South African Journal of Clinical Nutrition 2023; 36(4):147–153
https://doi.org/10.1080/16070658.2023.2172707

SAJCN
ISSN 1607-0658 EISSN 2221-1268

ARTICLE

Effect of group cognitive behavioural therapy on self-efficacy and anthropometric indices among overweight and obese postpartum women

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Objective: While usually associated with weight gain, pregnancy and the postpartum period are also considered as an opportunity to prevent weight gain and its complications. Therefore, the prevention of 'excessive/unnecessary' weight gain is a necessary issue. The aim of this study was to determine the effect of group cognitive behavioural therapy (CBT) on self-efficacy and lifestyle to control weight and anthropometric indices among overweight and obese postpartum women.
Design: Quasi-experimental study.
Setting: Public health centres in Izeh, Iran.
Subjects: Sixty eligible women were divided into two groups of intervention ($n = 30$) and control ($n = 30$) using a simple randomisation method. A demographic questionnaire, a checklist and Weight Efficacy Lifestyle Questionnaire (WELQ) were used to collect the data. The intervention group received eight sessions of group CBT, while the control group received routine care. All variables were measured at baseline and four weeks after the completion of the intervention. Data were analysed using an independent *t*-test, paired *t*-test, chi-square and analysis of covariance using SPSS version 24.
Outcomes measures: Self-efficacy, weight, height, body mass index, waist, hip, and arm circumference, waist/hip ratio,and body fat percentage were measured at baseline and 12 weeks after intervention.
Results: The results showed that in the CBT group, there was a significant increase in the total score of self-efficacy and its components, while weight, body mass index, waist circumference, hip circumference, waist/hip ratio, mid-upper arm circumference and body fat percentage significantly reduced in comparison with the control group ($p < 0.05$).
Conclusion: Cognitive behavioural therapy can improve self-efficacy, affecting weight and anthropometric indices in overweight and obese postpartum women. Therefore, CBT can be used as an adjunct to weight-loss intervention such as physical activity and diet or it can be used as a sole form of therapy to facilitate weight loss among overweight/obese postpartum women.

Keywords anthropometric indices, cognitive behavioural therapy, lifestyle, overweight women, self-efficacy

Introduction

Obesity refers to the excessive or abnormal accumulation of fat in the whole or specific parts of the body.[1] The prevalence of obesity and overweight in the Eastern Mediterranean countries has been reported to be 20.7%,[2] while in the Persian Gulf countries it is around 30–40%.[3] Obesity and overweight are also on the rise in Iran, and about 63.9% of Iranian women are prone to obesity and overweight.[4]

Women gain an average of 3–15 kg from early pregnancy to one year after giving birth, and 14–25% of them maintain extra weight of more than 5 kg after childbirth, which is mostly stored centrally.[5] Although usually associated with weight gain, pregnancy and the postpartum period are also considered as an opportunity to prevent weight gain and its complications.[6] The association of insufficient physical activity and suboptimal dietary intake, such as insufficient intake of vegetables, with overweight and obesity in pregnancy has been addressed in other studies.[7,8] Despite the effect of physical activity and diet on overweight and obesity during pregnancy and the postpartum period, the role of psychological factors such as stress is significant.[9] The US Preventive Services Task Force (USPSTF) Recommendation Statement recommends that all pregnant women should receive behavioural counselling for healthy weight gain during pregnancy.[10]

One of the concepts that has attracted enormous scholarly attention in weight loss programmes is the concept of Bandura self-efficacy.[11] Self-efficacy is an individual's perception of their ability to perform a particular action in a given situation. It is based on the assumption that a person's belief in their abilities and talents is the most important determinant of that person's behaviour.[12] Evidence has also recognised self-efficacy as a predictor of weight loss and a predictor of the success of weight control programmes (Weight-Lifestyle Self-Efficacy controls).[13] Studies have shown that enhanced self-efficacy is a major factor affecting weight loss and its management in overweight or obese individuals.[14]

