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# The effect of walking during late pregnancy on the outcomes of labor and delivery: A randomized clinical trial

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## Abstract:

**BACKGROUND:** Exercising during pregnancy has various benefits for the mother and the fetus, but there are controversial results about its effect on labor and delivery. Therefore, the present study was conducted to evaluate the effect of walking during late pregnancy on the outcomes of labor and delivery.

**MATERIALS AND METHODS:** The present randomized clinical trial was conducted on 102 pregnant women who were referred to the comprehensive health service centers of Rafsanjan and were selected using convenient sampling method and randomly were allocated into two groups from August 2018 to February 2019. The intervention group performed walking from the 34<sup>th</sup> week of pregnancy until the time of delivery 4 times per week, each time for 40 min. The control group just received the routine prenatal care. Information about the outcomes of delivery were gathered from the participants' medical files in the hospital and were analyzed using SPSS software version 22 and Chi-square and independent *t*-tests.

**RESULTS:** The results indicated that the Bishop score of the intervention group was significantly higher than the control group ( $P < 0.05$ ). Furthermore, regarding the duration of the third phase of delivery, spontaneous labor, induced labor, cesarean section, and instrumental delivery, a statistically significant difference was observed between the intervention and the control groups ( $P < 0.05$ ). There was no statistically significant difference between both the groups regarding the duration of the first and the second stages of delivery and Apgar score at 1<sup>st</sup> and 5<sup>th</sup> min ( $P > 0.05$ ).

**CONCLUSIONS:** Walking during late pregnancy could improve Bishop score, increase spontaneous onset of labor, and decrease induction, cesarean, and instrumental delivery without having any adverse effect on the neonate's Apgar score.

## Keywords:

Delivery, late pregnancy, outcome labor, walking

## Introduction

Despite the significant physiologic and anatomic changes during pregnancy, most of the pregnant women would benefit from exercising during this period. Evidence has shown the positive effects and harmlessness of physical activity during

uncomplicated pregnancies.<sup>[1]</sup> Physical activity and exercise during pregnancy is associated with improved quality of life of pregnant mothers<sup>[2]</sup> and is effective in decreasing the excess weight gain,<sup>[3]</sup> gestational diabetes,<sup>[4]</sup> preeclampsia,<sup>[5]</sup> varicose veins, deep-vein thromboembolism, lower back pain,<sup>[6,7]</sup> and fitness promotion.<sup>[8]</sup> It also has beneficial effects on the fetus,

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newborn, and during the next stages of this newborn's life.<sup>[9-11]</sup> In some studies, these benefits have also been observed in women who were prone to a complicated pregnancy. In the study of Shady *et al.*, walking by pregnant mothers who had overweight reduced the risk of preeclampsia, late delivery, and inappropriate weight gain.<sup>[12]</sup> In the study of Khoram *et al.*, the risk of preeclampsia and hypertension was reduced in pregnant women who were prone to pregnancy hypertension and performed walking during pregnancy.<sup>[13]</sup>

Concerns of some of the mothers regarding performing physical activity during pregnancy leading to abortion, stillbirth, intrauterine growth restriction, low birth weight, premature delivery, and harm to the fetus have not been confirmed in the studies.<sup>[14]</sup>

Although the benefits of exercise during pregnancy for the mother and the fetus have been approved in various studies, there are limited and controversial studies about its effects on the outcomes of labor and delivery. Owe *et al.* revealed that the chance of cesarean section was lower in nulliparous pregnant women who regularly and intensely exercised in comparison to nonathletic women.<sup>[15]</sup> In a review study by Davenport *et al.*, no significant relation was reported between prenatal exercising with induction of labor, duration of the stages of delivery, and type of delivery.<sup>[16]</sup> In the study of Sanda *et al.*, women who regularly exercised during pregnancy had a significantly longer first stage of labor and lower rate of emergency cesarean section in comparison to the control group.<sup>[17]</sup> In the study of Kondo *et al.*, the duration of the second stage of delivery in multiparous women who had more exercise during pregnancy was significantly shorter than multiparous women who exercised less during pregnancy. In this study, the duration of the second stage of delivery had no statistically significant difference in nulliparous women.<sup>[18]</sup> Li *et al.* concluded that walking during the 34<sup>th</sup> week of pregnancy was effective in reducing the chance of cesarean section. They also found a significant relation between walking with weight loss after delivery, labor pain, duration of labor, neonate's weight, and macrosomia.<sup>[19]</sup>

