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ORIGINAL ARTICLE

Effect of Aerobic Exercise of Walking on Weight and BMI During Pregnancy

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KEYWORDS

Regular walking;
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ABSTRACT: This study aimed to determine the effect of an 8-week regular walking on weight and BMI of primiparous women. This Field Trial was conducted on 80 healthy primiparous pregnant women aged between 20 and 35 yrs., housekeeper, non-athletic, with single pregnancy, BMI>19, from 28 weeks of pregnancy. The intervention group was assigned a regular 8-week exercise program, three times per week, each time 30 min with self-selected intensity in that mothers can talk while walking. The control group was only followed up. The results showed that the mean weight gain of women in the intervention group was less than that of the control group after the exercise period. This study is registered in the Iranian clinical trial system (Ref: IRCT201410011935INI). After the intervention, there was no significant difference between the intervention group and the control group in terms of the mean BMI. The result of Chi-square test showed that there was no significant relationship between the two groups in terms of weight gain. The rate of natural vaginal delivery was significantly more in the intervention group (P>0.05). There were no significant differences in weight, height, and head circumference of infants after birth between the two groups. Therefore, it is recommended that women perform correct and regular walking after 28 weeks of pregnancy with self-selected intensity to control weight.

INTRODUCTION

Weight gain during pregnancy is the result of a physiological process and a natural component of growth and development of mother and fetus. The increase is related to the growth of fetus, placenta and amniotic fluid, uterine tissue and increased volume and composition of blood and fat reserves and breast size [1].

American Institute of Medicine (IOM) and American College of Obstetrics and Gynecology (ACOG) presented a table based on the maternal body mass index was divided into four groups and determines the range of weight gain.

Weight gain for women over 19 yr in singleton pregnancy based on BMI is as follows: in underweight women with BMI less than 18.5 is between 12.5 and 18 kg, in normal-weight women with BMI between 18.5 and 24.9 is between 11.5 to 16 kg, and in over

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weight women with BMI between 25 and 29.9 is between 7 and 11 kg and in obese women with BMI greater than 30 is between 5 and 9.1 kg [2].

According to IOM's report, weight gain during pregnancy in different BMI groups was in the normal range only in one-third of pregnant women between 1990 and 2003. In the United States, 40% of women had normal weight and 60% of women were overweight in 2004-2007 (2), and 46% of women were overweight in 2003 [3].

In Sweden, weight gain during pregnancy is considered within recommended values in 30-40% of women. In Canada, 47%, 34% and 31% of women are underweight, normal weight or overweight and obese during pregnancy, respectively [4].

The prevalence of overweight and obesity in Iranian women is 33.7% and 15.8%, respectively, similar to European and American women [5]. Weight gain during pregnancy is below standard in 37%, above standard in 35% and within standard range in 28% of women [6]. The prevalence of obesity among pregnant women in Birjand and Isfahan is 24.8% and 11.2%, respectively [7]. Excessive weight gain of women during pregnancy leads to harmful and negative consequences, such as gestational diabetes, preeclampsia, cesarean section, fetal macrosomia (large for gestational age) and increased risk of obesity in early childhood [8]. During pregnancy, weight loss program is not recommended and if such a diet is selected, it is essential to carefully monitor the diet quality and prevent ketosis. A more practical measure is that weight gain in obese or overweight women will be limited by physical activity [2].

Some useful medical recommendations include encouraging women to have an optimal weight before pregnancy and change lifestyle during pregnancy, and have proper physical activity, if possible [9]. One of the most common beliefs about exercise during pregnancy is to control weight gain [10]. Therefore, to prevent too much weight gain in pregnancy, in addition to having a proper diet, it is emphasized to change the lifestyle and have appropriate physical activity during pregnancy [11].

There are advantages, disadvantages and risks associated with physical activity among people, but there are some special sports medicine considerations for pregnant women. As there are some limitations for human studies on exercise during pregnancy, the sports program should be conservative [12]. The benefits of exercise during pregnancy, reduced gestational diabetes, lower possibility of cesarean delivery, less pain, reduced anxiety and nausea, less insomnia, reduced leg cramps and prevention of disproportionate weight gain [13]. Pregnant women should exercise moderately for 30 min a day or most days of the week [14], while in Iran less than 25% of pregnant women exercise and 40-60% of pregnant women remain totally inactive [1]. Relaxation and low physical activity are considered more important than physical activity and many women decrease or stop exercising during pregnancy [1]. Numerous studies have examined the role of exercise during pregnancy in terms of intensity, duration, frequency, onset time, type of exercise and different social groups; however, there are fewer clinical trials studies on physical activity during pregnancy. Few studies have been conducted on exercise during pregnancy in Iran because few pregnant women exercise during pregnancy and provision of appropriate training programs accepted by obstetricians and sport experts requires a lot of study. Many sports common during pregnancy in other countries have no place in Iran. Walking is the most common sport activity of Iranian women during pregnancy (39%) [15].

