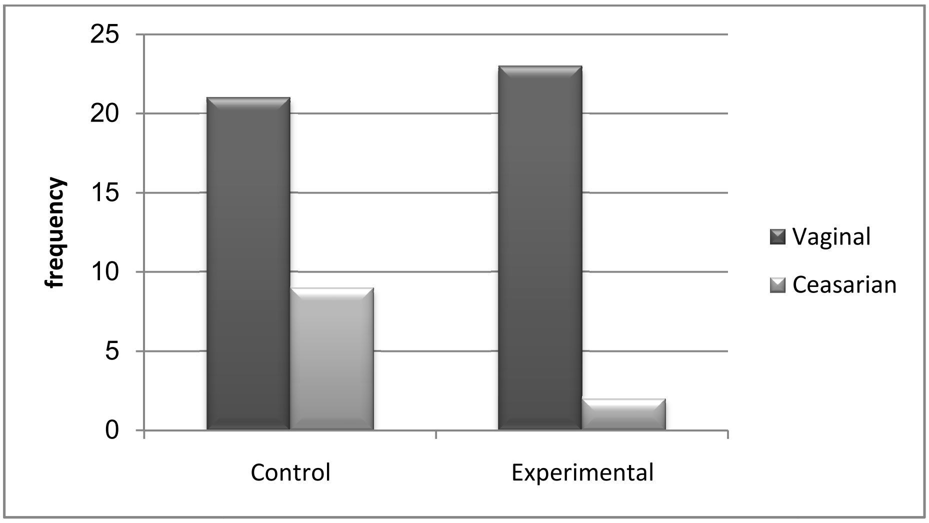
variable	Group	Delivery type		Total
		Vaginal	Caesarean	
frequency of Caesarean	Control	21	9	30
	Experimental	23	2	25
	total	44	11	55

Table 9) Chi-Square Tests

Statistics	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.125[a]	1	.042		
Continuity Correction[b]	2.865	1	.091		
Likelihood Ratio	4.454	1	.035		
Fisher's Exact Test				.051	.043
Linear-by-Linear Association	4.050	1	.044		
N of Valid Cases	55				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.
b. Computed only for a 2x2 table

Figure 3) Frequency of type of delivery



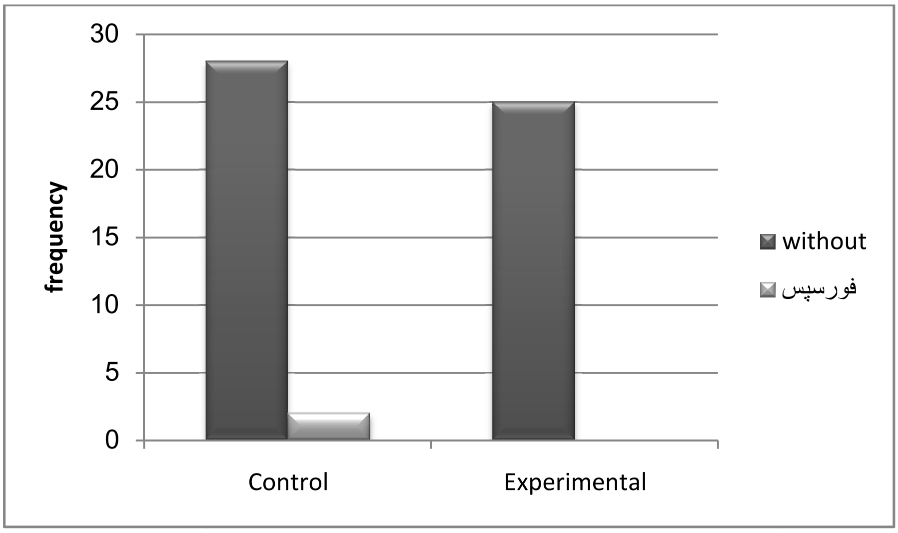
Instrumental vaginal delivery

This variable, too, was measured based on frequency. Thus, chi-square test was applied to compare the two groups in terms of the need for instrumental vaginal delivery. Considering the obtained significance level ($p = 0.188$), Tables 10 and 11 indicate the lack of significant difference between the experimental and the control group in frequency of instrumental vaginal delivery (Figure 4).

Table 10) Cross tabulation

Variable	group	Instrumental type		Total
		Without	Forceps	
frequency of instrumental vaginal delivery	control	28	2	30
	Experimental	25	0	25
	total	53	2	55

Figure 4) frequency of instrumental vaginal delivery



Birth weight

Due to non-normal distribution of birth weight for the experimental and the control group, Mann-Whitney U test was applied for making comparisons. Tables 12 and 13 show a significance level of 0.919, suggesting the lack of a significant difference between the two groups.

Table 11) Chi-Square Tests

Statistics	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.730[a]	1	.188		
Continuity Correction[b]	.350	1	.554		
Likelihood Ratio	2.487	1	.115		
Fisher's Exact Test				.495	.293
Linear-by-Linear Association	1.698	1	.193		
N of Valid Cases	55				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .91.
b. Computed only for a 2x2 table