The choice of most of the pregnant women for exercise during this period is walking and in comparison to other physical activities, it has more benefits and less obstacles to performing during pregnancy.<sup>[20]</sup> Walking with moderate intensity would not increase fetal developmental disorder and placental uterine blood flow disorder and although the heart rate of the fetus might change during walking, there is no evidence regarding distress and undesirable fetal outcomes.<sup>[21]</sup>

Due to the sensitivity of pregnant women to the health of the fetus and the favorable effect of exercise on it,

therefore, they are more prepared to exercise during pregnancy.<sup>[22]</sup> On the other hand, most of the pregnant mother would prefer to use a nonmedicinal method during the last weeks of pregnancy for the spontaneous start of labor and facilitating vaginal delivery and although walking is one of the most commonly used methods by the mothers for this purpose, there is not sufficient amount of studies to support this method for improving the outcomes of delivery.<sup>[23]</sup> According to experiences of the researches, one of the repeated questions of the pregnant mothers with controversial answers from the experts is that "would walking facilitate vaginal delivery?" The reason for the controversial answers is the lack of an evidence-based answer and personalized deal toward the matter. Considering the limited and controversial studies regarding the effect of exercise during pregnancy on the process of delivery and also acceptability and appropriateness of walking as a physical activity during pregnancy, the present study was conducted to determine the effect of walking during late pregnancy on the outcomes of labor and delivery.

## Materials and Methods

In this randomized clinical trial, based on a similar study<sup>[24]</sup> and with  $\alpha = 0.05$  and  $\beta = 0.10$ , 102 eligible pregnant women were selected from the women who referred to the comprehensive health service centers of Rafsanjan from August 2018 to February 2019 using convenient sampling method, then they were assigned into two groups of intervention and control using simple randomization method [Figure 1]. The inclusion criteria were willingness to participate and written informed consent for participation, being Iranian, being 18–35 years old, not having a history of cesarean section, not having an indication for cesarean section and not requesting for elective cesarean section, not having a history of infertility, gestational age 34 weeks (based on the 1<sup>st</sup> day of the last regular menstruation or the ultrasound before the 20<sup>th</sup> week), cephalic presentation, not being an athlete, having decided to have the delivery in the educational medical centers of Rafsanjan, lack of absolute and relative contraindication to exercise according to the American College of Obstetricians and Gynecologists' Guideline,<sup>[1]</sup> not having any psychological diseases such as depression and anxiety, not consuming any psychotropic substances, and ability to walk. The exclusion criteria were unwillingness to continue the study, not performing the walking according to the plan for two consecutive times, mother's exposure to bad news or sudden and severe stress, occurrence of risky pregnancy factors, and incompleteness of the information in the medical files of the participants.

