

Original Article

The effect of exercise on childbirth in primiparous women: A clinical trial study

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ABSTRACT

Background & Aim: The process of delivery, from physiologic point of view, is similar to long exercises and decrease in physical activities is so common during pregnancy which could cause disruptions in the process of delivery. This study aimed to determine the effects of exercise on childbirth process among primigravid women.

Methods & Materials: This single-blind randomized clinical trial recruited 80 primigravid women in Damghan, 2013-2014. Simple random sampling method was used to select the participants, who were then divided into two equal groups of intervention and control. The intervention group received an 8-week regular walking program and the control group was only followed up. The childbirth process controls and administrative processes were similar for both groups. The data were collected after childbirth and analyzed using descriptive and inferential statistics (independent t-test, chi-square, and Mann-Whitney) in SPSS Version 22.

Results: Both groups were matched for demographic indicators. The results showed significant differences in active and latent-phase hospitalization ($P < 0.0010$, $\chi^2 = 14.05$), duration of the active phase ($P = 0.0020$), and the time interval between admission to initiation of the active phase ($P = 0.0020$). The time interval between the admission and the childbirth ($P < 0.0010$), and duration of hospitalization ($P < 0.0010$) between two groups. The natural childbirth rate was more in the intervention group ($P < 0.0010$, $\chi^2 = 21.33$).

Conclusion: Regular walking with appropriate intensity and duration during pregnancy was correlated with reducing the length of childbirth stages and natural childbirth. This safe method is recommended in healthy pregnancies.

Introduction

Delivery is a physiologic event which most women experience it with no complications (1). The natural process of child birth is called labor. Clinical labor includes three stages. The first stage has a latent flat phase and an active rapidly progressive phase. This stage would end by full opening of the cervix. The second stage starts with full opening of the cervix and ends by the birth of the infant and at the third stage placenta would be delivered (2).

Studies have shown that when labor pains start in pregnant women, they usually have problem in management of their pain and would prefer to admit to hospital before the start of the active phase of delivery (3). One of the most important assessments in midwifery is accurate assessment of the time of the start of delivery stages and the time of hospitalization (1). Admitting the mother during the latent phase, due to its long duration and consequently prolonged hospitalization could have undesirable mental affects for the mother and her companions and could lead to heavy financial loads for the patient, prolong occupation of hospital beds and imposition of great costs on the health-care system. Fur-

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thermore, the physician would be under pressure by different matters and the odds for making the decision to perform a cesarean section would be increased (4). Prolonged labor would cause muscle exhaustion, increased rate of uterine infections, cesarean section, mental distress, mother's insomnia, fetal distress and increased rate of fetal and infant mortality (5). Bailit et al. (6), Gharoro et al. (7), Rahnama et al. (8) and Sehhati Shafaei et al. (9) in their studies by comparing women who have been hospitalized during their latent and active phase indicated that early hospitalization and prolonged latent phase are the reasons for problematic delivery and increased chance of cesarean section. There are some non-medicinal interventions that would decrease the duration of delivery and medical interventions during labor. Regular exercise regardless of age and physical condition has desirable effects on improvement of individual's mental condition including the states of anxiety, decreasing nervous disorders, mood enhancement, improvement of blood circulation to muscles, strengthening and more efficiency of muscles and transmission and consumption of oxygen (10).

Studies have shown that regular aerobic exercises during pregnancy would increase mental health and sense of peace, decrease back pain, decrease anxiety, maintain or improve physical fitness, increase the strength and integrity of pelvic muscles, strengthen abdomen muscles, decrease the duration of labor and midwifery intervention during labor, decrease pregnancy poisoning, decrease pregnancy diabetes, decrease the chance of cesarean section, relieve nausea and insomnia, decrease leg cramps, and prevent inappropriate weight gain (10-14). Providing a new pattern for caring of pregnant mothers requires paying attention to pregnancy exercises and appropriate physical activity during pregnancy (15). Knowledge about physical activity during pregnancy has been evolving during the past 50 years and there are sufficient evidences on supporting the improvement of physical activities to a moderate level before delivery for the health of the mothers (16). Labor pain is a personal marathon for pregnant women. If pregnant women would like to be in their best condition during their pregnancy and overcome the imposed stresses on their bodies, due to the development process of embryo, they should maintain or improve their physical condition. Exer-

