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The effect of exercise during pregnancy on health-related quality of life and depression

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Abstract

Background and Objective: Exercise has different physical and psychological benefits and can help ameliorate women's physical and psychological changes during pregnancy. This study aimed to investigate the effects of exercise during pregnancy on women's weight gain, health-related quality of life (HR-QOL), and depression, and neonates' birth weight and type of childbirth.

Materials and Methods: One hundred women who referred to Mostafa Khomeini Hospital (Tehran) from December 2016 to November 2017 for prenatal care were included into this study and randomized into two groups: the case group (n=50) with women whom exercised for 60 minutes 3 times a week for 12 weeks and the control group (n=50) with no exercise. At baseline and after 12 weeks, both groups completed SF-36 and Edinburg questionnaires for assessing their HR-QOL and depression, respectively. The type of childbirth, neonate's birth weight, and women's weight after childbirth were recorded.

Results: The case group had a significantly lower mean ±SD weight gain after 12 weeks as compared with the control group (4.9±1.50 kg vs 6.50±2.47 kg) (P=0.007), and a lower rate of cesarean section (P=0.001). The mean ±SD of neonates' birth weight was not different between the two groups (P=0.89). The total scores of SF-36, physical and social dimensions, and general health improved in the case group, while significantly decreased in the control group (P<0.05).

Conclusion: Exercise during pregnancy can reduce cesarean section rate and results in less weight gain after pregnancy. It can also improve patients' HR-QOL and decrease depression. Therefore, it is suggested to be included in the prenatal care protocol.

Keywords: Exercise, Pregnancy, Quality of Life, Depression

1. Introduction

Pregnancy is an important period of women's life and is associated with several physical and psychological changes, which are not only important for woman's health during pregnancy and later in life (1), but also for the risk of diseases in the offspring (2). An important issue during pregnancy is excess maternal weight gain, which increases the risk of hypertensive disorders, preterm birth, cesarean delivery, and large for gestational age (3,4), and increases infants' birth weight, independent of genetic factors (5). Therefore, it is important to consider interventions reducing the risk of excessive weight gain during pregnancy.

In addition to physical changes during pregnancy, pregnancy can be associated with several psychological changes such as depression, which affects about 15-20% of women during and after pregnancy (6). Depression during pregnancy increases the risk of preterm birth and low birthweight (7) and is also associated with negative outcomes in the offspring (8). The changes during pregnancy, lack of social support, and financial problems may impair women's health-related quality of life (HR-QOL) (9, 10). Accordingly, it is important to pay attention to

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women's health status during pregnancy and implement strategies for improving their HR-QOL.

Exercise, defined as planned, structured, and repetitive subset of physical activity, improves physical fitness and overall health in all stages of life (11). It has also been suggested effective for preventing excessive weight gain during and after pregnancy (12,13). The American College of Obstetrics and Gynecologists (ACOG) suggests moderate-intensity aerobic exercise for at least 20-30 minutes per day on most or all days of the week (at least 150 min per week) (14). In addition to the beneficial physical effects, exercise has beneficiary effects on mental health (15) and can reduce depression and anxiety (16). Accordingly, exercise can be an appropriate option for improving the pregnant women's HR-QOL, as well (17,18). However, the optimal type, frequency, duration, and intensity of physical activity required for beneficial health outcomes during pregnancy are not yet well defined (19).

In the present study, we aimed to investigate the effect of 12-week supervised exercise during pregnancy on women's weight gain during pregnancy, HR-QOL, and depression using validated questionnaires, as well as neonates' birth weight and childbirth method as compared with a control.