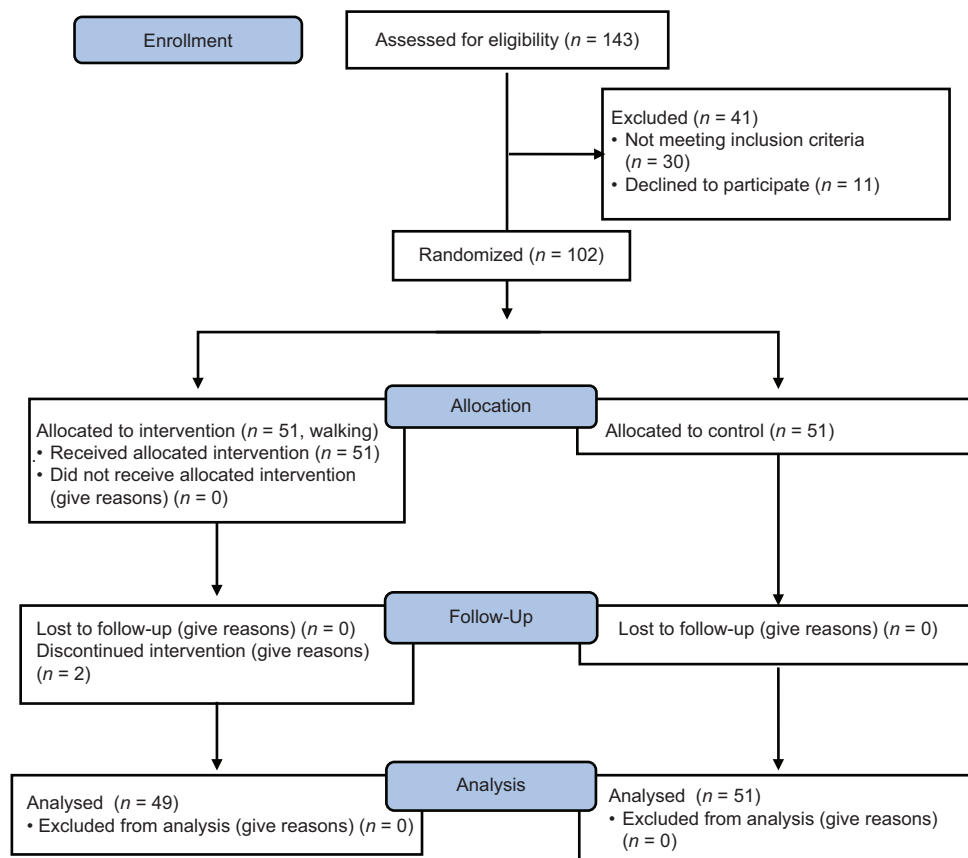


Figure 1: The consort diagram of the study

Participants of the intervention group, besides the routine prenatal care, performed the walking program from the 34<sup>th</sup> week of pregnancy until delivery 4 times a week each time for 40 min. The walking program was as follows: The first 5-min slow walking for warming up, then 30 min of walking with moderate intensity in a way that they could speak three words easily without a break while walking,<sup>[25]</sup> and then, again 5 min of slow walking to cool down. The control group only received routine prenatal care. To follow-up the walking program of the participants, weekly phone calls were made to the participants of the intervention group and also a checklist for the duration and the times of walking was given to them that would be checked during their next prenatal care visit. Consequently, two participants from the intervention group were eliminated due to not performing the walking program for two consecutive times [Figure 1].

Information gathering form included personal and fertility characteristics and delivery outcomes. Personal and fertility characteristics such as age, body mass index, number of pregnancies, number of deliveries, number of abortions, educational level, and occupation were completed at the beginning of the study, and delivery outcomes such as gestational age at the time

of admission for delivery, cause of visiting the hospital, Bishop score (total and simplified),<sup>[26,27]</sup> using or not using induction of delivery and augmentation of labor, duration of the stages of delivery, type of delivery, and Apgar score were extracted from the medical files of the participants after delivery and registered in the forms. In addition, the midwives who were in charge of admission and hospitalization in the sampling centers were asked to record all the five scales of the Bishop score, while the mothers were hospitalized during the study period.

Data were analyzed using SPSS (SPSS V.22 Inc., Chicago, IL, USA) and Chi-square test, independent *t*-test, and Fisher's exact test. Nonparametric Kolmogorov–Smirnov test was used to evaluate the normal frequency distribution of the quantitative variable. The level of significance was set at 0.05 for all the statistical tests.

This study was conducted with an ethics code of IR.RUMS.REC.1397.090. At the beginning of the study, written consents were obtained from all the participants participating in the project. Participants at each stage of the study could leave the study, and the implementation of the plan did not endanger the participants. The information obtained in this plan was confidential.