cising could improve the power, strength, and endurance of abdomen and pelvic muscles. These three factors could help pregnant women with carrying their weight and preparation for tolerating physical stress and labor pain (17). Nascimento et al. (18) by evaluating the pattern of physical activity in 1279 pregnant women stated that about half of the women would stop their activity during pregnancy and the lowest rate of exercising during the 1st month was 13.6% and during the 3rd month was 13.4%; hiking and aerobics were the two most common exercises. Studies about exercising during pregnancy have shown that the most appropriate exercise during pregnancy are aerobic exercises jogging, swimming, cycling, and light exercises. Exercising up to the level of physical fitness and moderate strength trainings are acceptable in a range before reaching maximum power (19, 20). Hiking, as a light, joyful and safe aerobic exercise during pregnancy has been more recommended than other exercises. Existing statistics indicates pregnant mothers', physicians' and sport specialists' more tendency toward this exercise during pregnancy; in a way that hiking is considered the perfect choice for beginners to increase aerobic capacity (12). Therefore, this study was conducted to evaluate the effect of 8 weeks of regular hiking on labor process of nulliparous women.

Methods

This study was a two-group single blind (midwifery personnel and administrative personnel of admission and discharge were blinded) clinical trial that was conducted on 80 pregnant women of 20-35 years old who referred to private offices of obstetricians and gynecologists (four offices) and all the health centers (four centers) of Damghan February to July 2014. The sample size was calculated to be 80 after preliminary studies and reviewing similar studies and according to Cochran's formula (two groups of case and intervention each containing 40 participants). Samples were randomly allocated to the case and the intervention group using simple randomization method (2:2) and for hiding, numbers' container was used. Study environment was Velayat Hospital of Damghan and sampling was continuous and through referral by obstetricians and gynecologists and centers' midwifery personnel to

the researcher. Sampling was continued until 80 participants were selected (Figure 1). The inclusion criteria were having a singleton pregnancy, being a housewife, having cephalic presentation, being healthy, being aged from 20 to 35 years, having Iranian nationality, not being an athlete, having a moderate range of physical activity, being in the range of normal weight or higher, being a resident of Damghan and intending on having their delivery at Velayat Hospital of Damghan. Exclusion criteria were occurrence of any contraindications of exercising during pregnancy, mother's unwillingness to continue the study and researcher's opinion about cutting the communication due to incorrect or

irregular performance of the exercise protocol. To prevent sample loss and integration of duration of aerobic activity of walking, gestational age of 28 weeks was considered for all participants and since sampling at the same time was not possible, sampling was conducted during 5 months continuously. After sampling, at each stage, while observing the provisions of the Helsinki declaration, informed consent was obtained from all samples before their allocation to the intervention and control groups and after group allocations, permission for participation in exercise protocol was obtained from the physician for the intervention group.