2. Materials and Methods

2.1. Study design

Through a prospective case-control study, pregnant women who referred to Mostafa Khomeini Hospital (Tehran, Iran) from December 2016 to November 2017 for prenatal care were considered as the study population. Participants who had the following inclusion criteria were included in the study. Pregnant women, aged 18-40 years with singleton pregnancy and gestational age of 20-24 weeks, and normal body mass index (BMI) (18.5 29.9 kg/m2) and gave consent for participation into the study. Any pregnant women with any (absolute or partial) contraindication for exercise during pregnancy according to ACOG recommendations or had a positive history of routine exercise before pregnancy were not included into the study. Women with a positive history of preterm labor in previous pregnancy or symptoms of preterm labor in the current pregnancy were not included into the study. The study protocol was approved by the Ethics committee of Tarbiat Modares University (Ethics code: 1.1395.REC.TMU.I). The researcher explained the study objectives to the participants and asked them to read and write an informed consent. The sample size was calculated as 43 in each group based on the study by Tendais and colleagues [21], considering 95% confidence interval (95% CI) and a study power of 80%. Considering 20% chance of lost to follow-up, a total sample of 50 was considered as the final sample size for each group, resulting in a total sample of 100 participants. In the first step, the demographics data including age, ethnicity, height, weight, educational level, occupational, and exercise before pregnancy were recorded. The participant's BMI was calculated based on the recorded height and weight. Using sealed envelopes, the participants were randomized into two groups of intervention and control by 8 blocks, placing four participants in the intervention group and four participants in the control group. In the intervention group (N=50), women were trained and encouraged to exercise for 60 minutes 3 times a week for 12 weeks. The exercises started by 10 minutes warming up and walking, 15 minutes stretching and reinforcement exercises (at an extent that muscles and joints would not be overstretched), and ended by cooling down in the final 5 minutes. The exercise room had sufficient air and light and was near the WC, had sufficient number of chairs and equipment for exercise and rest. All participants could see each other and the trainer. Before and after each exercise, fetal heart was checked by fetal heart detector. The control group (n=50), women received no exercise intervention, while both groups received the same prenatal care including controlling their weight, BMI, BP, fetal heart sounds, and screening tests. The control group was matched with the intervention group for age, BMI, occupational and educational level person-by-person. Neither the patients, nor the research team could be blinded to the group allocations, however, the statistician analysed the data based on coded groups. Both groups were asked to complete two questionnaires before and 12 weeks after the intervention, including SF-36 questionnaire and the Edinburgh Postnatal Depression Scale (EPDS) for assessing their HR-QOL and depression, respectively. SF-36 questionnaire evaluates participant's HR-QOL in eight dimensions, including physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). The first four dimensions (PF, RP, BP, and GH) evaluate physical health and the latter four dimensions (VT, SF, RE, and MH) evaluate the participant's psychological health. Each scale is scored from 0-100, which 0 indicates the worst and 100 indicates the best status. The Persian version of SF-36 which validated previously (23), was used. Edinburgh Postnatal Depression Scale (EPDS) evaluates the individual's psychological status in the past 7 days by 10 questions; each question is scored from 0 to 3, resulting in a minimum score of 0 and maximum score of 30; scores above 12 confirms depression in the individual. All participants were followed up until childbirth and the type of childbirth, neonate's birth weight, and women's weight after childbirth were recorded and compared between the groups. Women who did not refer for follow-up visits and women with preterm birth were excluded from the study (Figure 1).

