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# The Effect of Nutrition Education and Physical Activity on Weight Changes and Anthropometric Indices among Postpartum Women with High BMI

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**Abstract**

**Background:** Postpartum weight retention is known as a public health challenge that causes obesity in women in the long term.

**Aim:** The present study aimed to determine the effect of nutrition education and physical activity interventions on weight changes and anthropometric indices among postpartum women.

**Method:** This quasi-experimental randomized controlled trial (RCT) was conducted as a two-group pre/posttest research design in Bandar Abbas, Hormozgan, Iran, in 2020. A total of 64 women were randomly selected in their postpartum period. Multi-stage sampling was conveniently performed. The training sessions were held for the intervention groups of 5-7 participants in four sessions of 45-60 minutes and once a week by using a pedometer. The control group received routine postpartum care. Maternal weight and anthropometric indices were measured by the end of weeks four and eight.

**Results:** The study findings showed no significant difference in the mean weight of the two groups before the intervention ($p=0.47$). However, comparing the results of the fourth and eighth weeks after the intervention with the pre-intervention stage revealed that the mean weight in the intervention group had respectively reduced by -3.28±5.57 and -3.75±0.65 which was statistically significant ($p<0.001$). The mean waist and hip circumferences also decreased significantly before and after the intervention in both study groups, but such a reduction in the intervention group was significantly higher than that in the controls .($p<0.05$).

**Implications for Practice:** Using a pedometer in nutrition and physical education is simple, low-cost, and uncomplicated. Promoting nutritional behaviors and physical activity in postpartum women is recommended by extensively implementing this intervention program which moderates their weight and improves their anthropometric indices.

**Keywords:** Education, Nutrition, Obesity, Physical activity, Postpartum, Weight change

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**Introduction**

The increasing prevalence of overweight and obesity is one of the most important public health concerns worldwide which has drawn the attention of health circles (1). More than 1.9 billion adults over 18 were overweight in 2016 of whom 650 million were obese according to the World Health Organization (WHO). Also, 39% of adults over 18 (namely, 39% of men and 40% of women) were overweight and about 13% of the world's adult population (11% of men and 15% of women) were obese (2). Regarding the studies from 1980 to 2008, 0.5 $kg/m^2$ has been added to the body mass index (BMI) in women every decade (3).

As stated in recent reports, the prevalence of obesity has almost tripled in developing countries mainly due to lifestyle changes over the past two decades (4). Iran is also experiencing an obesity epidemic and its consequences like many other developing countries (5). For example, a study in Kermanshah, Iran, in 2015, had established that 39.4%, 21.9%, 57.5% of women had overweight, obesity, and abdominal obesity, respectively (6). The prevalence of maternal obesity and overweight in Iranian women had been reported 12% and 30%, respectively in several other studies. The average postpartum weight retention had been recorded by 4.1-5 kg in 50-80% of women one year after delivery (7).

Determining overweight and obesity is an essential aspect of medical prevention and social health which serves as barriers to physical, mental, and social health and causes serious diseases and conditions (8). Obesity is increasing the total or topical body fat (9). Most complications of obesity, such as insulin resistance, diabetes, hypertension, hyperinsulinemia, and hyperandrogenism, are mainly associated with visceral or upper limb fat in women (10). Postpartum weight retention is known as a public health problem that causes obesity in women in the long term and leads to major risks including complications of heart diseases. Growth of only 3 $kg/m^2$ in women's BMI during their pregnancy also increases the risk of preeclampsia, hypertension, Cesarean section, stillbirth, and high birth weight, even with a normal BMI in previous pregnancies (11).

Although many other factors cause overweight and obesity, the obesity epidemic appears to involve complex biological, behavioral, cognitive, and motivational factors (12). Increasing the prevalence of obesity in developing countries can be attributed to inadequate physical activity in childhood and lifestyle changes that occur mainly with lifestyle-related variables (9). Health experts also consider lifestyle as one of the factors affecting health. Moreover, postpartum weight retention is more affected by lifestyle changes during and after pregnancy than prenatal factors. Numerous risk factors such as maternal weight, prenatal weight gain, age, parity, race, smoking, exercise, occupation, and lactation are thus effective in postpartum weight retention and obesity (11). As declared by the WHO, lifestyle changes confront many risk factors that mostly cause death. WHO aims to promote healthy lifestyles in societies (12).