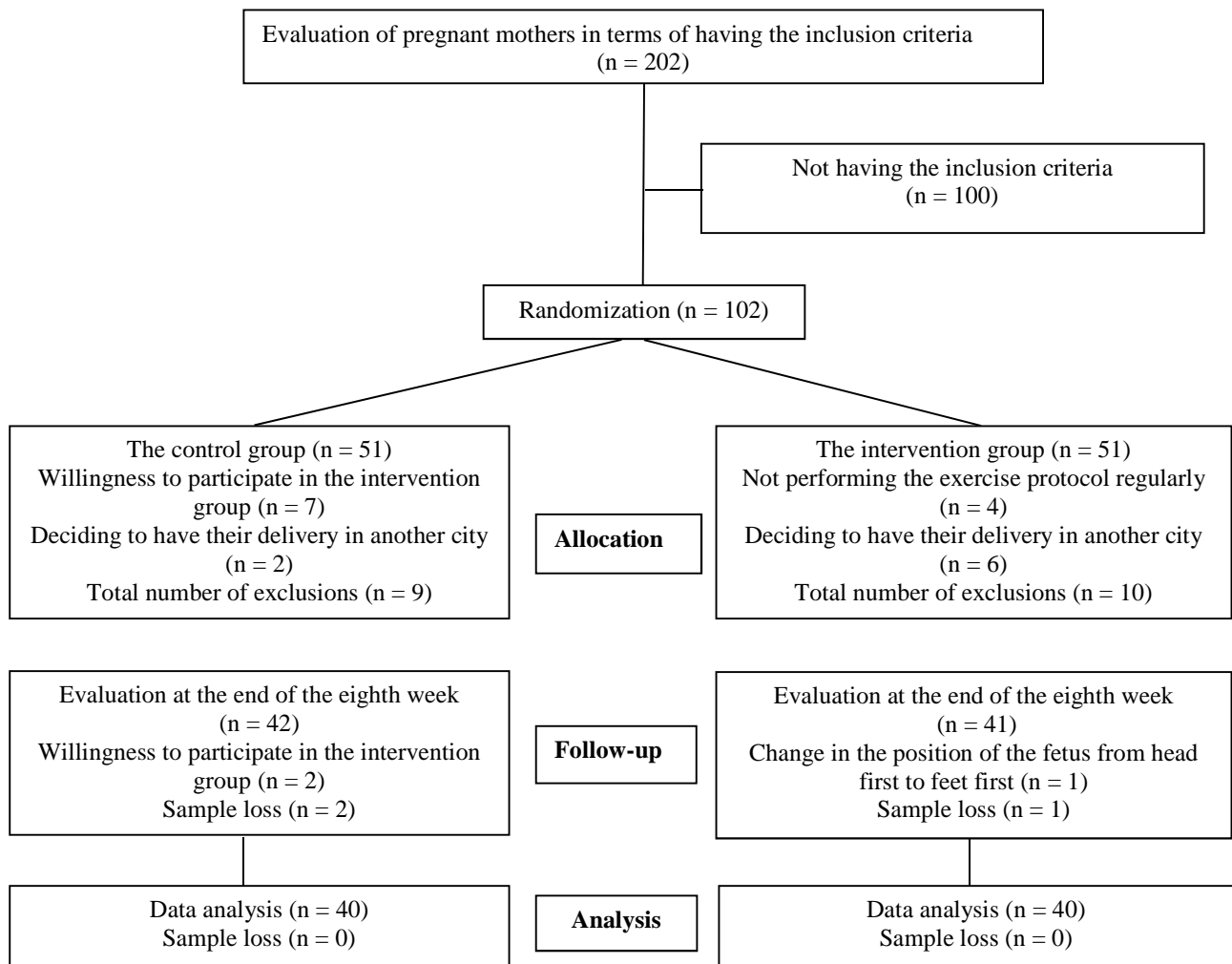


Figure 1. The CONSORT diagram for this study

Data gathering tools were two questionnaires. First questionnaire was about demographic characteristics such as age, educational level, weight, height, and the history of pregnancy including: date of the 1st day of the last menstrual period, probable date of birth and history of consumption of routine drugs during pregnancy. The second questionnaire was about the process of delivery and information about mother's hospitalization (date and time of hospitalization and discharge from hospital and delivery phase at the time of admission to hospital). Duration of active phase, the interval between admission to hospital and start of active phase, the interval between admission to hospital and the end of delivery, the interval between admission to discharge and the type of delivery were determined using partograph form and mother's admission file. The start of active phase was considered at 4 cm dilatation and the time of delivery for both vaginal delivery and cesarean was the time of birth. Validity of this questionnaire was approved by experts through content validity and its reliability was approved at the time of filling the questionnaire using equivalent inter-related method. Recording the stages of delivery in the intervention and the control group and completing partograph form were all similarly performed according to state's instructions of clinical guide to perform natural deliveries and caring at maternity wards was performed by two midwives and under supervision of a gynecologist; admission time and discharge time, regardless of physician's order, were considered as the time that was mentioned in patients' files. The process of admission and discharge was similar for all the partici-

pants and conducted at the same office at a predetermined time. The midwives who controlled the process of labor and completed partograph form, the gynecologist who controlled the process of labor and the administrative personnel of admission and discharge office were all unaware of the project and its participants.