Considering the need for documented local studies, this study aimed to evaluate walking during pregnancy with a new approach in terms of intensity, duration, frequency, distance and appropriate onset time and its effect on weight gain.

MATERIALS AND METHODS

This field trial study was conducted on primiparous women attending all obstetricians' private clinics and pregnancy care clinics in Damghan, Semnan Prov-

ince, Iran. Inclusion criteria included 20-35 yr of age, gestational age of 28 weeks, healthy, housewife, singleton pregnancy, non-athlete, BMI>19, education level of high school diploma and higher, living in Damghan, with proper nutrition and using pharmaceutical supplements (one iron tablet and one multivitamin capsule per day) and regular participation in eight training and monitoring sessions.

This study is registered in the Iranian clinical trial system (Ref: IRCT201410011935INI).

The exclusion criteria included mother's request not to continue, the incidence of one of the barriers to performing exercise during pregnancy and the researcher's opinion for excluding the subject due to not performing regular exercise protocol. As sampling was not possible at one time, it was conducted continuously over five months.

Pregnant mothers' demographics were similar and informed written consent was obtained from all subjects. In the intervention group, physician's permission was taken for the regular walking.

A large number of women were excluded because they were dissatisfied, and finally 80 qualified primiparous women were entered into the study from March, 2014 to July, 2014. The sample size was considered 80 women according to similar domestic and international studies.

Participants were selected randomly and divided into intervention and control groups. Each intervention group included 8 to 10 participants who participated in a regular aerobic exercise program of walking according to the principle of progressive overload; the control group was only followed up. The exercise protocol included 3-5 min stretching movements and warm up exercise, appropriate walking program, 15 min each time in the first week, 20 min in the second week, and 30 min from the third week onward and 3-5 min of cool down at the end. The walking exercise was performed thrice a week for eight weeks under the researcher's supervision using self-report system, paying attention to warning signs and observing safety precautions. Pregnant women's performance was monitored and evaluated by the researcher each week.

According to the study of Van Raaij, pregnant women were supposed to determine the intensity of walking (Self-Selected walking) [16]; so, they were asked to choose the intensity that they felt comfortable so that they could talk while walking (Talk-Test) [1, 17].

In both groups, BMI was calculated before pregnancy and 48 h after the intervention, so the weight gain range was determined. The instrument used in this study was weight gain chart for singleton pregnancy of Health Deputy of the Ministry of Health and Medical Education, Iran.

The data were collected in a researcher-made form and analyzed in SPSS-22 (Chicago, IL, USA) using chi-square test to determine the relationship between variables and one-way analysis of covariance to compare the post-test in both groups at significance level of 0.05.

RESULTS

The results of studies conducted on demographic characteristics of subjects showed that the mean age was 25.17 ± 3.03 yr in the intervention group and 25.77 ± 3.37 yr in the control group with no statistically significant difference between them ($t=0.413^{ns}$).

Education level was similar in both groups and there was no statistically significant difference between them ($\chi^2= 5.368^{**}$).

The rate of natural vaginal delivery was significantly more in the intervention group ($X^2=21.33^{**}$). There were no significant differences in weight, height, and head circumference of infants after birth between the two groups (Table 1).

Table 1. Mean and standard deviation of delivery and weight, height, head circumference of infants in intervention and control groups

Group	Intervention	Control	The results of Test
Normal Vaginal Delivery	87%	12.5%	X^2=21.33**
Cesarian Cection	35%	65%	X^2=5.36**

Group	Intervention (Mean ± SD)	Control (Mean ± SD)	P value
Weight	44.4±3.176	48.1±3.200	P=0.69
Height	52.32± 2.12	50.77± 2.087	P=0.941
Head circumference	34.60 ±1.5	33.35± 1.44	P=0.78

The mean and standard deviation of weight, BMI and the subjects' weight changes in both groups before and after the intervention show that after the training period, weight gain was less in the intervention group than in the control group (Table 2).

Table 2. Mean and standard deviation of weight, BMI and weight changes in intervention and control groups

Group		Weight	BMI	Weight changes
		Mean ± SD	Mean ± SD	Mean ± SD
Intervention	Pre-test	60.24±9.203	24.01±3.305	11.29±2.46
	Post-test	71.54±9.506	28.72±4.01	
Control	Pre-test	65.29±10.14	25.53±3.020	12.20±4.40
	Post-test	77.49±11.180	29.92±2.96	

Desirable and undesirable weight changes (less than expected) were more observed in the intervention group than in the control group. In contrast, undesirable weight changes (more than expected) were more in the control group. However, at the start of training, the weight of the study groups was different and the difference was examined. Table 2 shows the absolute and expected frequency in each groups in pre-test and post-test. In both pre-test and post-test, the absolute frequency of normal and desirable range is more in the intervention group; however, it should be examined whether or not the differences between the absolute frequencies of ranges mentioned in the table are due to the effect of group. So, chi-square test of independence was used separately to evaluate the assumption in pre-test and post-test.