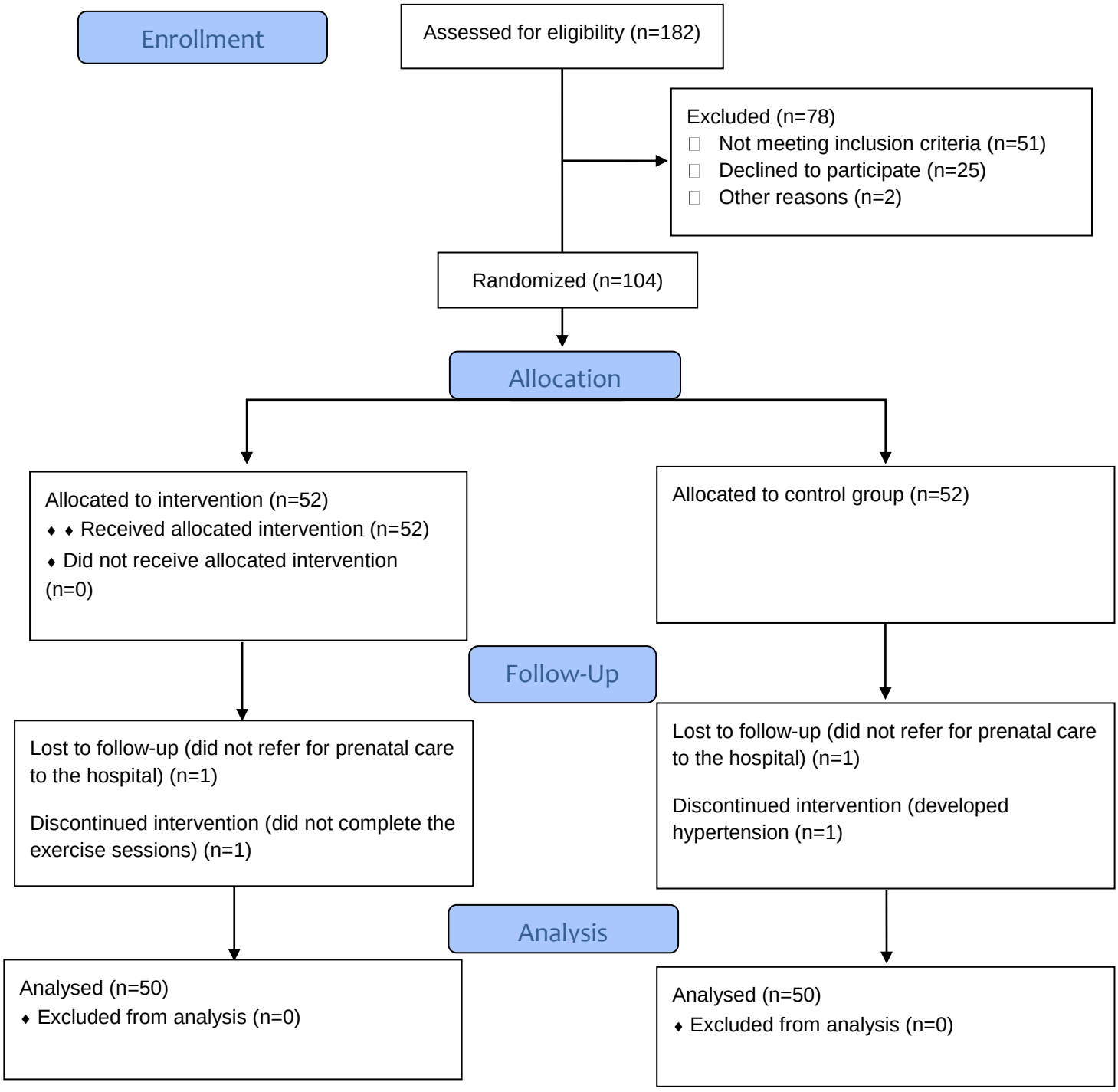

Fig 1. Flow diagram for study enrollment

2.2 Statistical analysis

First descriptive results were presented by mean ± standard deviation (SD) for quantitative variables and by frequency (percentage) for categorical variables. Kolmogorov-Smirnov (K-S) test was used to assess the normal distribution of data and continuous variables were compared between the intervention and control groups, using t test or Mann-Whitney U test, based on the results of K-S test on normal distribution of each. Categorical variables were compared between the groups by Chi-square test. All statistical analyses were performed by the statistical software IBM SPSS Statistics for Windows version 21.0 (IBM Corp. 2012. Armonk, NY: IBM Corp.). P values less than 0.05 were considered as statistically significant.

3. Results

A total of 50 women completed the study in each group, who had similar demographic characteristics, which confirmed that the groups were matched in terms of age, occupational, educational level, and BMI categories (Table 1).

Table 1. The results of comparing the frequency of demographic characteristics between the case and control groups

Variable	Category	Case group	Control group	P-value
Age (years)	18-20	5 (10%)	3 (6%)	0.19
	21-29	20 (40%)	29 (58%)	
	30-40	25 (50%)	18 (36%)	
BMI (kg/m^2)	Normal (18.5-29.9)	39 (78%)	30 (60%)	0.06
	Overweight (>30)	11 (22%)	20 (40%)	
Number of pregnancies	1	30 (60%)	24 (48%)	0.27
	2	16 (32%)	17 (34%)	
	≥3	4 (8%)	9 (18%)	
Gestational age (weeks)	-	21.11±0.78	21.12±0.73	0.95
Occupational status	Housewife	30(60%)	38(76%)	0.08
	Working	20(40%)	12(24%)	
Educational level	Under high school diploma	10(20%)	7(14%)	0.60
	High school diploma	16(32%)	20(40%)	
	Academic education	24(48%)	23(46%)	

Although the two groups were similar in baseline weight (62.14±5.98 kg in the intervention group vs. 64.45±7.98 kg in the control group; P=0.07), the intervention group had a significantly lower weight after 12 weeks compared with the control group (67.04±5.99 kg vs. 71.15±8.80 kg, respectively; P=0.007). The mean ±SD of weight gain during this period was 4.9±1.50 kg in the intervention group and 6.50±2.47 kg in the control group, which was statistically significant (P=0.001). The mean±SD of neonates' birth weight was not different between the intervention and control groups (3.18±0.23 kg vs. 3.19±0.29 kg, respectively; P=0.89). The frequency of cesarean section delivery was significantly higher in the control group, compared with the intervention group (62% vs. 40%, respectively; P=0.02). There was a significant difference between the groups in terms of change in the HR-QOL scores (Table 2).

