

# Prevention of Postpartum Weight Retention during One Year after Childbirth by Prenatal Nutrition Education: A Randomized Controlled Trial

## Abstract

**Background:** It seems that 14–25% of the women retain at least 5 kg weight from 6 to 12 months after delivery and gestational weight gain is the most important reason of weight retention. Thus, we assessed the effect of prenatal nutrition education program on the retained weights at 8, 26, and 52 weeks after delivery in primiparous women. **Methods:** This randomized controlled trial was implemented among 192 primiparous pregnant women in five hospitals, fifteen community health centers, and fifteen private offices. Self-developed questionnaire was used to collect the participants' characteristics. A 72-hr dietary recall was applied to evaluate the food intakes before and after intervention. The pregnancy physical activity questionnaire determined the physical activity score. The participants' weights at 8, 26, and 52 weeks after delivery were measured by a digital beam. **Results:** The means of postpartum weight decreased in both groups, but nutrition education was significantly effective on reducing postpartum weight in intervention group ( $\beta = -3.112$ ,  $SE = .7384$ ,  $P < 0.001$ ). Also, the women in intervention group had less retained weight compared to control during the follow-up ( $\beta = -3.35$ ,  $SE = 0.75$ ,  $p < 0.001$ ). The proportion of pregnant women in intervention group who reached to their pre-gravid weight was more than control during the follow-up ( $OR = 2.86$ ,  $95\% CI: 1.62, 5.07$ ). **Conclusions:** Nutrition education considering an individualized calorie-appropriate diet for each pregnant woman and based on the national guideline is effective on postpartum weight retention and reaching to pre-gravid weight.

**Keywords:** Clinical trial, gestational weight gain, Iran, pregnancy, prenatal education

## Background

Postpartum weight retention (PPWR) is defined as the difference between weight at some time after delivery and pre-pregnancy weight. It seems that fourteen to twenty-five percent of the women retain at least 5 kg weight from 6 to 12 months after delivery<sup>[1]</sup> and gestational weight gain (GWG) is the most important reason of weight retention.<sup>[2]</sup> Thus, researchers have designed nutrition and physical activity interventions during the pregnancy, postpartum period, or both to control PPWR.<sup>[3]</sup> Huang *et al.*'s trial including diet and physical activity was performed from pregnancy to six months after delivery (EP group) and from 24–48 hours after birth to six months postpartum (EPP) while the comparison group received the routine program. The average weight retention at six months postpartum was 2.34 in EP group, 4.06 in EPP group compared to 5.08 kg in control group.<sup>[4]</sup> Another study also decreased GWG

and the PPWR through prenatal nutrition and physical activity intervention.<sup>[5]</sup> We found only two studies<sup>[6,7]</sup> which decreased PPWR through nutritional interventions. In Wolff *et al.*'s survey, the maintained weight in experimental group was 6.9 kg lesser than that in the control, four weeks after delivery.<sup>[6]</sup> In Ruesten *et al.*'s study, adherence to Norwegian food guidelines during pregnancy, reduced the weight retention six months after delivery.<sup>[7]</sup> Although the life style interventions including physical activity and nutrition is increasing, the role of dietary instructions such as obedience to gestational dietetic recommendations on postpartum weight retention, should be revealed. Considering that nutrition education is simpler, more affordable, and without the complications caused by the prenatal exercise. Additionally, prenatal nutrition training will not have a negative effect on breastfeeding. Thus, in the present article which is part of an intervention for

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improving gestational weight gain,<sup>[8]</sup> we assessed the effect of prenatal nutrition education program on the retained weights at 8, 26, and 52 weeks after delivery in primiparous women. The determination of percentage of women who reached to pre-gravid weight is another aim.