## Results

Kolmogorov–Smirnov test showed that quantitative variables had a normal distribution ( $P > 0.05$ ). According to the results, both the groups of intervention and control were similar regarding their age, body mass index, number of pregnancies, number of deliveries, number of abortions, educational level, and occupation ( $P > 0.05$ ) [Table 1].

There was a statistically significant difference between the intervention and the control groups regarding their Bishop score (total and simplified) at the time of admission for delivery ( $P < 0.001$ ) and mothers of the intervention group had a more prepared and appropriate cervix for delivery [Table 2].

According to the results, the duration of the third stage of delivery, spontaneous labor, labor induction, and type of delivery had a statistically significant difference between both the groups ( $P < 0.05$ ), in a way that in the intervention group, the duration of the third stage of delivery was shorter, spontaneous labor was more, vaginal delivery was more than cesarean section, and cases of induction with oxytocin were less. Instrumental delivery (vacuum) was more in the control than the intervention group. There was no statistically significant difference between both the groups regarding the duration of the first and the second stages of delivery, 1<sup>st</sup> and 5<sup>th</sup> min Apgar scores, and augmentation of labor with oxytocin ( $P > 0.05$ ) [Tables 3 and 4].

**Table 1: Comparing the demographic and fertility characteristics between the women in the intervention and the control groups**

Variable	Group, mean±SD (range)		t	Degree of freedom	P*
	Intervention (walking) (n=49)	Control (n=51)			
Mother's age (years)	25.12±4.37 (19-35)	25.31±4.72 (18-35)	-0.21	98	0.834
Body mass index (kg/m <sup>2</sup> )	23.70±3.72 (17.58-34.29)	24.73±4.22 (17.22-36.90)	-1.28	98	0.204

Variables	Subgroup	Group		Value of $\chi^2$	Degree of freedom	P**
		Intervention (walking) (n=49), n (%)	Control (n=51), n (%)			
Rank of pregnancy	Primigravida	30 (61.2)	32 (62.7)	0.02	1	0.876
	Multigravida	19 (38.8)	19 (37.3)			
Rank of delivery	Nulliparous	35 (71.4)	37 (72.5)	0.01	1	0.901
	Multiparous	14 (28.6)	14 (27.5)			
Abortion	Yes	6 (12.2)	6 (11.8)	0.00	1	0.941
	No	43 (87.8)	45 (88.2)			
Educational level	Under diploma	5 (10.2)	8 (15.7)	1.58	2	0.453
	Diploma	27 (55.1)	22 (43.1)			
	Higher than diploma	17 (34.7)	21 (41.2)			
Occupation	Housewife	44 (89.8)	45 (88.2)	0.06	1	0.803
	Employed	5 (10.2)	6 (11.8)			

\*Independent t-test, \*\*Chi-square test. SD=Standard deviation

**Table 2: Comparison between the mean and standard deviation of the total and simplified Bishop score of the intervention and the control groups at the time of admission for delivery**

Variable	Group, mean±SD		t	Degree of freedom	P*
	Intervention (walking)	Control			
Total bishop score	6.14±2.82	3.49±2.46	5.02	98	<0.001
Simplified bishop score	5.98±2.74	3.47±2.29	4.98	98	<0.001

\*Independent two-sample t-test. SD=Standard deviation

**Table 3: Comparing the quantitative outcomes of labor and delivery between the intervention and the control groups**

Variable	Group		t	Degree of freedom	P*
	Intervention (walking)	Control			
Duration of the first stage of delivery (min)	422.91±370.11	612.45±680.58	-1.53	70	0.132
Duration of the second stage of delivery (min)	33.30±34.47	45.96±47.50	-1.29	68	0.242
Duration of the third stage of delivery (min)	6.59±3.19	11.77±10.36	-3.09	68	0.019
First minute Apgar score	8.82±0.53	8.61±1.34	1.01	98	0.313
Fifth minute Apgar score	9.94±0.24	9.73±1.42	1.04	98	0.301

\*Independent two-sample t-test

**Table 4: Comparing the qualitative outcomes of labor and delivery in nulliparous women between the intervention and the control groups**