Eating self-efficacy is measured based on five factors including negative emotions, availability, social pressure, physical discomfort and positive activities.[15] People may be resistant to weight-reduction programmes for a variety of reasons, such as having a depressive mood, having stress, and failure in previous weight-reduction programmes.[16] One of the most effective non-surgical methods in the treatment of overweight and obesity that has been considered by many researchers is cognitive

behavioural therapy (CBT).[17] CBT is recommended as a psychological method for the treatment of obesity, and it is designed to strengthen a healthy lifestyle in the long run by changing eating habits and inappropriate behaviours and developing mental beliefs.[18] In fact, this treatment is based on the theory that the problems raised (e.g. obesity) are maintained by some dysfunctional beliefs and cognitions.[19] Studies have shown that, in addition to diet and exercise, behavioural and environmental factors play a vital role in developing overweight and obesity.[20] The mechanism of CBT for weight reduction may be postulated as follows: changing the cognition of the client regarding obesity and weight control, which enables them to achieve long-term maintenance of lifestyle change.[21]

Dalle Grave *et al*. showed the effectiveness of CBT in the treatment of anorexia nervosa and bulimia.[22] Madjd *et al*. enrolled in their study 113 female adults who had already lost their weight and underwent a CBT programme for weight maintenance, and they found that CBT could significantly reduce weight, body mass index and waist circumference after a 24-week intervention.[23] Since the amount of weight gained during pregnancy can be controlled by focusing on the use of non-surgical methods such as CBT, the adverse consequences such as gestational hypertension, gestational diabetes and pre-eclampsia can be prevented.[24] Therefore, the aim of the present study was to determine the effect of group cognitive behavioural therapy on self-efficacy to control weight and anthropometric indices among overweight and obese postpartum women.

Methods

This quasi-randomised trial was conducted on 60 overweight or obese postpartum women referred to public health centres in Izeh, Iran. This study started in July and was completed in December 2020.

Sampling

The sample size was calculated to be 27 women in each group, based on a similar study,[11] considering a confidence interval of 95%, and power of 0.90. We considered 10% of attrition rate; therefore, 30 women were calculated to be necessary for each group. The following formula was used for sample size calculation:

$$n = \frac{(Z_1 - \alpha/2 + Z_1 - \beta)^2(s_1^2 + s_2)^2}{(\bar{x}_1 - \bar{x}_2)^2}$$

$$n = \frac{(1/96 + 1/28)^2(5/73^2 + 5/4)^2}{5^2} = 27$$

Inclusion/exclusion criteria

The inclusion criteria were as follows: literate primiparous breastfeeding women, aged 18–40 years and with a body mass index of 25 or higher (overweight and obese women) and at least six months past their delivery. Exclusion criteria were as follows: being pregnant or planning for pregnancy, receiving psychotropic or weight-affecting medications, having self-reported eating disorders, having medical conditions such as thyroid disorders or diabetes, and receiving concomitant psychotherapy or other weight-loss programmes.

Ethical considerations

The proposal for this study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (Ref No: IR.AJUMS.REC.1398.769). All participants provided written informed consent prior to participation.

Recruitment

Women ($n = 85$) from three public health centres (Health Centres 5, 1 and Health Centre of Dehdez) were screened according to inclusion/exclusion criteria, of whom 17 were not eligible and 8 did not provide consent. Finally, the remaining 60 women were randomised into two groups ($n = 30$).

Outcomes

- The primary outcome of this study was improvement in self-efficacy for weight control as measured by WELQ.
- The secondary outcome of this study was reduction in weight, body mass index, waist, hip, and arm circumference, waist/hip ratio and body fat percentages.

Measurements

In this study, a demographic questionnaire, a checklist and Weight Efficacy Lifestyle Questionnaire (WELQ) were used to collect the data. The demographic questionnaire included questions on age, age of the husband, the women's and their husbands' educational attainment, occupation and mode of delivery. Weight, height, body mass index, waist circumference, hip circumference, waist/hip ratio, arm circumference and body fat percentage were recorded on the checklist.