## Methods

This randomized clinical trial (with the registration number IRCT2016012026129N<sup>1</sup>) was performed from 6 to 10th weeks until the end of pregnancy among 192 primiparous women between May 2015 and September 2016. Eighty-six participants were considered for each group based on  $n = [(Z_{1-\alpha/2} + Z_{1-\beta})^2 \cdot 2S^2] / \Delta^2$ .<sup>[9]</sup> The significance level of 0.05,  $\beta$  of 20%, and the standard deviation of 7 (S) for at least a 3 kg difference ( $\Delta$ ) in gestational weight gained between two groups determined the sample size. Five hospitals, fifteen community health centers, and fifteen private offices were selected according to the stratified sampling. Originally Iranian pregnant women aged 18 years old and older who their BMI was lower than 40 kg/m<sup>2</sup> were entered. Pregnant women with a history of diabetes, weight-related complications, using a special regimen, anemia, urinary tract diseases, chronic disease and addiction were excluded.<sup>[10]</sup> Health care providers medically examined participants and then an intended person described the study aims for them whereas took the written consent, too. After that, we arranged the satisfied pregnant women in two groups, randomly. The random provision software<sup>2</sup> verified the assigned codes to each person and these codes were preserved in sequentially numbered letters. Then, pregnant women opened the next closed letters to determine the allocated place in intervention or control group. Our participants in two groups received the regular prenatal care while training sessions were considered for the experiment group. Obstetricians and midwives were not aware of randomization theme and educational items and details. But, instructor and participants were not blind because of the nature of intervention. Research Ethics Committee for Health Sciences, at the Public Health School of Shahid Sadoughi University of Medical Sciences (4326) and the Research and Technology of Isfahan University of Medical Sciences (294048) approved this trial. The study protocol was approved by the Ethics Committee of the Public Health College of Shahid Sadoughi University (IR.SSU.SPH.REC.1395.13).

## Instrument

Participants' characteristics were collected through a self-developed questionnaire administered by the study researchers. Postpartum weight retention is the difference

between weight at 8, 26, and 52 weeks postpartum and pre-pregnancy weight.

A 72-hr dietary recall was applied to evaluate the food intakes at 6–10 and 35 weeks of gestation. Its validity and reliability have been confirmed previously by researchers.<sup>[11]</sup> Nutrient intakes were extracted through nutritionist 4 software while the responsible nutritionist was not aware of contents of trial. Since the amount of physical activity score is one of the most important confounding variables, the pregnancy physical activity questionnaire<sup>[12]</sup> was used which its validity and reliability have been confirmed in Iranian pregnant women.<sup>[13]</sup>

## Nutrition education intervention

The basic assessment<sup>[11]</sup> and questionnaire scores were considered for intervention while the responsible nutritionist estimated a calorie-appropriate diet for each person in interventional group immediately after entering the study. Our training sessions lasted 45-60 minutes at 6-10, 18, and 26 weeks of gestation. At the first session, one educational leaflet<sup>[14]</sup> was assigned to each pregnant woman in the experimental group. The content of the intervention program included the following four main points: (1) various and well-adjusted diet based on food groups; (2) weight gaining in accordance to IOM; (3) healthy eating. Pregnant women in the interventional group were recommended to consume low-fat dairy product, high fiber bread rather than white bread, and vegetables in place of pickles. Energy intake was estimated based on the basic assessment and 50–55% of that was dedicated to the total carbohydrate intake, preferably complex carbohydrates. Energy from fat intake was limited in the range of 25–30% of total energy. We considered 25–30% for fat intake and fifty to twenty percent for protein intake, too. Pregnant women were advised to consume the mono-saturated fatty acids instead of the saturated and trans-fatty acids. The experimental group wrote their daily received food during one month to enhance self-efficacy and to examine their compliance. At the second session, the instructor described the practical ways to increase self-efficacy (goal setting techniques). The groups of two to eight persons were formed during the second and third sessions to perform group discussion, role-playing, and brain storm strategies. Two telephone numbers were also assigned to answer the questions to control the stress. Computer-based curriculums were applied to instruct healthy cooking ways during the third session. The education intervention was performed by the first author. We measured the participants' weights at each educational session and after 8, 26, 52 weeks postpartum through a digital beam [Figure 1].

## Statistical analysis

Continues variables described as mean  $\pm$  standard deviation and categorical data as number (percentage). Normality of continues variables outcomes were investigated using Q-Q

<sup>1</sup>It was registered by the Iranian Registry of Clinical Trials.