Variable	Group		$\chi^2$	Degree of freedom	P*
	Intervention (walking), n (%)	Control, n (%)			
Spontaneous labor					
Yes	45 (91.8)	30 (58.8)	14.53	1	<0.001
No	4 (8.2)	21 (41.2)			
Total	49 (100)	51 (100)			
Induction of labor					
Yes	10 (20.4)	24 (47.1)	7.91	1	0.005
No	39 (79.6)	27 (52.9)			
Total	49 (100)	51 (100)			
Augmentation of labor					
Yes	20 (40.8)	12 (23.5)	3.43	1	0.064
No	29 (59.2)	39 (76.5)			
Total	49 (100)	51 (100)			
<b>Type of delivery</b>	<b>Group</b>		$\chi^2$	Degree of freedom	P**
	Intervention (walking), n (%)	Control, n (%)			
Vaginal delivery	41 (83.7)	22 (43.1)	-	-	<0.001
Cesarean section	5 (10.2)	25 (49.0)			
Instrumental delivery	3 (6.1)	4 (7.8)			
Total	49 (100)	51 (100)			

\*Chi-square test, \*\*Fisher's exact test

## Discussion

According to the findings of the researchers, this is the first trial that has evaluated the effect of walking on various outcomes including the process of labor, especially preparation of the cervix, spontaneous beginning of the labor, and induction of labor along with the duration of stages of delivery.

Mother's exercise during pregnancy has various benefits without any undesirable effects for the mother, fetus, and the neonate.<sup>[28-30]</sup> However, few controversial studies have evaluated the effect of exercise on the process of labor and delivery, and hence, the present study is considered of great importance.

The results showed that pregnant women in the intervention group had a more prepared cervix and a higher Bishop score at the time of admission for delivery in comparison to the control group. Cervical ripening and its preparation for delivery is a strong predictive factor for spontaneous delivery or successful induction of labor<sup>[31]</sup> and many studies that have been conducted about medicinal and nonmedicinal methods for preparing the cervix before delivery have shown the importance of this matter.<sup>[32-34]</sup> In the presence of an unfavorable cervix, the possibility for the need to induce the labor and also its duration, the chance of other interventions, and the risk of failure in induction would increase and the possibility of vaginal delivery would decrease.<sup>[35]</sup> In the present study also, in the intervention that women had a more prepared cervix, the cases of induction and cesarean section were less than the control group. In the

previous studies conducted about the effect of exercise on the process of delivery, preparation of the cervix and Bishop Score were not evaluated and evaluation of these factors is one of the strengths of this study.

According to the results, there was a statistically significant difference between the walking and the control groups regarding the women who were referred to the hospital with spontaneous labor. From the theoretical point of view, the mother's physical preparation is effective at the beginning of the labor because it could stimulate many metabolic and hormonal changes that would stimulate uterus contractions and would make them easier to tolerate.<sup>[36]</sup> The results of the Pereira study also showed that walking during the term increases the spontaneous onset of labor and reduces the incidence of induction.<sup>[37]</sup> In the study of Portela *et al.* and Ferreira *et al.* also, the rate of spontaneous labor was higher among women who had physical activity during pregnancy than the control group.<sup>[38,39]</sup> Various studies have shown that pregnant women performed walking with this belief that walking would stimulate and start their labor pains.<sup>[23,40,41]</sup>

Spontaneous onset of the labor is of great importance and if delivery would not start spontaneously, women without the appropriate criteria would be admitted to the hospital. Not only would these women experience more obstetric interventions such as induction of delivery with oxytocin, instrumental delivery, epidural analgesia, and cesarean but also they would lose the chance to experience a physiologic delivery.<sup>[42]</sup> In the present study, women in the intervention group, who

had a higher rate of spontaneous onset of delivery than the control group, induction of delivery, instrumental delivery, and cesarean section were significantly lower than the control group.