Designed by Clark *et al*. in 1991, WELQ includes 20 items that describe weight self-efficacy in five subscales of negative emotions (questions 1, 6, 11 and 16), availability (questions 2, 7, 12, 17), social pressure (questions 3, 8, 13 and 18), physical discomfort (questions 4, 9, 14, 19) and positive activities (questions 5, 10, 15 and 20). The scoring of this questionnaire is based on a 9-point Likert scale from very uncertain (score 0) to very confident (score 9). To obtain the total score of this questionnaire, the score of all questions is summed and divided by 20, and to obtain a score for each subscale, the sum of the questions on the same subscale is divided by the number of questions in each subscale. The score of each subscale is between 10 and 40, with higher scores indicating better self-efficacy for weight control. In their study, Clark *et al*. reported a Cronbach's alpha coefficient of 0.70–0.90 for this questionnaire.[15] The validity and reliability of this questionnaire were approved by Navidian *et al*. in Iran.[25] In the present study the Cronbach's alpha was 0.85 for WELQ.

Measurement of anthropometric indices

The lead investigator initially screened women for eligibility in three public health centres in Izeh, Iran. Eligible women were invited to attend the health clinics. The eligible women were weighted barefoot and wearing light clothes, using a Seca digital scale (Seca, Hamburg, Germany) with 0.1 kg accuracy. The height of the participants was measured using a stadiometer with 0.1 cm accuracy. The body mass index (BMI) was then calculated using weight (kg) divided by squared height (metres). Waist circumference was measured in the narrowest part of the lumbar region in the area between the upper ridge of the iliac bone and the end of the ribs. Hip circumference was measured at the widest area of the hips using a non-stretch tape measure. The waist/hip ratio was obtained by dividing the waist circumference by the hip circumference (cm).

To measure the fat percentage of the body, the German Beurer diagnostic scale BG64 USB (Beurer GmbH, Ulm, Germany) was used. After the device was turned on, it was placed on a flat

surface and the women were requested to step on barefooted. The characteristics of the participants including age, sex, height and physical activity level were recorded in the device. The body fat percentage, body water percentage, muscle percentage, bone mass and basal metabolism rate were measured and recorded. All anthropometric indices were measured at baseline and 12 weeks after the intervention.

Randomisation and blinding

Eligible women ($n = 60$) were randomly divided into two groups of intervention ($n = 30$) and control ($n = 30$) using block randomisation with a block size four and an allocation ratio of 1:1. Due to the nature of the study, blinding was not possible. To prevent transfer of data, the two groups were scheduled to come to the clinic separately on different days.

Intervention

Women in the CBT group received 8 sessions of CBT aimed at improving self-efficacy for weight control. In the first session, the participants received information on the principles of CBT and its theoretical foundations, spontaneous thoughts and cognitive errors, the setting and the rules of the sessions. In the second session, the women received information on using CBT for weight loss, formulating and providing a conceptual framework of CBT, conceptualising the participants' issues, discussing the relationship between thoughts and perceptions related to diet in times of excitement and eating-related behaviour.

In the third session, the women received information on inner speech of thoughts, feelings and behaviours related to eating, practice prior to eating aimed at strengthening control over behaviour, goal setting, preparing a special notebook for treatment, and activity planning.

In the fourth session, the women received information on identifying and recognising spontaneous thoughts related to various events and incidents in life as well as spontaneous thoughts related to eating, and they also practised recording thoughts and doing so as homework.

In the fifth session, the women learned the following: changing and modifying spontaneous thoughts about eating, the techniques of creating rational alternatives, constant communication with the person who has had a successful diet, and focusing on thoughts about the benefits of a particular diet and its consequences.

In the sixth session, the women were taught how to recognise the cognitive errors related to overeating, use internal speech before eating, review evidence and prepare coping cards.