<sup>2</sup>Random Allocation Software (version 1.0.0.) was developed by Saghaei, M, the professor of anesthesiology, Isfahan University of Medical Sciences in 2006.

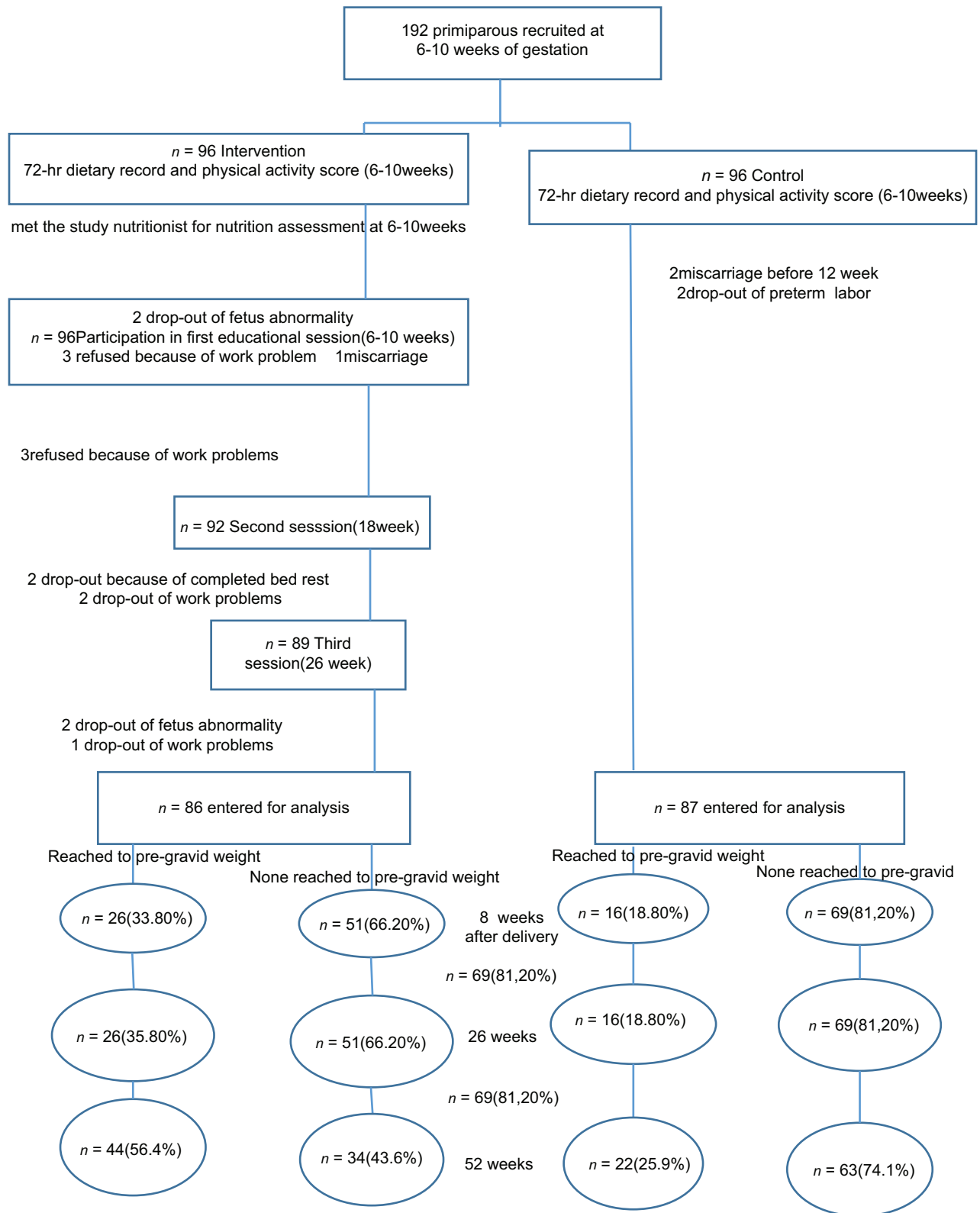


Figure 1: Participants' selection flowchart

plot. Baseline comparison across groups was conducted by independent sample t test or chi-square test as appropriate. Linear regression was used to investigate the effect of intervention on the desired outcomes using generalized