Intervention protocol included: (1) Training the right method of hiking during pregnancy (intensity, duration, and repetition), (2) training safety tips during exercising and paying attention to warning signs, (3) training the methods of warming up and cooling down before and after exercising, (4) providing an exercise protocol and training it face to face to groups of 6 to 8, (5) Monitoring the method of intervention execution once a week. All of the intervention programs including trainings, execution and monitoring were performed by the main researcher. The exercise protocol included 3-5 minutes of warming up and hiking, based on the principle of increase load (21), 3 times a week. The duration of hiking was 10 minutes at the 1st week, 20 at the 2nd week and 30 from the 3rd week forward and after each hiking 3-5 minutes of cooling down was performed; the duration of exercise protocol was 8 weeks (Table 1). Participants of the control group only performed their daily activities and had no exercise protocol and were followed up by the researcher through phone calls once a week. Based on a study by van Raaij et al. (21) titled "energy cost of walking at a fixed pace and self-paced before, during and after pregnancy," mothers were responsible to select their own pace for hiking (self-selected walking) in a way that they could talk easily (talk test).

Table 1. Exercise protocol for the intervention group

| Month of pregnancy | 1 st week | 2 nd week | 3 rd week | 4 th week |
|-----------------------|----------------------------|----------------------------|---|---|
| 1 st month | 3-5 minutes of warm up | 3-5 minutes of warm up | 3-5 minutes of warm up | 3-5 minutes of warm up |
| 1 st month | 10 minutes of slow walking | 15 minutes of slow walking | 25 minutes of hiking | 30 minutes of hiking |
| 1 st month | 3-5 minutes of cool down | 3-5 minutes of cool down | 3-5 minutes of cool down | 3-5 minutes of cool down |
| 2 nd month | 5 th week | 6 th month | 7 th month | 8 th month |
| 2 nd month | 3-5 minutes of warm up | 3-5 minutes of warm up | Similar to the 4 th , 5 th and 6 th week | Similar to the 4 th , 5 th and 6 th week |
| 2 nd month | 30 minutes of hiking | 30 minutes of hiking | Similar to the 4 th , 5 th and 6 th week | Similar to the 4 th , 5 th and 6 th week |
| 2 nd month | 3-5 minutes of cool down | 3-5 minutes of cool down | Similar to the 4 th , 5 th and 6 th week | Similar to the 4 th , 5 th and 6 th week |

Table 2. Demographic characteristics of the participants of the control and the intervention group

| Characteristics | Intervention | Control | P |
|---------------------------|--------------|--------------|--------|
| Age (year) [Mean ± SD] | 25.17 ± 3.03 | 25.77 ± 3.47 | 0.0413 |
| Educational level [N (%)] | | | |
| Under diploma | 1 (2.5) | 3 (7.5) | 0.2520 |
| Diploma | 10 (25) | 15 (37.5) | |
| Associate degree | 14 (35) | 7 (17.5) | |
| Bachelor's degree | 15 (37) | 14 (35) | |
| Master's degree | 0 (0) | 1 (2.5) | |
| BMI range | | | |
| Normal | 25 (62.5) | 20 (50) | 0.1680 |
| Overweight | 12 (30) | 19 (47.5) | |
| Grade 1 obesity | 3 (7.5) | 1 (2.5) | |

SD: Standard deviation, BMI: Body mass index

This study was registered at the Iranian Registry Clinical Trials under the code IRCT2014100119351N1.

Data analysis was conducted in two parts of descriptive and inferential. To describe the data, central tendency index (mean), dispersion indices (standard deviation) and also tables and diagrams were used. For inferential analysis of the data, chi-square test (chi-square test was used to compare the absolute frequency of educational level and body mass index (BMI) range variables and chi-square test of independence was used to evaluate the relation of each variable between the both groups of control and intervention), independent t-test (to compare the age of participants between the control and the intervention group) and Mann-Whitney test (to compare the main variable of the study between the control and the intervention group in case the defaults of independent t-test were not met) were used. All the analyses were conducted using SPSS (version 22; SPSS Inc., Chicago, IL, USA) and the significant level was set at $P < 0.0500$.