Table 2. The results of comparing the mean and standard deviation of change in the health-related quality of life 12 weeks after the intervention compared to the baseline scores between the groups

Dimension/group	Intervention group	Control group	P-value
Physical functioning	8.70±17.80	-9.90±26.56	**<0.001**[*]
Role limitations due to physical health problems	11.50±28.21	1.47±39.25	0.09[†]
Role limitations due to emotional problems	3.33±29.54	-4.66±43.12	0.08[†]
Vitality	2.20±13.48	-2.00±18.95	0.20[*]
Mental health	1.76±9.80	0.48±10.67	0.53[*]
Social functioning	11.5±12.58	-5±20.97	**<0.001**[†]
Bodily pain	1.95±16.48	-3.15±20.97	0.17[*]
General health	4.80±10.24	-2.81±18.40	**<0.001**[*]
Total score	5.71±10.55	-3.19±20.47	**0.008**[*]

[*]The results of t test, [†]The results of Mann-Whitney U test

Considering depression scores, although the groups were similar in terms of baseline depression score (5.40±2.93 in the intervention group vs. 6.48±3.68 in the control group; P=0.10), the intervention group had a significantly lower depression score 12 weeks after the intervention, compared with the control group (4.96±2.70 vs. 7.96±3.19, respectively; P<0.001). Comparison of post-intervention depression score with the baseline scores showed that the score decreased in the intervention group (mean±SD of -0.44±1.71), while the depression score increased in the control group after 12 weeks compared with the baseline score (mean±SD of 1.48±1.99) with a significant difference between the groups (P<0.001).

4. Discussion

In the present study, 50 pregnant women received 60 minutes supervised exercise 3 times a week for 12 weeks, including 10 minutes warming up and walking, 15 minutes stretching and reinforcement exercises, and 5 minutes cooling down. In the control group, 50 pregnant women were selected, who received no additional intervention, other than routine prenatal care. The results confirmed that the groups were matched in terms of age, gestational age, occupational status, educational level, and BMI categories.

The intervention and control groups were similar considering baseline weight and the results showed that after 12 weeks of exercise, the intervention group had a significantly lower weight compared with the control group. The mean weight gain during this period was also lower in the intervention group compared with the control group. Weight gain during pregnancy is an important factor for health status of mothers and neonates, as excess weight gain can increase the risk of maternal complications (such as hypertensive disorders, preterm birth, and cesarean delivery) (3, 4), as well as neonatal adverse outcomes (such as large for gestational age), independent of genetic factors (5). In the study by Cordero and colleagues, 101 women were randomized to receive aerobic and toning exercises three sessions per week

for 2 weeks, 60 min performed on land and one session aquatic based (50 min); the results of comparison of excessive maternal weight gain with the control group showed significant differences (24), which is in line with the results of the present study, although the exercise protocol differed. According to a meta-analysis of 24 studies, weight management interventions reduced the number of women gaining excess weight by 20% and reduced the odds of excessive gestational weight gain than those in control groups (25). Controlling the nutritional intake between the exercised and control groups showed lower weight gain during the intervention period in obese pregnant women with -0.1 kg/week difference in weight gain in the intervention group, compared with the non-exercised group (26). Other studies have also confirmed that ≥3 times a week exercise for 6-9 months during pregnancy decreases the odds of excessive gestational weight gain (27). These results confirm that of the present study on the effect of exercise on reducing the pregnant women's weight gain, although the exercise protocol differed in the studies.

Although in the present study, the exercise intervention reduced the pregnant women's weight gain, it had no effects on neonate's birth weight, which could be due to the role of other variables, such as dietary and genetic factors, on neonate's birth weight. In the randomized clinical trial by de Oliveria Melo and colleagues, healthy pregnant women who were sedentary at admission were randomized to exercise moderate-intensity walking three times a week, initiated at 13 weeks and the results of comparison with a control group showed that the neonates' birth weight was not different between the groups (28), which is consistent with the results of the present study. Haakstad and Bo randomized 105 women into two groups, one receiving exercise intervention similar to that in the present study (60 minutes of aerobic and strength exercise intervention with moderate intensity 2-3 times a week for at least 12 weeks) and the other group receiving no exercise intervention (control group). The authors reported no difference in neonates' birth weight between the groups (29), which is in line with the results of the present study. Bisson and colleagues also examined the effect of the same exercise program (moderate and vigorous activity) starting from 15th gestational week on obese pregnant women and reported no difference in neonate's birth weight, compared with the control group (26). These results are also in line with the results of the present study and suggest the possible role of other important factors affecting neonates' birth weight.