In the seventh session, the participants received instructions on how to design the graded task, use the visual coping technique, provide feedback for themselves if they succeeded in the treatment plan and review the positive consequences of the diet and write them down.

In the eighth session, the participants reviewed incomplete activities, homework, notebooks and treatment, and their questions were answered. All the CBT sessions were conducted by one of the researchers (AJ) who had been trained in a CBT workshop and received a certificate. Furthermore, a clinical psychologist supervised all CBT sessions.

We did not assess the physical activity or diet of the participants based on standard questionnaires. However, for measuring body fat percentage, we had to ask about the participants' physical activity. The majority of the participants in the two groups undertook no physical activity apart from their housework, or performed light physical activities such as occasional walking or gardening, and none of them was following any special diet. During counselling sessions, women in the intervention group were requested to do physical activity at least three times a week starting from the second session of counselling.

Due to the spread of the COVID-19 pandemic in Iran, we classified women in the intervention group into six groups of five, and each group was allocated a specified time for the CBT session (one session per week). All sessions were face to face, and each session lasted 60–90 minutes for each group. None of the participants was affected by COVID-19 infection during the study. Although some relatives of the participants were infected with COVID-19, none of them had been affected severely or died from the disease. All women delivered their babies in hospital. During the study period, vaccination had not officially started in Iran.

Follow-up

Four weeks after the completion of eight weeks of counselling, the participants were requested to complete the WELQ questionnaire, while one of the researchers (AJ) was available in case of any ambiguity. Also, the anthropometric indices and body fat percentage of the two groups were measured by the lead investigator and recorded in the checklist. The control group did not receive any intervention for weight control, and they received only routine care from health providers in public health centres. After completion of the intervention, they received a compact disk on CBT for improvement of self-efficacy.

Statistical analysis

All data were entered into SPSS version 24 (IBM Corp, Armonk, NY, USA). The normal distribution of the data was tested using Shapiro–Wilk test. A Chi-square test and independent *t*-test (two tailed) were used for categorical and continuous data, respectively. The paired *t*-test was used for comparison of pre- and post-intervention differences within groups. An analysis of covariance (ANCOVA) test was used to check the differences between the two groups after adjusting for confounding variables. $P < 0.05$ was considered statistically significant.

Results

We recruited 60 overweight or obese women who had given birth at least six months earlier. None of the women withdrew from the study (Figure 1). Most participants in the two groups had a mean age of 27 years, had a university degree, had a moderate economic status, and underwent Caesarean section (Table 1). The two groups did not show any significant differences regarding demographic characteristics.

As evident from Table 2, the self-efficacy of women in the intervention group was 131.26 ± 24.14 prior to intervention, which improved to 168.20 ± 12.18 after intervention, while in the control group self-efficacy changed from 129.96 ± 20.54 to 127.63 ± 17.52 ($p < 0.001$). All components of self-efficacy including negative emotions, availability, social pressure, physical discomfort and positive activities improved significantly in the intervention group in comparison with the control group

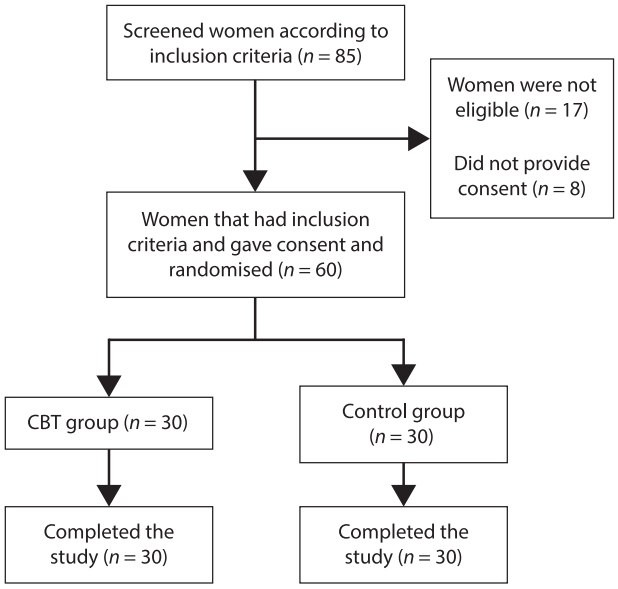

Figure 1: Flow diagram of study.