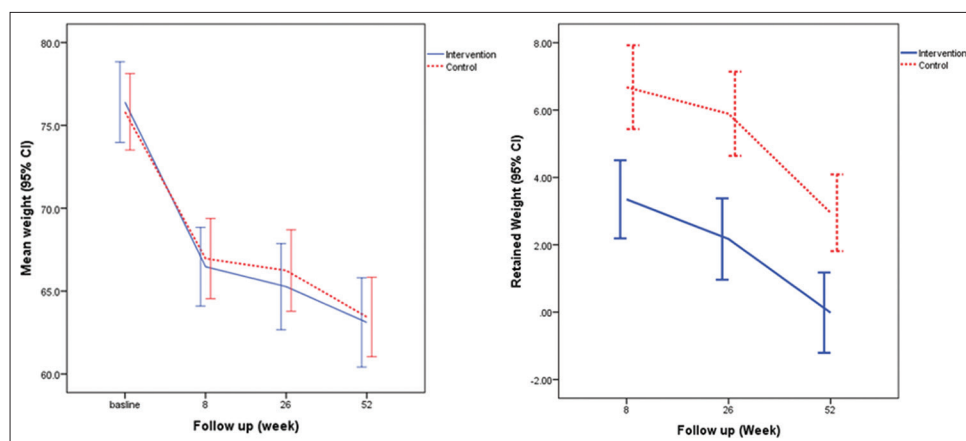
estimating equation (GEE) method. The model was included intervention effect (control as reference group), time effect (in week), pre-pregnancy weight as baseline value, and interaction effect of time and intervention (week\*group).

**Table 1: Comparison of participants' characteristics and baseline values according to study groups**

Variable	Intervention (n=86) Mean±Std. Deviation	Control (n=92) Mean±Std. Deviation	P
Age (years)	26/45 ± 4/00	26/73 ± 3/97	0/64
Pre-gravid weight (kg)	62.72±11.66	60.27±9.73	0.12*
Pre-gravid BMI (kg/m <sup>2</sup> )	23.75±4.15	23.15±3.71	0.30*
years of education	14.62	14.15	0.66
Family income (Rials)			
<6000000	22 (25.60%)	19(20.70%)	0/57**
6000000-12000000	40 (46.50%)	58(63.00%)	
>12000000	24(27.90%)	15(16.30%)	
First trimester- physical activity (met/hour)	31.02±11.55	30.01±11.02	0.61*
Third -trimester physical activity (met/hour)	29.92±10.78	27.89±10.50	0.54*
Duration of breast-feeding	18.8±6.5	17.1±7.2	0.70

**Table 2: Comparison of desired outcomes according to study groups**

Variable	Intervention Mean±Std.Deviation	Control Mean±Std. Deviation	P
Participant' mean weight			
After 8 weeks	66.47±10.39	66.96±11.01	0.77
After 26 weeks	66.27±11.36	66.25±11.19	0.58
After 52 weeks	63.11±11.63	63.45±0.68	0.85
The mean of retained Weight			
After 8 weeks	3.35±5.07	6.68±5.66	<0.001
After 26 weeks	2.17±5.21	5.89±5.69	<0.001
After 52 weeks	-0.01±5.07	2.95±5.08	<00.001
Percentage of reaching to pre-gravid weight	<b>Number (percent)</b>	<b>Number (percent)</b>	
After 8 weeks	26 (33.80)	16 (18.80)	0.04
	51 (66.20)	69 (81.20)	
After 26 weeks	26 (33.80)	16 (18.80)	0.03
	51 (66.2%)	69 (81.2%)	
After 52 weeks	44 (56.4%)	22 (25.9%)	<0.001
	34 (43.6%)	63 (74.1%)	