Most studies so far have emphasized a series of interventions for postpartum weight loss (13). Kelishadi et al. (2007) stated that nutrition and physical activity were the greatest modifiable factors affecting lifestyle which could reduce postpartum weight in Iran (14). Using a pedometer (as an objective physical activity measurement tool) was introduced in another study as a stimulus for increasing the volume of physical activity during the postpartum period and even as a cost-effective, accessible, and effective tool that could be employed by those with lower levels of education (15). However, several studies have reported that physical activity fails to solely reduce postpartum weight (16). Lim et al. (2015) had further stated that changes in physical activity along with nutrition education could more effectively lower weight during the postpartum period (17). Unlike Lim et al., Bertz et al. (2012) reported that physical activity and dietary modification were not significantly greater than dietary modification alone (18). Women wish to participate in weight loss interventions and seek an opportunity to exercise and receive health and nutrition tips in an educational context during the postpartum period (19). High prevalence of overweight and obesity, the importance of returning to normal weight, the effects of postpartum overweight, and the role of midwives in promoting women's health in different life cycles were the most fundamental concerns, especially in this period. Limited studies, to the best of our knowledge, were conducted on the combined intervention of nutrition education and physical activity through pedometers as a motivational aid during the postpartum period. The present study aimed to determine the effect of nutrition education and physical activity on weight changes and anthropometric indices in postpartum women with high BMI.

**Methods**

This quasi-experimental randomized controlled trial (RCT) was conducted as a pre/post-test research design in Bandar Abbas, Hormozgan, Iran, in 2020. The statistical population was all women who met the inclusion criteria and referred to Bandar Abbas community health centers. Multistage sampling was used in conducting this study from August to December. Five community health centers in Bandar Abbas were listed according to the population coverage. Then, one center was randomly selected for the intervention group. Moreover, the nearest center in terms of distance and similarity of socioeconomic context was chosen as the control group. The reason for selecting the intervention and control centers separately was to prevent disseminating of information between the two groups. The study by Park et al. (2006) (20) was used with the confidence interval (CI) of 0.95 and the test power of 80%, based on the formula for the mean difference between the two groups for determining the sample size. The minimum sample size was 29 women in each group according to these calculations. A total of 32 people were selected as the samples in each group concerning 10% loss probability in each group.

The inclusion criteria were the age range of 18-45 years, the BMI between 25 and 34.9 in prenatal and postpartum periods, referral to community health centers in weeks 6-12 postpartum, lactation, and poor physical activity (between 20 and 39 points) or inactive (less than 20 points) based on the Physical Activity Index (PAI). The exclusion criteria were non-cooperation at any stage of the study, absence in more than one intervention session, not walking in three consecutive or five intermittent sessions, and less than 100 steps per minute in more than five sessions.

The demographic/obstetric characteristics such as a scale, a meter, a marathon pedometer made in Iran, a follow-up form (weight, anthropometric indices, physical activity, number of daily steps), and the PAI were the data collection tools used in the present study. The level of physical activity in each person was measured concerning three items of intensity, duration, and frequency. The total PAI score was the product of the intensity score multiplied by the duration and the frequency of physical activity.

The minimum and maximum scores were 0 and 100, respectively. Considering the interpretation of the PAI scores, a score below 20 indicated an inactive person, between 20 and 39 represented poor physical activity, and between 40 and 59 showed relatively good physical activity. Moreover, the scores of 60-80 and 81-100 suggested very good and high physical activity, respectively. Ahmadi et al. (2012) confirmed the validity and reliability of the PAI (21). The content validity of this study was implemented based on the opinions of the professors at Mashhad University of Medical Sciences, Mashhad, Iran. Its reliability was measured and confirmed through Cronbach's alpha (r=0.89).

The researcher started collecting data by submitting a written letter of introduction from the School of Nursing and Midwifery, Mashhad University of Medical Sciences to the President of Bandar Abbas University of Medical Sciences, Bandar Abbas, Hormozgan, Iran, and to the related community health centers. The researcher identified the participants with high BMI (25-39.4) in their first pregnancy by referring to the given centers and reviewing their existing records. Then they were invited by phone calls to visit the community health centers for participating in the study. The PAI score during the past week was determined by obtaining informed written consent. The demographic/obstetric characteristics form was completed if the participants were poorly active or inactive (scored lower than 39). Then, the anthropometric indices (i.e., height, weight, BMI, waist circumference, hip circumference, and the waist-to-hip ratio [WHR]) were determined. The researcher presented the educational intervention to the intervention group by using lecture slides, group discussions, as well as questions and answers in groups of 5-7 during four sessions of 45-60 minutes, once a week in addition to routine health care services.