Although the duration of the first and second stages of delivery was clinically significantly shorter in the intervention group than the control, the difference was not statistically significant. In a prospective cohort study by Gawade *et al.* 2009<sup>[43]</sup> and the study of Ruiz *et al.* 2013<sup>[44]</sup> also, no significant relation was observed between exercising during pregnancy and the duration of the second stage of the delivery. The results of the study by Taniguchi and Sato 2016, in line with the results of the present study, showed that in the group who performed walking in the house, although the total duration of the labor was shorter, no statistically significant difference was observed between the two groups of intervention and control regarding the duration of the different stages of delivery.<sup>[45]</sup> In a clinical trial by Li *et al.* (2014) that was titled "the effect of walking during late pregnancy on the outcomes of pregnancy in low risk primiparous women," the difference between the two groups regarding the time of labor was significant which is not similar to the present study.<sup>[19]</sup> Women in the study of Li *et al.* were primiparous, but in the present study, they were primiparous and multiparous and this difference might be the reason for the difference in the results. In the study of Kardel *et al.* (2009), exercising during late pregnancy led to a shorter duration of the labor.<sup>[36]</sup> The study of Perales *et al.* 2016 showed that following an exercise program during pregnancy would shorten the first stage of labor but has no effect on the second and third stages.<sup>[46]</sup> These differences in the results might be due to the gestational age at the time of starting the exercises and the type of exercises. The difference between the duration of the third stage of delivery in the intervention group and the control group was statistically significant, but in both the groups, the third stage of labor did not reach 30 min or more, which was considered as the long third stage.<sup>[47]</sup>

In the present study, delivery with vacuum and cesarean section had a statistically significant difference between the intervention and the control groups. This effect has been approved in many studies and there is less controversial regarding this issue, especially regarding the cesarean section.<sup>[15,27,48,49]</sup> In the study of Taniguchi and Sato (2016), the type of delivery had no statistically significant difference between inactive women who performed walking in the house 3 times a week for 30 min from the 30<sup>th</sup> week of pregnancy and the control group.<sup>[45]</sup> This different result might be due to the differences in the pregnant women and the difference in the type of walking. The mean of cesarean section in the developing and developed countries had a 27% rate of increase in 2013.<sup>[50]</sup> The rate of cesarean section in all the states of

America was reported as 32.8% in 2012 and 32.7% in 2013.<sup>[51]</sup> Along with the increase in the rate of cesarean section in most countries, complications such as the endometrium, infection of the area of surgery, especially the complications of superficial wounds, hemorrhage, injury to the pelvic organs, and thromboembolism disorders could be predicted.<sup>[52]</sup> It must be noted that cesarean section is usually performed for the benefit of the fetus, but it could not guarantee the fetal health. It has fetal complications such as respiratory distress, transient tachypnea of the newborn, sepsis, hypoglycemia, seizure, hospitalization in the neonatal intensive care unit, and mortality of the neonates.<sup>[53]</sup> Therefore, any factor that could decrease the increasing growth of the rate of cesarean section in the world could decrease the rate of maternal and fetal mortality and morbidity.

The present study showed that the 1<sup>st</sup>- and 5<sup>th</sup>-min Apgar scores of the intervention group were higher than the control group without a statistically significant difference which was in line with the results of the studies by Ghodsi and Asltooghi<sup>[54]</sup> and Memari *et al.*<sup>[55]</sup>

Researchers found no study that examined the effect of walking in late pregnancy on outcomes of labor such as Bishop scores and spontaneous onset of labor, and hence, the present study seems to be novel in this regard. One of the limitations of this study is that due to mothers referring to different times for delivery, it was not possible for a specific person to perform the first examination of all mothers to determine bishop score. According to the results of the present study, walking during late pregnancy could be an effective, safe, and acceptable method to achieve cervical ripening and spontaneous onset of labor. More studies in this field are required.

## Conclusions

According to the results of the present study, walking could be recommended to low-risk pregnant women to improve some of the significant outcomes of labor and delivery such as cervix preparation and Bishop Score, increasing the cases of spontaneous labor, and decreasing the cases of induction of labor and cesarean section without causing any undesirable effects on the neonate's Apgar score. Further studies in this field are required.

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## Conflicts of interest

There are no conflicts of interest.

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