Results

This study was conducted on 80 nulliparous

pregnant women who were allocated into two groups of control and intervention each containing 40 participants. Results showed that demographic characteristics of both groups including age, educational level, and BMI were homogeneous and no significant difference was observed between them (Table 2).

Since the defaults for normal distribution of data were not met in study groups for any of the interval between admission and start of the active phase, the interval between admission and the end of the delivery, the interval between admission and discharge from hospital and the duration of active phase variables, for comparing the mentioned variables between the intervention and control group, non-parametric Mann-Whitney test was used. Table 3 shows the characteristics of admission to hospital timeline and the process of labor (the interval between admission and start of the active phase, the interval between admission and the end of the delivery, the interval between admission and discharge from hospital and the duration of active phase) in the participants of both groups (control and intervention) and the results of Mann-Whitney test.

Table 3. The mean ± SD of the labor's timeline characteristics in the study groups

| Variables | The interval between admission and start of the active phase (minute) | The interval between admission and the end of the delivery (minute) | The interval between admission and discharge from hospital (minute) | The duration of active phase (minute) |
|--------------|---|---|---|---------------------------------------|
| | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD |
| Group | | | | |
| Intervention | 379.910 ± 315.490 | 55.640 ± 75.391 | 2187.750 ± 678.394 | 329.860 ± 220.682 |
| Control | 1140.000 ± 1069.329 | 1296.500 ± 1018.811 | 3667.500 ± 1614.846 | 451.300 ± 187.890 |
| P value | 0.0020 | < 0.0010 | < 0.0010 | 0.0020 |

SD: Standard deviation

Table 4. Comparing the frequency of variables between the intervention and the control group

| Variables | Group | | χ^2 test |
|--|-----------|--------------|---------------|
| | Control | Intervention | |
| | N (%) | N (%) | |
| Phase at the time of admission to hospital | | | |
| Latent | 35 (87.5) | 28 (70) | < 0.0010 |
| Active | 5 (12.7) | 12 (30) | |
| Sum | 40 (100) | 40 (100) | |
| Type of delivery | | | |
| Natural | 14 (35) | 34 (85) | 0.0010 |
| Caesarean | 26 (65) | 6 (15) | |
| Sum | 40 (100) | 40 (100) | |

Results of table 3 shows that in all four variables of the interval between admission and start of the active phase, the interval between admission and the end of the delivery, the interval between admission and discharge from hospital and the duration of active phase the difference between the intervention and the control group was significant ($P < 0.0500$).

According to table 4, 30% of the intervention group and 12.5% of the control group were admitted to hospital during their active phase and this difference was significant. The rate of natural delivery was 85% in the intervention group and 35% in the control group which their difference was significant (Table 4).

Discussion

In this study, exercise intervention program could cause a positive and significant relation between regular performance of an aerobic exercise like walking and the appropriate time of hospitalization, type of delivery and variables like the interval between admission and the start of active phase, the interval between admission and the end of delivery, the interval between admission and discharge from hospital and the duration of the active phase. Many of the mothers in the intervention group who were admitted to hospital during their active phase had natural deliveries and the duration of their hospitalization was shorter; mothers of the control group, who were mostly admitted during their latent phase, had longer hospitalizations and more cesareans. Results of this study in this regard were similar to the results of Rahnema et al. (8), Jackson et al. (23), Bailit et al. (6),

Gharoro et al. (7) and Sehhati Shafaei et al. (9). They also revealed that admission during active phase would increase the chance of spontaneous vaginal delivery among low-risk women. The duration of the first stage of delivery in the intervention group was 329.800 ± 220.682 minutes and in the control group was 451.300 ± 187.890 minutes. Perales et al. (24) in a similar study, after conducting an exercise intervention for 55 60-minute sessions, reported that the first stage of delivery in the intervention group was 389.60 ± 347.64 minutes and in the control group was 515.72 ± 353.36 minutes ($P = 0.0200$). Difference in the start time of the exercise intervention, type of the exercise, parity, volume, intensity and duration of the exercise, mother's physical fitness, genetic factors and mother's economic, social and mental conditions could affect the results differently.

