

A Comparison between LEARN Program and Cognitive- Behavior Intervention on Modifying Leptin Levels, Body Mass Index, Eating, Exercise and Self-Efficacy among Obese and Overweight Women

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Abstract

Introduction: Genetic, environmental, physiologic, psychological, and sociocultural variables are contributing factors to the development of obesity. Obesity and overweight are risk factors for cardiovascular diseases, type II of diabetes, and hypertension. Hence, the aim of this was to compare the effectiveness of LEARN program and cognitive- behavior therapy (CBT) on modifying leptin levels, body mass index, eating, exercise and self- efficacy among overweight and obese females.

Method: 30 volunteer females with BMI>25 were selected and randomly assigned into two experimental groups (i.e. LEARN multidimensional program and CBT). Data analysis were conducted by using variance analysis with repeated measures.

Results: Data analysis by variance analysis with repeated measures revealed that both interventions could significantly modify BMI, eating and exercise self- efficacy, and leptin levels ($P<0.05$). But, there were no significant differences between two interventions except to leptin levels ($P>0.05$). So that, leptin levels were more decreased among LEARN group in comparison to CBT group ($P<0.05$).

Conclusion: It seems that both interventions by receiving positive feedback from health status in consequence to weight reduction and modifying physical function could lead to enhancing physical-bio-psychological components. But, LEARN program by focusing on behavioral pathways could more modify biological components levels e.g. leptin.

Declaration of Interest: None.

Key words: Cognitive-behavior therapy, Eating self-efficacy, Exercise, LEARN, Leptin, Overweight.

Introduction

The energy imbalance is one of the consequences of modern life style and bio-psycho-sociological factors, which can lead to obesity. Prevalence of obesity has been increasing, which is also one of the risk factors for development of cardiovascular diseases (1). It has been demonstrated that behavioral factors SUCH AS WHAT?? Can lead to, obesity, eating disinhibition, and increase in appetite (2). Self-efficacy is considered as one of the

influential factors in reduction and control of behavioral factors (WHAT FACTORS). Self-efficacy refers to an individual's beliefs about his/her ability to successful implementation of certain behaviors that is required to produce the desired outcome in performance (3). Moreover, self-efficacy is related to weight loss behaviors as well as weight maintenance (4).

Eating self-efficacy refers to individual's beliefs about his/her ability in successful involvement in physical activity or restricting

calories for losing weight (5). Exercise and eating self-efficacy play an important role in weight loss for individuals who intend to lose weight. Dieting is always arduous for individuals who intend to lose weight or are on diet. Diet can be challenging for individuals most of them lose their motivation in the midst of diet. In these cases, usually, the level of self-efficacy among individuals have a direct effect on their motivation to stay committed to their diet (6). It has been revealed that there is a positive correlation between self-efficacy and weight loss (7). Success of a participant who took part in an obesity management program was related to the ability in successfully performing behaviors that were necessary to weight maintenance (5). Therefore, self-efficacy could be efficient whenever individuals are struggling to lose weight or weight maintenance (5). Thus, self-efficacy and motivation is considered as an influential variable in weight loss.

On the other hand, endocrinological investigations have shown that leptin (a hormone that involves in obesity) is produced by a gene for obesity, which is located in the adipose tissue (8). It seems that leptin is a part of a signaling pathway which is responsible for regulating body fat content as well as energy balance as part of a hemostatic mechanism which take part in continuous maintenance of fat mass (9). In human beings, endocrine mechanism break down in control of leptin (an increase in leptin levels) is mainly related to increase appetite and preference of high calorie foods. Additionally, increasing in leptin levels is associated with some other factors such as reduced physical activity and increased of lipogenic metabolism (10). So, leptin, through this pathway, could be result in obesity (11).

Thus, It has been believed that in order to achieve obesity management, it is demanded to take advantages of everlasting life style changes including diet and exercise, because of their effect on the Leptin functions (13).

On that account, behavioral and lifestyle intervention consists of setting reasonable goals, making a plan for change, creating a positive attitude towards the exercise, offering positive incentives, self-monitoring training,

getting nutritional advice are necessary to weight management programs. Also, the components of the lifestyle modification with respect to obesity and overweight management are including: (1) nutritional dieting, (2) physical exercise and (3) behavior therapy that consist of a set of principles and techniques for modifying the nutritional style and physical activity (14).