Table 1: Demographic characteristics of participants in the CBT and control groups

Variables	CBT $n = 30$	Control $n = 30$	p-value
	Mean ± SD		
Age (years)	27.5 ± 4.67	27.7 ± 3.65	0.854
Age of husband (years)	31.23 ± 4.28	31.66 ± 4.29	0.246
Age at marriage (years)	22.7 ± 4.10	23.9 ± 3.83	0.697
	n (%)		
Mode of delivery:			
Vaginal	9 (30)	16 (53.3)	0.058
Caesarean section	21 (70)	14 (46.7)	
History of medical disorders:*			
Yes	5 (16.7)	8 (26.7)	0.266
No	25 (83.3)	22 (73.3)	
Education:			
High school and diploma	15 (50)	14 (46.7)	0.355
University education	15 (50)	16 (53.3)	
Occupation:			
Employee	4 (13.3)	1 (3.3)	0.16
Housewife	26 (86.7)	29 (96.7)	
Does family income cover the costs of whole family?:			
No	2 (6.7)	6 (20)	0.178
Yes, partially	26 (86.6)	20 (66.7)	
Yes, totally	2 (6.7)	4 (13.3)	

*Medical disorders such as diabetes and hypertension.
Self-efficacy and all its components, including negative emotions, availability, social pressure, physical discomfort, positive activities.

($p < 0.05$). BMI in the intervention group reduced from 28.22 ± 2.49 to 26.56 ± 2.43 after intervention ($p = 0.03$), while in the control group it had an upward trend. Waist circumference in the intervention group reduced from 88.6 ± 4.04 to 86.2 ± 4.08 cm after intervention ($p = 0.002$), while in the control group there was an increase in this rate. Hip circumference in the CBT group had a significantly reduction (from 105.5 ± 4.5 to 101.46 ± 5.04 cm after intervention) ($p = 0.002$), while in the control group it had increased after the intervention.

Arm circumference reduced significantly in the CBT group (from 31.36 ± 1.95 to 28.16 ± 1.98 in comparison with the control group where it remained almost unchanged (from 30.63 ± 1.44 to 30.86 ± 2.06) ($p < 0.001$). There was a significant decrease in body fat percentage in the CBT group (from 40.10 ± 3.37 to 37.3 ± 3.77), while the control group experienced an increase in this respect ($p = 0.002$). Although the waist/hip ratio reduced significantly in the intervention group, the differences between the two groups was not significant after intervention.

Before the intervention, most of the women in the intervention and control groups 22 (73.3%) had moderate self-efficacy (score 100–150), but after intervention 28 (93.3%) of the women in the intervention group and only 4 (13.3%) in the control group had good self-efficacy (score 150–200, $p < 0.001$) (data not given in tables).

Table 3 shows the comparison of self-efficacy and anthropometric indices after intervention, adjusting for before intervention. As evident from this table, the total score of self-efficacy and the score of all its subscales were significantly improved in the CBT group compared with the control group. Also, all anthropometric indices significantly decreased in the CBT group compared with the control group.

Discussion

This study aimed to evaluate the effectiveness of CBT for weight-control self-efficacy among overweight and obese post-partum women. Our results showed that weight-control self-efficacy and all its components improved significantly in the intervention group compared with the control group. Overweight and obesity is a multifaceted issue that is mostly related to lack of physical activity and an unhealthy diet, but it sometimes has a psychological origin, and the individual's behaviour and thoughts should definitely be examined along with their diet and physical activity.[26] CBT helps people to accept weight -loss methods more easily, change their mindset concerning overweight and obesity, and, most importantly, change their lifestyle throughout life.[21]