Another important finding in the present study was the lower rate of cesarean section in the intervention group, compared with the control group (62% vs. 40%). Exercise can improve the pelvic muscle strength and ease normal vaginal delivery. The study by Price and colleagues also showed that exercise program of supervised aerobic training (45-60 minutes, 4 days a week) starting from 12-14th weeks of gestation resulted in significantly fewer cesarean deliveries, compared with the control group [30], which confirms the results of the present study. Baraket and colleagues investigated the effect of three-session exercise per week (40-45 minutes), starting from 6-9th week of gestation until the end of pregnancy and reported significantly lower cesarean rates in the exercised group, compared with the control group (16% vs 23%, respectively) (31), which is consistent with the results of the present study and confirm the positive effect of exercise on reducing the cesarean rate.

The two other important aspects evaluated in the present study are the depression status and HR-QOL, examined at baseline and after the intervention. According to the results of the present study, total scores of SF-36, dimensions of physical and social, and general health improved in the intervention group during the intervention period, while they significantly decreased in the control group after 12 weeks. Arizabaleta and colleagues randomized 64 nulliparous pregnant women to receive 3-month supervised exercise program, including walking (10 min), aerobic exercise (30 min), stretching (10 min), and relaxation (10 min) and compared the results with the control group. The results showed improved HR-QOL by 6 points in physical component and 7 points in physical function and bodily pain domains (32).

Comparison between active pregnant women with at least 150 min of moderate-intensity leisure-time physical activity per week with less active women (control group) showed higher HR-QOL in the active group (33), which confirms the beneficiary effect of exercise on HR-QOL of pregnant women, as shown by the results of the present study, as well. Other researchers have also indicated that antenatal exercise improves postpartum HR-QOL (34), which shows that the beneficial effects of exercise during pregnancy on HR-QOL can also last after childbirth. Considering depression scores, evaluating the depression scores before and after intervention by EPDS showed that although the groups were similar in terms of baseline depression scores, the intervention group had a significantly lower depression score 12 weeks after the intervention, compared with the control group. Comparison of post-intervention depression score with the baseline scores showed that the score decreased in the intervention group (mean ±SD of -0.44±1.71), while the depression score increased in the control group after 12 weeks compared with the baseline score (mean ±SD of 1.48±1.99). Robledo-Colonia and colleagues assessed the depression score of pregnant women after 3-month exercise (including 10 min walking, 30 min aerobic exercise, 10 min stretching, and 10 min relaxation) by Center for Epidemiological Studies Depression Scale (CES-D)

and reported the reduction of the CES-D score 4 points more than the control group (35), which confirms the results of the present study, although they used a different scale, while the scale used in the present study, the EPDS, is proven as the most appropriate tool for studying depression in pregnant women (20). Perinatal depression, especially in late pregnancy and after childbirth, is considered an important pregnancy-related problem and several studies, confirming the results of the present study, suggest exercise has as an appropriate effect (36, 37).

The present study had several strengths; first, we compared two groups of intervention and control with randomized allocation and matched the groups to obtain optimal results. Second, we supervised their exercise performance each week to control the correctness of the exercises and compared the change in the variables after the intervention, compared with the baseline values. And third, as the results indicated, the control group had similar baseline values in all of the studied parameters, which enabled accurate comparison for the effect of intervention. However, this study could have some limitations. One of the limitations of the present study was not controlling the nutritional status of the pregnant women, which could act as a confounder on maternal weight gain and neonate's birth weight. Furthermore, we matched the groups for several parameters affecting the women's QOL, such as economic status and educational level, but might have missed other factors such as family support, which is mainly due to the multifactorial nature of QOL.

Conclusion

According to the results of the present study, comparison of the matched groups showed that the 12-week exercise intervention had several beneficiary effects. First, it reduced the amount of maternal weight gain during pregnancy as well as the rate of cesarean section. Second, it had a positive effect on reducing women's depression score (assessed by EPDS), while the depression score of the control group increased during the intervention period. Finally, the results showed that the intervention improved the total SF-36 score, physical and social dimension, and general health in the intervention group during the intervention period, while they significantly decreased in the control group after 12 weeks. Accordingly, it is suggested to include this exercise intervention in the routine prenatal care of pregnant women to reduce the rate of excess weight gain during pregnancy, cesarean section, and depression, and improve women's HR-QOL.

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Conflict of Interest:

The authors declare that they have no conflict of interest

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Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the Ethics committee of Tarbiat Modares University (Ethics code: 1.1395.REC.TMU.I) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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