The first training session was focused on explaining the objectives of the study, describing the benefits of postpartum physical activity and the advantages of using a pedometer, and how to use it. A family member or a friend was invited to the educational sessions to achieve the goal of verbal encouragement and approval from others due to their profound impact on forming nutritional behavior and physical activity. The second session was about education on obesity, its causes and complications, and how to calculate BMI and nutritional behaviors. The participants were educated about food groups, daily servings for women, and key points in using each food group in the third group. Besides, a person was introduced who succeeded in postpartum weight loss as a social model with alternative experiences. Finally, the fourth session was dealt with teaching the principles of

weight control and loss and providing health and nutrition tips and recommendations for physical activity in overweight and obese people.

At the end of the first session, the participants were provided with an eight-week walking program designed by a fellow physiologist and then they were asked to note the number of steps in it after the educational sessions. Initially, the walking exercise program lasted 150 minutes per week (15,000 steps), and then 10 minutes per week (1000 steps) were added to the program. So, 215 minutes of walking was recorded during the eighth week of the exercise program which increased to 21500 steps per week.

The first and the second weeks included three sessions of 35 minutes and one session of 45 minutes. The third week included two sessions of 35 minutes and two sessions of 45 minutes. One session of 35 minutes and three sessions of 45 minutes was included in the fourth week. The fifth week included four sessions of 45 minutes. Three sessions of 35 minutes and two sessions of 45 minutes was included in the sixth week. The seventh week included two sessions of 35 minutes and three sessions of 45 minutes. Eventually, the eighth week included one session of 35 minutes and four sessions of 45 minutes.

The researcher's phone number was provided to the participants for solving problems and answering questions, and a healthy lifestyle educational booklet (with nutritional and physical activity tips) was given to them at the end of the educational sessions.

Phone calls were made to follow up with the intervention group during the second and fourth weeks after completing the training sessions. The control group merely received routine postpartum care. Maternal weight and anthropometric indices were also measured and compared in both groups at the end of weeks four and eight. The educational booklet was similarly given to the control group to comply with ethical standards.

Notably, blinding the participants was not possible due to the nature of the educational intervention used in the present study. A total of 64 eligible mothers were accordingly included in the study of which 32 individuals were allocated to the intervention group and 31 to the control group (one person excluded due to migration) (Figure 1).