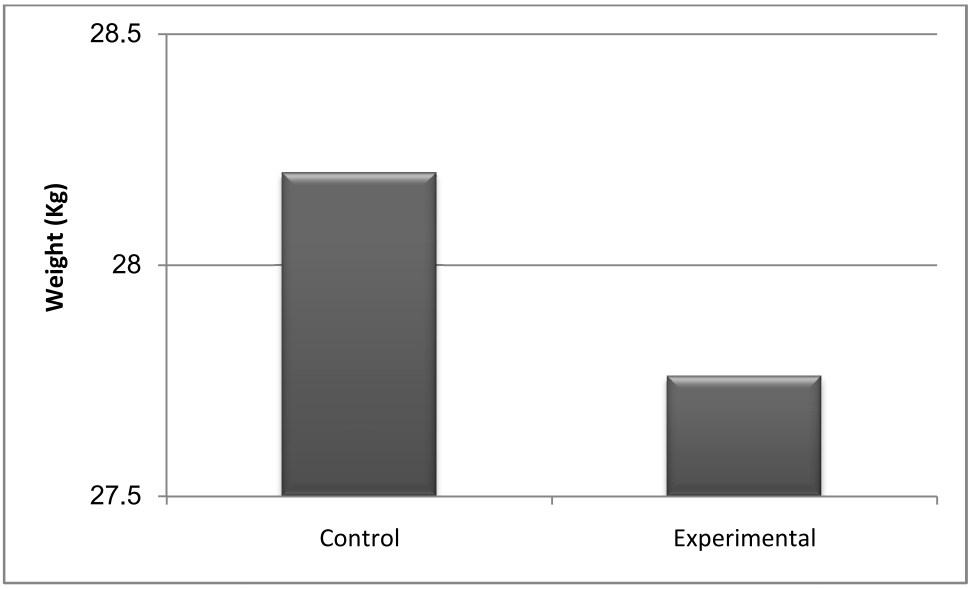
Table 12) Ranks in the experimental and the control group

variable	group	N	Mean Rank	Sum of Ranks
birth weight	control	30	28.20	846.00
	Experimental	25	27.76	694.00
	total	55		

Table 13) Mann-Whitney U test statistics

Statistics Variable	Mann-Whitney U	Wilcoxon W	Z	Sig. (2-tailed)
birth weight	369.000	694.000	-0.101	0.919

Figure 5) Birth weight



DISCUSSION

The results of the present research showed that the duration of the active stage of labor was significantly shorter in the experimental group. Moreover, Caesarean section was less frequent in the experimental group. However, no significant difference was observed in the duration of the second stage of labor, instrumental vaginal delivery, and birth weight.

Duration of the first and second stages of labor

Ghodsi and colleagues found that the duration of the active stage of labor was shorter in women who performed exercises during pregnancy [15]. However, Botkinet al., Melzer et al. and Forouhari et al. reported that exercise during pregnancy does not decrease the duration of the active stage, but influences the second stage of labor and that this stage is significantly shorter in the experimental group[8,10,16]. In another study, Kristinargued that aerobic exercise during pregnancy shortens pregnancy from the beginning of the active stage [9]. The research by Barakat et al., Kardelet al. , and Rice et al. found no significant relationship between exercise during pregnancy and duration of the first and second stages of delivery. Megann and colleagues came to the conclusion that high-intensity exercise during pregnancy is associated with longer delivery [9,17-19].

Clap and colleagues argued that physical exercise during the third trimester of pregnancy can positively affect the development of the cervix and coordination of uterine muscles [20]. One study showed the possible effect of exercise on prostaglandins, which play a significant role in preparing the uterus and thus shortening the duration of the active stage of labor [21]. One of the factors that shorten the second stage of labor is the voluntary contraction of abdominal muscles. The exercises included in the training protocol of this research involved abdominal and pelvic muscles, but due to the special condition of the subjects, these exercises were not strengthening and did not affect the strength of abdominal muscles. Regarding the effect of exercise on the duration of the second stage of labor, the reason for the inconsistency of the present finding and some studies is that the training experience of the subjects was not controlled and a questionnaire was used to evaluate the physical activity of the subjects during pregnancy.

Type of delivery and instrumental vaginal delivery

Regarding type of delivery and the need for instrumental vaginal delivery, the present findings were consistent with the results of Clapp et al. ,Bungumet al. , and Megann et al. [1,19-20]. However, the findings were inconsistent with the results of Kardel et al. , Baciuk et al. , and Barakat et al. [9,17,22]. The number of exercise sessions, absence of the subjects in introductory courses, and the use of questionnaire for evaluating physical activity during pregnancy may have affected the results. The reason for Caesarean section in the control group was to control preterm delivery due to urinary tract infection, pre-eclampsia, premature rupture of membrane, and fetal distress in the second stage of labor as well as the fear of vaginal delivery. The reason for Caesarean section in the experimental group was the transverse position of the fetus.

Birth weight

Regarding birth weight, the results of some studies are consistent with the present findings [9, 23-27]. Hickman found that performing exercise during pregnancy has no effect on fetal growth and other pregnancy outcomes [13]. Perkins and colleagues found that fetal growth is negatively related to exercise intensity [26]. Debra reported normal birth weight range in mothers who performed aerobic exercises during pregnancy [28]. Fleten and colleagues argued that exercise during pregnancy has little effect on birth weight, while the mother's BMI is a stronger predictor of birth weight [15]. Exercise variety, intensity, duration, and repetition, lack of control over the job-related activities of pregnant mothers, and changes in their weight are important factors that affect the results of these studies. The present research examined the job condition of the subjects, all of whom were housewives and had no other jobs.

Considering the results of the present research, it can be argued that healthy, non-athlete pregnant women can positively start the protocol from 12-14th week of pregnancy and continue it until the end of pregnancy. This protocol not only has no negative effect on fetal growth, but also shortens the active stage of labor and reduces the frequency of performing Caesarean section.

Acknowledgements

I express my gratitude of all the people who helped me in this study, including the esteemed dean of Torbat-e Heydarieh University of Medical Sciences and the hardworking personnel of the maternity section of Razi Hospital, especially Ms. Rafi'I and Gholizadeh who offered her sincere cooperation.

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