In pre-test, as two cells from six cells had the expected frequency less than 5 and it formed 33.3% of table's cells, the pre-assumption of chi-square test of independence was not met. Thus, this problem was resolved by combining the categories of overweight and grade 1 obesity. The result of chi-square test of independence showed that there is no significant relationship between the group and the BMI range of pregnant women: (χ^2= 1.543)

Table 3 shows the result of chi-square test of independence in the post-test. According to chi-square statistics (χ^2=2.395), there was no significant relationship between group and weight gain range. These results suggest that the frequencies observed in the range of desirable, undesirable less than expected and undesirable more than expected are independent of groups (intervention and control).

Table 3. The results of chi-square test of independence in pre-test

	Value	df	Sig
Chi-square	2.395	2	0.302
Likelihood rate	2.434	2	0.296
Effect size (phi coefficient)	0.172		0.302

Since there was a significant difference between both groups in terms of BMI in pre-test (P<0.05), one-way analysis of variance was used to compare the post-test of two groups. Table 4 shows the results of one-way analysis of variance with control of pre-test to compare BMI of both groups in post-test.

Table4. The results of one-way analysis variance

Variable	Source	Type III sum of squares	Degrees of freedom	Mean square	F	Significance level
BMI	Modified model	437.804	2	218.902	29.768^{ns}	0.069
	Pre-test	408.710	1	408.710	551.580 ^{ns}	0.168
	Group	0.196	1	0.196	0.27 ^{ns}	0.169
	Error	673.572	78	7.353		

As Table 4 shows, the main effect of group is not significant. This means that there is no significant difference between the two groups in terms of BMI in post-test.

DISCUSSION AND CONCLUSIONS

Many factors contribute to weight gain during pregnancy, and along with factors such as mother's young age, increasing maternal birth weight, smoking cessation from 14-16 weeks of pregnancy, increased duration of nightly sleep and high consumption of seafood, we can also refer to reduced physical activity from 14-16 weeks of pregnancy and behaviors that lead to physical inactivity during pregnancy. Therefore, exercise is a factor that can prevent primiparous women's severe weight gain during pregnancy (18).

The results of this study are consistent with the studies conducted earlier in terms of the absence of significant difference in BMI after an exercise intervention, despite the difference in exercise duration and intensity and type of selected exercise (19-22).

Rochart et al., placed two groups of pregnant women in low-intensity and high-intensity walking training program and concluded that weight gain was not affected in the group with low-intensity walking, but weight was a little decreased in the group with high-intensity walking [23]. The difference between the results of this study and the findings of the above study is due to the intensity difference used. With increasing months of pregnancy and maternal weight gain, the pressure of exercise is reduced spontaneously and a self-selected intensity helps to continue physical activity during pregnancy and prevents weight loss.

A 50% increase in blood volume and a 20% increase in heart rate, especially in the second trimester of pregnancy, are physiological changes during this period. Therefore, the increased heart rate is not a good measure for the intensity of exercise during pregnancy and if the pregnant woman can continue the exercise as long as she can talk, it means that the exercise is of medium intensity [1]. In the United States that 4837 studies were reviewed on exercise during pregnancy and its effects on weight and significant reduction in weight gain during pregnancy in only 38% of interventions [24], it becomes clear that in addition to differences in the severity and duration, one of the main reasons for these differences is nutrition during pregnancy. Obstetricians emphasize more on the importance of proper nutrition during pregnancy com-

pared to appropriate physical activity in current planned pregnancies, especially in primiparous women, and in performing appropriate and controlled pregnancy care, so that pregnant women are referred to dietitians for weight control more than to sports experts; therefore, controlled diet food should be added to reasons for the lack of significant difference in BMI of pregnant women after intervention.

Pregnancy is an ideal time for positive lifestyle changes, including increased physical activity along with a healthy diet. In the absence of medical conditions, pregnant women should be encouraged to continue and maintain an active lifestyle during pregnancy. Regular aerobic exercises during pregnancy help to maintain or improve physical fitness, weight control and increased mental health. ACOG recommends that all pregnant women participate in aerobic exercises as a part of healthy lifestyle during their pregnancy and sedentary women should begin with 15 minutes of continuous exercise three times a week and exercise 4-7 times a week for 30 minutes with gradual increase in the frequency and duration of sessions [13]. It is suggested that an interventional study with simultaneous exercise and diet be conducted in Iran. The results of this study showed that regular walking of primiparous women with a self-selected intensity leads to optimal range of weight gain, suggesting that selecting the intensity could help take advantage of benefits of this convenient, amusing and easy physical activity during pregnancy. Therefore, it is recommended that proper walking with intensity, duration, frequency and appropriate regular time be trained in antenatal classes by trained and experienced teachers. In addition, it is necessary that aerobic activities be more emphasized in our current society in prenatal care for healthy pregnant women and sports experts be used in this regard to get an appropriate exercise program with intensity, duration, frequency and type of exercise.

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