In the present study, our focus was on enhancing self-efficacy and its subscales in order to induce weight loss and reach improvement in other anthropometric measurements of participants. We could not find any study to evaluate the effect of CBT on self-efficacy of women after childbirth. Therefore, we compared our results with those of other studies dealing with the effect of CBT on other target groups. Miri *et al*., in their study on 110 overweight adolescents, found that using CBT could significantly increase the total self-efficacy score as well as all of its components.[27] Golkarian *et al*. evaluated the effectiveness of CBT in self-efficacy of obese people and found that compared with going on a diet CBT could significantly improve self-efficacy.[28]

Table 2: Comparison of self-efficacy of lifestyle and anthropometric indices in two groups of CBT and control before and after intervention

Variables	Time	Intervention $n = 30$	Control $n = 30$	*p*-value between groups	95% confidence interval	
		Mean ± SD			Lower	Upper
Self-efficacy	Before	131.26 ± 24.14	129.96 ± 20.50	0.823	−10.28	12.88
	After	168.2 ± 12.18	127.63 ± 17.52	< 0.001	36.1	43.40
Negative emotions	Before	25.9 ± 6.30	25.7 ± 5.60	0.89	−2.89	3.29
	After	34.13 ± 3.50	25.4 ± 4.90	< 0.001	6.50	10.96
Availability	Before	24.5 ± 5.30	24.5 ± 6.90	0.98	−3.23	3.16
	After	32.7 ± 4.10	23.9 ± 6.02	< 0.001	6.09	11.40
Social pressure	Before	27.3 ± 6.20	24.7 ± 5.80	0.09	–0.45	5.70
	After	34.1 ± 3.40	24.03 ± 4.40	< 0.001	8.05	12.21
Physical discomfort	Before	29.1 ± 5.00	28.9 ± 4.90	0.87	−2.38	2.78
	After	35.6 ± 3.05	28.4 ± 4.10	< 0.001	5.26	9.05
Positive activities	Before	24.3 ± 6.70	26.06 ± 3.60	0.21	−4.52	1.05
	After	31.5 ± 4.70	25.8 ± 3.01	< 0.001	3.72	7.81
Body mass index (kg/m^2)	Before	28.22 ± 2.49	27.62 ± 1.76	0.291	–0.521	1.71
	After	26.56 ± 2.43	27.84 ± 2.01	0.03	1.37	2.45
Waist circumference (cm)	Before	88.6 ± 4.04	89.8 ± 4.64	0.304	−3.26	1.26
	After	86.2 ± 4.08	90.03 ± 5.02	0.002	4.87	7.36
Hip circumference (cm)	Before	105.5 ± 4.50	105.18 ± 4.16	0.778	−1.92	2.55
	After	101.46 ± 5.04	106.10 ± 6.19	0.002	7.93	11.93
Arm circumference (cm)	Before	31.36 ± 1.95	30.63 ± 1.44	0.096	–0.138	1.63
	After	28.16 ± 1.98	30.86 ± 2.06	< 0.001	2.66	4.07
Waist/hip ratio	Before	84.86 ± 3.93	83.56 ± 2.64	0.139	−1.44	2.30
	After	84.56 ± 4.50	84.4 ± 3.23	0.870	0.262	2.71
Body fat percentage (%)	Before	40.10 ± 3.37	39.9 ± 4.12	0.865	−1.72	2.19
	After	37.3 ± 3.77	40.86 ± 4.80	0.002	6.21	9.63

P-value for all measurements before and after in the intervention group was significant (< 0.001), while in the control group it was not significant.

The results of the present study showed that the mean BMI, body fat percentage, waist, hip and arm circumferences, and waist/hip ratio in the CBT group significantly decreased in comparison with the control group. In the study by Miri *et al*., 110 overweight adolescents were randomised to CBT or control groups, and the researchers found that CBT could significantly reduce weight, waist circumference, hip circumference, waist/hip ratio, BMI and body fat mass. The CBT group also experienced improvement in their physical activity and health-related quality of life.[27] The results of our study are consistent with those of Miri *et al*., except that in the present study we did not measure physical activity of the participants using a standard questionnaire. Almost all women in our study did not have any regular physical activity, but during the counselling sessions the women were requested to undertake physical activity at least three times a week starting from the second session.