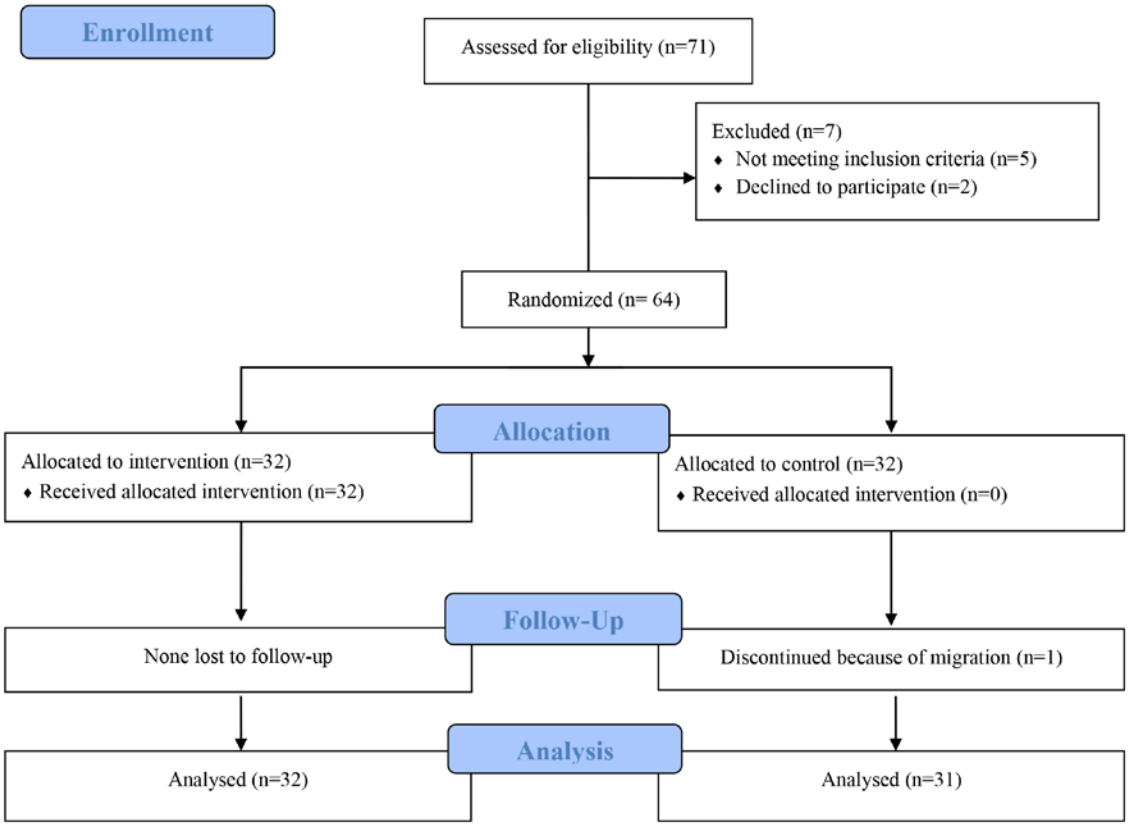


**Figure 1. Sampling flow chart**

Finally, the data were analyzed using the SPSS V.23. Accordingly, the Kolmogorov-Smirnov test and the Shapiro-Wilk test were performed to determine the normality of the quantitative variables. Parametric tests were applied if normality existed; otherwise, their non-parametric equivalents were used. Data analysis was completed by the independent-samples t-test, the Mann-Whitney U test, the repeated measures ANOVA, and the Friedman test. The p-value<0.05 was considered significant.

**Results**

The demographic/obstetric characteristics of the participants are shown in Table 1. The mean age of the postpartum women in the intervention and control groups was 30.31±6.44 and 28.52±6.37, respectively. The majority of the participants in both groups had high school diplomas and they were housewives. As well, the study results revealed that the participants were homogeneous in terms of the variables of age, level of education, occupation, number of pregnancies, number of children, and BMI at the onset of pregnancy, prenatal weight gain, type of recent delivery, and the length of pregnancy at the time of inclusion (p<0.05) (Table 1).

The results of the Mann-Whitney U test also demonstrated no significant difference between the mean weight in the intervention and control groups before the intervention program (p=0.47). Reviewing the results during the fourth and eighth weeks after the intervention compared to its onset, and eight weeks compared to four weeks after the intervention, showed that the mean weight in the intervention group significantly decreased (p<0.001). Also, the intragroup comparison using the Friedman test indicated that the difference between the intervention stages in the intervention group was significant (p<0.001). Dunn's post hoc test also showed that the difference between the intervention group four and eight weeks after and at the onset of the intervention (p<0.001) and between eight weeks and four weeks after the intervention (p=0.003) were significant. The results of repeated measures ANOVA demonstrated that the difference between the intervention stages was not significant (p=0.38) in the control group. In other words, the mean weight in the control group failed to change before and after the intervention, but it significantly decreased in the intervention group (Table 2).

Contrarily, the results of the present study on the anthropometric indices implied a significant decrease in the waist and hip circumferences of the participants in both intervention and control groups within four and eight weeks after the intervention with its onset and eight weeks compared with four weeks after the intervention. However, this decrease was significantly greater in the intervention group than in the control one. The results of WHR in the intervention group showed that

**Table 1. Demographic/obstetric characteristics of study participants**

| | Control group(31) | Intervention group(32) | P value |
|---|---|---|---|
| Age(y) | 28/52±6/37 | 30/31±6/44 | *P=0/27 |
| Weight gain during pregnancy (kg) | 11/39±2/70 | 12/33±3/14 | *P=0/20 |
| Education(number/percentage) | | | |
| Elementary and middle school | 11(35/48) | 13(40/62) | |
| High school and diploma | 9(29/03) | 13(40/62) | **P=0/39 |
| Post-diploma and bachelor's degree | 7(22/58) | 5(15/62) | |
| Master's degree and higher | 4(12/90) | 1(3/12) | |
| Job | | | |
| Employed | 10(32/25) | 6(18/75) | ***P=0/20 |
| Housewife | 20(64/51) | 26(81/25) | |
| Student | 1(3/22) | 0 | |
| Type of delivery | | | |
| Vaginal | 15(48/38) | 12(37/50) | ***P=0/36 |
| Cesarean section | 15(48/38) | 16(50/00) | |
| Childbirth with tools | 1(3/22) | 4(12/50) | |
| Parity | 2/61±1/09 | 2/88±1/24 | ****P=0/36 |
| Number of children | 2/19±0/95 | 2/44±0/95 | ****P=0/28 |
| BMI at the beginning of pregnancy (kg / m2) | 27/06±1/15 | 27/56±1/43 | ****P=0/16 |

* Independent t. ** Chi-square. *** Accurate chi-square. **** Man Whitney.