**Figure 2: The effect of intervention on the desired outcomes.**

When the interaction effect of week\*group was not significant, results was reported according the model

without it. Effect of intervention on returning to pre-gravid weight was evaluated using generalized estimating equation

**Table 3: The effect of intervention on interested outcomes**

Effect of intervention on the means of postpartum weight							
		Model 1 <sup>a</sup>			Model 2 <sup>a</sup>		
		<i>B</i>	SE	<i>P</i>	<i>B</i>	SE	<i>P</i>
Time		-0.086	0.0113	<0.001	-0.082	.0085	<0.001
Group	Intervention	-3.333	0.9203	<0.001	-3.112	.7384	<0.001
	control	Reference	.	.			
Pre-pregnancy weight		0.906	0.0397	<0.001	.906	.0397	<0.001
Group * Time		0.008	0.017	0.647			
Effect of intervention on the postpartum retained weight							
		Model 1 <sup>a</sup>			Model 2 <sup>a</sup>		
		<i>B</i>	SE	<i>P</i>	<i>B</i>	SE	<i>P</i>
Time		-0.087	0.0113	<0.001	-0.082	.0085	<0.001
Group	Intervention	-3.618	0.92317	<0.001	-3.345	.753	<0.001
	control	Reference	.	.			
Group * Time		0.01	0.0172	0.573			
Effect of intervention on the odds of reaching to pre-gravid weight							
		Model 1 <sup>b</sup>			Model 2 <sup>b</sup>		
		OR	95% CI	<i>P</i>	OR	95% CI	<i>P</i>
Time		.980	(0.97 0.99)	.010	.976	(0.20 0.61)	<0.001
Group	Intervention	2.15	(0.91 5.09)	.083	2.86	(1.62 5.07)	<0.001
	control	Reference	.	.			
Group * Time		1.01	(0.99 1.03)	.335			

<sup>a</sup>Linear regression model using generalized estimating equation approach. <sup>b</sup>Generalized estimating equation modification of logistic regression. Model 1: with interaction effect of time by group. Model 2: model 1 without interaction effect of time by group. *B*: Coefficient regression. SE: Standard error.

(GEE) modification of logistic regression. Two-tailed statistical significance probability was considered less than 0.05. Statistical analysis was performed in SPSS 20.

## Results

Baseline characteristics between two study groups were not significantly different [Table 1]. The participants' mean weight, the postpartum retained weight, and percentage of women who reached to pre-pregnancy weight during the follow-up have been shown in Table 2. Table 3 represents the effect of intervention on interested outcomes. The first part provides the effect of intervention on the means of postpartum weight during follow-up using linear regression model in a generalized estimating equation approach. The results adjusted for pre-pregnancy weight. Regarding non-significant interaction effect of trial groups and time of follow-up ( $p = 0.647$ ), there was no significant difference in pattern of decreasing in postpartum weight between two groups (model 1). However, according to the results of model 2, postpartum weight decreased significantly within 52 weeks following in both group ( $\beta = -0.84$ ,  $SE = 0.009$ ,  $P < 0.001$ ) and intervention was significantly effective on reducing postpartum weight ( $\beta = -3.112$ ,  $SE = 0.7384$ ,  $P < 0.001$ ) [Figure 2]. The retained weight also decreased significantly within 52 weeks following the intervention in both group ( $\beta = -0.08$ ,  $SE = 0.009$ ,  $p < 0.001$ ) (model 2). The women in intervention group had less retained weight

compared to controls during the follow-up ( $\beta = -3.35$ ,  $SE = 0.75$ ,  $P < 0.001$ ). Regarding non-significant interaction effect of follow-up weeks and intervention groups ( $P = 0.573$ ), variations of retained weight were not significantly different between two groups (model 1) [Figure 2].

The third part in Table 3 shows effect of intervention on returning to pre-gravid weight using generalized estimating equation (GEE) modification of logistic regression. The Odds of returning to pre-gravid weight significantly increased within 52 weeks following the intervention in both group (OR = 0.976, 95% CI: 0.20,0.61) (model 2). The women in intervention were more likely to attain their pre-gravid weight compared to controls during the follow-up (OR = 2.86, 95% CI:1.62, 5.07).