Maharana et al. (25) in a study that was conducted on healthy pregnant women in India showed that performing yoga daily for an hour from the 20th week of pregnancy could affect all the stages of delivery and decrease the duration of its stages; in a way that the first stage of delivery among women who had practiced yoga was only 4.71 ± 0.59 minutes. Regarding the effect of exercise on variables of the interval between admission and the start of active phase, the interval between admission and the end of delivery, the interval between admission and discharge and duration of the active phase, the difference between both groups was significant and the duration of mother's hospitalization,

duration of active phase and the interval until the start of labor in mother were significantly lower in the intervention group. The duration of active phase in the intervention group was 329.860 ± 220.682 minutes and in the control group was 451.300 ± 187.890 minutes. The difference between both groups in the interval between admission and the end of delivery was 163 hours, in the interval between admission and the start of active phase was 10.8 hours and in the interval between admission and discharge was 225 hours.

These results were similar to the results of studies by Ajori et al. (26), Ghodsi and Asltoghiri (27), Sehati Shafaei et al. (9), Beckmann and Beckmann (28), Salvesen et al. (29) and Szumilewicz et al. (30). These mentioned studies have each used a type of physical exercise and have proven that physical activity during pregnancy would decrease the duration of active phase, increase the chance of vaginal delivery, decrease obstetric interventions, decrease the duration of hospitalization, decrease the chance of caesarean section and decrease the duration of hospitalization during the latent phase and the only difference between these studies were in their durations. However, these results were not similar to the results of Greulich and Tarrant (31) who mentioned that hiking during pregnancy had no effect on impairment or improvement of the labor process but could decrease pregnant women's perception of pain as a calming activity. In fact, the mentioned durations were all affected by the type of delivery and the phase of delivery at the time of admission to hospital; in Iran, the duration of mother's hospitalization in natural deliveries is 24 hours and in cesarean sections is 48 hours and mothers who were hospitalized during their active phase mostly had natural delivery. Many studies about the type of delivery have shown that appropriate physical activity during pregnancy by positively affecting physical fitness and increasing muscle efficiency during preg-

nancy would increase the rate of natural delivery; in the present study also the rate of natural delivery was higher in the intervention group compared to the control group and these results were similar to the results of Sabbaghian Rad and Jahanshiri (32) and Zand and Zamani (34) but were not similar to the results of Haj Kazemi et al. (33). Haj Kazemi et al. (33) stated that performing exercise had no effect on the type of delivery. The reasons for this difference could be the differences in the method of performance and exercise protocol (intensity, duration, repetition). Performing exercise with more duration and repetition, higher physical fitness and enhancing trainings' adaptabilities for pregnant mothers would be effective on shortening the stages of delivery and performing a natural delivery by causing positive effects on aerobic capacities and muscle fiber which are effective in the course of delivery.

Bungum et al. (35) in a study that was conducted on two groups of inactive (93 participants) and active (44 participants) calculated the relative chance and stated that active women had a 2.05 times less chance for having cesarean section compared to inactive women. The nature of hiking, as an aerobic exercise, is to release natural anti-pains by decreasing tension, anxiety, fidgetiness, fear and excitement and increase patience and self-esteem; it is possible that in time admission of pregnant mother's to hospital has been under the influence of mentioned factors and this has consequently improved other time variables which were all affected by in time admission and hospitalization of the pregnant mother. Performing regular hiking after the 28th week of pregnancy, in a health pregnancy, could increase the rate of natural deliveries, decrease the complications caused by lingered hospitalization and decrease the rate of cesarean sections by helping mothers to admit to hospitals at an appropriate time. Therefore performing regular hiking based on the exercise protocol of this study could be a

general recommendation in healthy pregnancies and it is recommended to add a chapter to pregnancy classes under the title of training the correct method of regular hiking during pregnancy with appropriate intensity, duration and repetition to improve the quality of physical activity during pregnancy; also it is recommended to provide other protocols with different intensity, duration, repetition, and volume and starting different physical activities at different gestational ages and to provide more appropriate patterns to improve physical activities during pregnancy. One of the limitations of this study was the self-report system by the mothers of the intervention group and that it was not possible for the researcher to monitor all the aerobic exercises all the time.