Pondenejadan *et al*. (2013) examined the effect of CBT on BMI of male employees and found that, compared with physical activity and diet therapy, CBT could significantly reduce BMI in the intervention group.[29] These findings are also in line with our results. In another study, Jordan *et al*. (2008) examined

Table 3: Comparison of self-efficacy of lifestyle and anthropometric indices in two groups (CBT and control) after intervention using ANCOVA adjusting for pre-intervention

Variables	Sum of squares	df	Mean square	*F*	Sig	Partial eta squared
Self-efficacy total score	23 731.9	1	23 731.9	467.3	< 0.001	0.891
Negative emotions	1 113.4	1	1 113.4	170.8	< 0.001	0.750
Availability	1 159.1	1	1 159.1	167.7	< 0.001	0.746
Social pressure	1 065.4	1	1 065.4	223.9	< 0.001	0.797
Physical discomfort	743.9	1	743.9	179.7	< 0.001	0.759
Positive activities	624.1	1	624.1	61.8	< 0.001	0.520
BMI (kg/m^2)	53.7	1	53.7	50.1	< 0.001	0.468
Waist circumference (cm)	554.3	1	554.3	97.3	< 0.001	0.631
Hip circumference (cm)	1 479.0	1	1 479.0	99.2	< 0.001	0.635
Waist/hip ratio	33.2	1	33.2	5.90	0.018	0.094
Arm circumference (cm)	162.3	1	162.3	91.8	< 0.001	0.617
Body fat percentage	940.6	1	940.6	85.9	< 0.001	0.601

the effect of CBT on overweight or obese mothers from low-income families. They reported that an eight-week intervention using CBT could reduce the waist circumference by 3.5 cm, which is in line with our results.[30] Using the Transtheoretical Model in an interventional study on 55 adult women, Karintrakul *et al*. (2017) found that the fat percentage of women in the intervention group reduced by 1.54%, while its reduction in the control group was just 0.08%.[31] These findings are also similar to our results.

Limitations of the study

Despite its strengths, the present study suffered from a number of limitations. First, individual social differences among the participants could affect their self-efficacy in weight control, and this may have affected the results. Second, we did not assess the physical activity or diet of the participants using standard questionnaires. However, as we had to ask about the participants' physical activity for measuring the body fat percentage, we found that the majority of the participants in the two groups did no physical activity apart from their housework, or did light physical activity such as occasional gardening, and none of them was following any special diet. Third, change in eating habits as a result of the intervention was not determined by post-intervention assessment.

Fourth, due to the nature of the study, blinding was not possible, and this may produce bias in this study. Finally, the physical activity of the participants and their food consumption and long-term stay at home during the COVID-19 pandemic affected their anthropometric indices, so generalisation of the results of this study is specific to the pandemic period and cannot be generalised to other times.

In sum, cognitive behavioural therapy can improve self-efficacy affecting weight and anthropometric indices of overweight and obese postpartum women. Therefore, CBT can be used as an adjunct to a weight-loss intervention/increased level of physical activity diet or it can be used as a sole form of therapy to facilitate weight loss among overweight/obese postpartum women.

Acknowledgements – This study was extracted from a master's thesis of AJ. All expenses of this study were provided by Ahvaz Jundishapur University of Medical Sciences. We would like to thank all women who participated in this study.

Disclosure statement – No potential conflict of interest was reported by the authors.

Funding – All expenses of this study were provided by Ahvaz Jundishapur University of Medical Sciences. The funder did not have any role whatsoever in the design, data collection, data analysis and interpretation, or in writing and submitting the manuscript to a journal.

Availability of data and materials – The data used in this study will be available upon reasonable request from the corresponding author.

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Received: 15-04-2022 Accepted: 20-01-2023