## Discussion

This single blind randomized controlled trial was effective on PPWR and the proportion of participants who returned to their pre-gravid weights or below on the 8th, 26th, and 52nd weeks after childbirth, respectively. Similarly, Ruesten *et al.*' found that higher adherence to official Norwegian food guidelines during pregnancy seems to be associated with lower postpartum weight retention 6 months postpartum. [7] Also, Wolff *et al.*' showed that their prenatal nutrition intervention was effective to control the postpartum retained weight in obese participants (-4.5 vs. 2.4kg, 95% CI of



difference: 2.5–11.2,  $P = 0.003$ ).<sup>[6]</sup> We are unaware of any other study that reduced postpartum weight retention through prenatal nutrition education. However, Huang *et al.*'s nutrition and physical activity trial was effective on retained weight 6 months after delivery. Olson *et al.*' intervention decreased the risk of post-partum weight retention in a subgroup of low-income, overweight women, too.<sup>[4,15]</sup> Researchers' findings demonstrated that higher scores on a nutrition knowledge was associated with lesser retained weight at 1 year postpartum while dietary quality was not associated with postpartum weight retention.<sup>[16,17]</sup> Therefore, the nutrition education is necessary to manage of postpartum weight retention. Also, we showed that the present intervention during and not after pregnancy could also overcome weight gain at 12 months after delivery while Herring *et al.* reported that intervening in pregnancy alone, may be doubtful to make the same degree of weight loss.<sup>[18]</sup> Phelan *et al.*<sup>[5]</sup> executed a behavioral intervention during pregnancy which increased the percentages of normal, over-weight, and obese women who returned to their pre-gravid weights or lower (30.7% vs. 18.7%;  $P = 0.005$ ) by six months postpartum. Their intervention increased marginally the percentages of women who reached pre-gravid weight at the 12-mo follow-up, too.<sup>[5]</sup> In another behavioral intervention during and after pregnancy, 56% of obese African American participants reached to their early pregnancy weights by 6 months postpartum and not by 12 months.<sup>[19]</sup> Ronnberg *et al.*' lifestyle trial during pregnancy reduced the post-partum weight retention at  $\leq 16$  weeks, but the retained weight was not statistically significant at one year postpartum.<sup>[20]</sup> The long-term effects of the present intervention seem to be due to the degree of success in management of gestational weight gain. As we previously reported that our nutrition intervention prevented of excessive gestational weight gain in all BMI group<sup>[8]</sup>; while Phelan *et al.*'s and Olson *et al.*'s intervention decreased the risk of excessive GWG in normal and overweight women, respectively.<sup>[5,15]</sup> Likewise, Rong *et al.*' demonstrated that GWG affects the long-term postpartum weight retention.<sup>[21]</sup> Our nutrition trial enhanced the participants' self-efficacy of gestational weight management<sup>[8]</sup> which may also be associated with post-partum weight management as Phelan *et al.* reported.<sup>[5]</sup> Pre-pregnancy weight seems to be a strong predictor of 52 weeks postpartum weight retention, and retained weight after delivery in normal-weight women is lesser than overweight and obese women, consistent with another research.<sup>[22]</sup>

This trial was conducted on thin, normal, over-weight and obese women from 6 to 10th weeks until the end of pregnancy and not during breast feeding due to its difficulties. The current intervention included the practical relevance and a steady effect on postpartum weight retention during one year after delivery. However, the generalization of our findings to the four BMI groups needs to more studies with larger sample. We did not also estimate the nutrients intake during one year after delivery.

## Conclusions

Nutrition education considering an individualized calorie-appropriate diet for each pregnant woman and based on the national guideline is effective on postpartum weight retention and reaching to pre-gravid weight. Therefore, attention should be devoted to support nutrition education for pregnant women to get reliable and truthful information from health care providers.

## Declaration of patient consent

The authors certify that they have obtained all appropriate pregnant women consent forms. In the forms the pregnant women have given their consent for their clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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