**Table 2. Mean and standard deviation of weight in the intervention and control groups before and after the intervention**

| Weight | Control group(31) Means±SD | Intervention group(32) Means±SD | P-value Intergroup test |
|---|---|---|---|
| The beginning of the intervention | 78/92±6/79 | 80/19±7/20 | *p=0/47 |
| 4 weeks after the intervention | 78/57±6/64 | 76/91±8/63 | *p=0/54 |
| 8 weeks after the intervention | 78/75±6/93 | 76/45±7/26 | P=0/20 |
| The difference between 4 weeks after the intervention and its beginning | -0/35±1/08 | -3/28±5/57 | *p<0/001 |
| The difference between 8 weeks after the intervention and its beginning | -0/17±1/69 | -3/75±0/65 | *p<0/001 |
| The difference between 8 weeks and 4 weeks after the intervention | 0/18±1/45 | -0/47±5/57 | *p<0/001 |
| Intragroup test | ***p=0/38 | **p<0/001 | |

* Man Whitney. ** Friedman. *** Analysis of covariance

the difference between four and eight weeks after the intervention was significantly greater than the onset of the intervention, and eight weeks later compared with four weeks after the intervention. The intragroup comparison in the intervention group also denoted a significant decrease in the WHR during the study, while this ratio was not significant in the control group (Table 3).

**Table 3. Mean and standard deviation of anthropometric indices (waist circumference, pelvic circumference, and waist to pelvic circumference ratio) in the intervention and control groups before and after the intervention**

| Waist circumference | Control group(31) Means±SD | Intervention group(32) Means±SD | P-value Intergroup test |
|---|---|---|---|
| The beginning of the intervention | 89/39±8/41 | 93/31±9/53 | *p=0/10 |
| 4 weeks after the intervention | 88/61±8/62 | 90/48±9/32 | *p=0/40 |
| 8 weeks after the intervention | 88/37±8/76 | 87/80±9/32 | *p=0/77 |
| The difference between 4 weeks after the intervention and its beginning | -0/78±1/04 | -2/83±0/96 | *p<0/001 |
| The difference between 8 weeks after the intervention and its beginning | -1/02±1/47 | -5/52±0/99 | *p<0/001 |
| The difference between 8 weeks and 4 weeks after the intervention | -0/24±0/74 | -2/69±0/69 | *p<0/001 |
| Intragroup test | *p<0/001 | **p<0/001 | |
| pelvic circumference | | | |
| The beginning of the intervention | 100/90±7/79 | 106/03±7/22 | *p=0/009 |
| 4 weeks after the intervention | 100/24±8/25 | 103/78±7/10 | *p=0/20 |
| 8 weeks after the intervention | 100/00±8/51 | 101/38±7/11 | *p=0/48 |
| The difference between 4 weeks after the intervention and its beginning | -0/66±1/45 | -2/25±0/82 | *p<0/001 |
| The difference between 8 weeks after the intervention and its beginning | -0/90±1/97 | -4/66±2/59 | *p<0/001 |
| The difference between 8 weeks and 4 weeks after the intervention | -0/24±0/83 | -2/41±2/23 | *p<0/001 |
| Intragroup test | *p=0/01 | *p<0/001 | |
| waist to pelvic circumference ratio | | | |
| The beginning of the intervention | 88/83±8/25 | 88/25±9/40 | *p=0/79 |
| The difference between 4 weeks after the intervention and its beginning | -0/17±0/78 | -0/82±1/06 | *p=0/007 |
| The difference between 8 weeks after the intervention and its beginning | -0/18±0/96 | -1/40±2/29 | *p<0/001 |
| The difference between 8 weeks and 4 weeks after the intervention | -0/02±0/70 | -0/58±1/78 | *p=0/001 |
| Intragroup test | **p=0/19 | ***p=0/001 | |