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Conflict of interest

The authors declare no conflict of interest.

References

1. Gary C, Kenneth LJ, Steven BL, John HC, Larry GC, Katharine WD. Concise Williams obstetrics. Trans. Ebrahimiadib T. Tehran, Iran: Sobhan Publications; 2010. [In Persian].
2. Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, et al. Williams Obstetrics. 24th ed. New York, NY: McGraw-Hill Medical; 2014. p. 51, 162, 177, 961.
3. Marowitz A. Caring for women in early labor: can we delay admission and meet women's needs? *J Midwifery Womens Health* 2014; 59(6): 645-50.
4. Naghizadeh S, Sehati Shafaei F, Ghojzadeh M. Comparing the post partum hemorrhage based on hb and hct in women admitted in latent and active phase of labor. *J Urmia Nurs Midwifery Fac* 2013; 11(8). [In Persian].
5. Direkvand Moghadam A, Delpisheh A. Effect of increased intravenous hydration on duration of labor and outcome of pregnancy among nulliparous women: a randomized controlled trial. *Hayat* 2013; 19(3): 38-46. [In Persian].
6. Bailit JL, Dierker L, Blanchard MH, Mercer BM. Outcomes of women presenting in active versus latent phase of spontaneous labor. *Obstet Gynecol* 2005; 105(1): 77-9.
7. Gharoro EP, Enabudoso EJ. Labour management: An appraisal of the role of false labour and latent phase on the delivery mode. *J Obstet Gynaecol* 2006; 26(6): 534-7.
8. Rahnama P, Ziaei S, Faghihzadeh S. Impact of early admission in labor on method of delivery. *Int J Gynaecol Obstet* 2006; 92(3): 217-20.
9. Sehhati Shafaei F, Naghizadeh S, Gojazadeh M. Comparison of maternal outcomes in women admitted in latent and active phases of labor. *Iran J Obstet Gynecol Infertil* 2013; 16(53): 18-28. [In Persian].
10. Wilmore JH, Costill DL, LarryKenney W. Physiology of sport and exercise. Trans. Moeeni Z, Rahmaninia F, Rajabi H, Aghaalinejad H, Salami F. Tehran, Iran: Mobtakeran, Iran; 2008. p. 82, 639, 642. [In Persian].
11. Wang TW, Apgar BS. Exercise during pregnancy. *Am Fam Physician* 1998; 57(8): 1846-52.
12. Artal R, Lockwood CL, Fricker P, Barss VA. Exercise during pregnancy and the postpartum period [Online]. [cited 2016]; Available from: URL: <http://www.uptodate.com/contents/exercise-during-pregnancy-and-the-postpartum-period>
13. ACOG Committee opinion. Number 267, January 2002: exercise during pregnancy and the postpartum period. *Obstet Gynecol* 2002; 99(1): 171-3.
14. Zavorsky GS, Longo LD. Exercise guidelines in pregnancy: new perspectives. *Sports Med* 2011; 41(5): 345-60.
15. Office of Maternal Health, Ministry of Health and Medical education. The Country Guide for Gynecology and Infertility Services. 3rd ed. Tehran, Iran: Charsooye Honar; 2012.
16. Downs DS, Chasan-Taber L, Evenson KR, Leiferman J, Yeo S. Physical activity and pregnancy: past and present evidence and future rec-