* Man Whitney. ** Friedman. *** Analysis of covariance

**Discussion**

The study results revealed that nutrition education and physical activity interventions lead to weight loss and reduction of the anthropometric indices among postpartum women. In other words, implementing an educational intervention could moderate weight and anthropometric indices in overweight and obese women. Huseinovic et al. (2016) studied women with BMI≥27 during the postpartum period. They have shown that the mean median weight change after 12 weeks in the intervention group (6.1 kg) significantly decreased compared to the control group (1.6 kg) and the differences in the intervention group were significant after one year. In addition, decreasing BMI, waist circumference, hip circumference, and body fat percentage in the intervention group was lower than the controls 12 weeks and one year after delivery which was consistent with the present study. However, Huseinovic et al. (2016) reported that the follow-up period was one year after the intervention which should be performed in two stages after 12 weeks and 9 months later. The intervention and follow-ups in the present study as a master's thesis were respectively performed at the onset and during weeks four and eight of the study due to time and financial constraints. Therefore, nutrition education and awareness-raising are both inducing behavior modifications or leading to correct behaviors followed by weight loss (22). Providing support and education by midwives to postpartum women seems to increase their ability and in turn improve their health status (23).

Maturi et al. (2012) had also reported the effect of physical activity on reducing BMI and weight in women during the postpartum period. A pedometer was used in their study for 12 weeks which increases physical activity and reduces the mean change of body weight and BMI. Their results were in line with the present study. Accordingly, a pedometer as a motivational aid can boost physical activity and ultimately lead to weight loss (24). Further cross-sectional studies have indicated that 10,000 steps or 30-minute walking per day reduces subcutaneous fat and BMI. Additionally, the results of some studies have revealed that increasing physical activity to 10,000 steps per day was significantly effective in reducing weight, BMI, body fat percentage, and waist and hip circumferences (25). Exercise and weight loss during the postpartum period increase women's sexual satisfaction (26).

Bertz et al. (2012) revealed that nutritional intervention in postpartum women with overweight and obesity caused weight loss during this period and this trend has remained stable for 9 months. The findings also showed that combination therapy was not significantly superior to nutrition education in weight loss and physical activity which supports the results in the present study. Modifying nutritional behavior and physical activity reduced weight in the participants of the two studies. So, the weight in the intervention group had a decreasing trend for eight weeks in the present study. One of the reasons for the inconsistency of the results can be the use of different educational materials. On the other hand, only one intervention group was examined in the present study, but Bertz et al. employed three intervention groups (18).

Huseinovic (2016) and Maturi (2012) similarly reported a decrease in BMI of the intervention group following nutrition and physical education (22, 24). Abdi et al. (2019) reported that an educational program based on lifestyle changes has led to weight loss and reduced BMI in obese women (1). The educational content of the present study considered two aspects of nutrition and physical activity, but Abdi et al. simply taught lifestyle to obese women in ten sessions.

The present study established that waist and hip circumferences in both intervention and control groups significantly decreased during the study, but this decrease was greater in the intervention group than in the control one.

Besides, Gaeini et al. (2008) reported that an eight-week physical activity and nutrition protocol could not significantly reduce waist and hip circumferences which conflicted with the present study (27). This difference might be due to the type of physical activity implemented in both studies as Gaeini et al. used core strengthening activities along with pelvic floor and flexibility exercises. It should be noted that postpartum women are more interested in walking due to their responsibilities and roles.

Ramezankhani et al. (2017) had also found that 16 weeks of physical activity and a low-calorie diet could reduce weight, BMI, and WHR in sedentary obese women (28), which was consistent with the results of the present study. As well, Nikpour et al. (2010) had reported that eight weeks of endurance exercise could reduce waist circumference, waist-to-height ratio, and abdominal circumference, but failed to affect WHR (29). The statistical populations were different in both studies; however, a

significant decrease in waist circumference was reported in both intervention groups.
Combining two interventions of nutrition education and physical activity was one of the strengths of the present study. Among the limitations of this study was the difference in the level of education of participants which was partially controlled by assigning them randomly. Moreover, follow-up lasted eight weeks in this study, and no longer one was done. Blinding the participants was not also possible due to the nature of the educational intervention.

**Implications for Practice**

Nutrition education and physical activity were used as effective, low-cost, non-pharmacological interventions which could improve changes in weight and anthropometric indices during the postpartum period. Implementing these interventions is recommended during the postpartum period for promoting nutrition education and physical activity as well as reducing weight and boosting anthropometric indices. Therefore, taking measures such as lifestyle changes and implementing nutrition and physical activity promotion programs by midwives as community health agents can enhance postpartum women's health.

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**Conflicts of Interest**

The authors declare no conflict of interest in publishing this article.

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