- ommendations. *Res Q Exerc Sport* 2012; 83(4): 485-502.
17. Shakerinejad M. Exercise for pregnancy and after childbirth. Tehran, Iran: Golban Publications; 2015. [In Persian].
 18. Nascimento SL, Surita FG, Parpinelli MA, Siani S, Pinto e Silva JL. The effect of an antenatal physical exercise programme on maternal/perinatal outcomes and quality of life in overweight and obese pregnant women: a randomised clinical trial. *BJOG* 2011; 118(12): 1455-63.
 19. Zolfaghari M, Asadi Noghani AA. Maternal newborn nursing, Iran. Tehran, Iran: Boshra Publications; 2012. [In Persian].
 20. Danforce J, Scott R. Diseases of obstetrics and gynecology. Trans. Niroomanesh M. Tehran, Iran: Teimorzadeh Publications; 2003. [In Persian].
 21. McArdel WD, Katch FI, Katch VK. Exercise physiology. Trans. Khaledan A. Tehran, Iran: Samt Publications; 2011. [In Persian].
 22. van Raaij JM, Schonk CM, Vermaat-Miedema SH, Peek ME, Hautvast JG. Energy cost of physical activity throughout pregnancy and the first year postpartum in Dutch women with sedentary lifestyles. *Am J Clin Nutr* 1990; 52(2): 234-9.
 23. Jackson DJ, Lang JM, Ecker J, Swartz WH, Heeren T. Impact of collaborative management and early admission in labor on method of delivery. *J Obstet Gynecol Neonatal Nurs* 2003; 32(2): 147-57.
 24. Perales M, Calabria I, Lopez C, Franco E, Coteron J, Barakat R. Regular exercise throughout pregnancy is associated with a shorter first stage of labor. *Am J Health Promot* 2016; 30(3): 149-54.
 25. Maharana S, Nagarathna R, Padmalatha V, Nagendra HR, Hankey A. The effect of integrated yoga on labor outcome: a randomized controlled study. *Int J Childbirth* 2013; 3(3): 165-77.
 26. Ajori L, Masoumi M, Rahbari H, Ahmadi K. Prolonged latent phase: maternal and neonatal outcomes. *J Shahid Sadoughi Univ Med Sci* 2010; 18(1): 3-7. [In Persian].
 27. Ghodsi Z, Asltoghiri M. Effects of aerobic exercise training on maternal and neonatal outcome: a randomized controlled trial on pregnant women in Iran. *J Pak Med Assoc* 2014; 64(9): 1053-6.
 28. Beckmann CR, Beckmann CA. Effect of a structured antepartum exercise program on pregnancy and labor outcome in primiparas. *J Reprod Med* 1990; 35(7): 704-9.
 29. Salvesen KA, Stafne SN, Eggebo TM, Morkved S. Does regular exercise in pregnancy influence duration of labor? A secondary analysis of a randomized controlled trial. *Acta Obstet Gynecol Scand* 2014; 93(1): 73-9.
 30. Szumilewicz A, Wojtyla A, Zarebska A, Drobniak-Kozakiewicz I, Sawczyn M, Kwitniewska A. Influence of prenatal physical activity on the course of labour and delivery according to the new Polish standard for perinatal care. *Ann Agric Environ Med* 2013; 20(2): 380-9.
 31. Greulich B, Tarrant B. The latent phase of labor: diagnosis and management. *J Midwifery Womens Health* 2007; 52(3): 190-8.
 32. Sabbaghian Rad L, Jahanshiri A. Effect of a period of exercise during pregnancy on certain delivery parameters. *Euro J Exp Bio* 2013; 3(2): 78-85.
 33. Haj Kazemi E, Heidari M, Faizi Z, Haqqani H. The effect of exercise during pregnancy on pregnancy outcome. *Iran J Nurs Midwifery Res* 2000; 13(25).
 34. Zand S, Zamani A. The effect of simple exercise maneuvers and proper performance of daily activity on outcome of pregnancy 2009. *Iran J Obstet Gynecol Infertil* 2009; 12(3): 51-7. [In Persian].
 35. Bungum TJ, Peaslee DL, Jackson AW, Perez MA. Exercise during pregnancy and type of delivery in nulliparae. *J Obstet Gynecol Neonatal Nurs* 2000; 29(3): 258-64.