Healthy lifestyle modification aims to train methods to modify overeating and leaving sedentary life by doing more physical exercise. And the purposes of such interventions are to increase physical activity through walking and or increasing the activities in everyday life. The five main components of the LEARN program, as a lifestyle modification program for weight management, consists of lifestyle, exercise, attitudes, relationships and nutrition modification. To create a commitment in order to change lifestyle, increase physical activity and reduce the received calories and ultimately, a gradual weight loss, is the aim of aforementioned program. The purpose of this program is to implement self-monitoring on eating behaviors, to control eating stimulates, physical activity, healthy nutrition training, regulating emotions and correcting the destructive thoughts, which are associated with the obedience of nutritional diet and body image, setting realistic goals, interpersonal relationships and maintaining weight and to prevent regaining weight (15,16,17).

Cognitive-behavior therapy for weight management is another psychological intervention designed by Cooper, Fairburn and Hawker can be an effective method for losing weight or weight maintenance (18). This intervention consists of three discrete elements: first, it will help the client to accept the weight loss needs to be achieved; second, to encourage accepting the weight stability instead of weight loss as an aim. Third, to support the client to learn behavioral skills and cognitive responses that are required for successful weight control. In order to achieve these objectives, there are strategies and methods determined in Cooper's et al. (18), These processors are as follow: the beginning of the treatment, weight stabilization and maintenance, putting the concentration on weight loss obstacles, increasing activity;

considering body image concerns; paying attention to the weight goal; following the primary goals, healthy eating and maintaining weight.

According to aforementioned issues, this study aimed to make an experimental comparison between these two interventions to evaluate their effectiveness and their ability for changing the related weight management factors, such as eating self-efficacy, exercise self-efficacy and leptin. And on account of this procedure, it would be possible to determine bio-psychological links which can influence the weight loss and weight maintenance.

Method

Quasi-experimental research design with pre-test and post-test was utilized in this study. In the current study, the statistical population consisted of all women residing in Tehran with the age range of 18 to 45 years (after puberty and before the age of menopause with the body mass index (BMI) exceeded by 25 considering as an obese. Convenience sampling method was applied. After a structural interview from 46 volunteers who were overweight or obese, 30 volunteer were selected to participate in the study. Eligible participants signed the informed consent prior to the beginning of the study. The inclusion criteria consisted of having a Body Mass Index ^(BMI) more than 25, an age between 18 to 45 years old, being female, not being menopause or pregnant. Exclusion criteria included individuals with mental disorders such as personality disorders, bipolar disorder, obsessive-compulsive disorders, having a moderate intensity exercise program at least 20 minutes a day, three days a week on a regular basis in the past 6 months, suffering from an auto-immune diseases, heart diseases, cancer, diabetes, hypothyroidism, high blood pressure, and consuming any medications which could affect the body metabolism or body weight. Finally all of the participants were randomly substituted in two separate groups of LEARN and CBT intervention.

All the participants filled out the items of eating self-efficacy scale, exercise self-efficacy scale, leptin levels as well as BMI before and after receiving interventions.

Leptin levels measurement procedure: A laboratory technician took blood samples from left hands of the participants who all of them were fasted in the laboratory office at 8 A.M. All samples were put in the encoded test tubes, and were immediately transferred to the laboratory of biochemistry and were analyzed immediately after arrival to the laboratory for measuring leptin levels. In this study, Human Leptin ELISA Kit research and prognosis products of Biovender Corporation are used for measuring the leptin levels which uses Immuno Enzymer Assay sandwich method in order to measure human leptin in serum and its standard domain is equal to 11.1 to 33.5 ng/ml. This kit is merely prepared for research activities. Decreased leptin results in a reduction in appetite and an increase in energy consumption as well as an increase in the metabolism of fats. The rhythm of leptin production is circadian. Therefore, it increases during the night. Endometrial leptin can control body weight and this hormone is influenced by the amount of body fat, insulin secretion, glucocorticoids, catecholamine and sex hormones (available on the following website: info@biovender.com).

BMI Calculation: Amron digital measurement device, made in Japan, with an accuracy of 0.1 was used to calculate the BMI. After entering data related to age, sex and height of each participant to the device, the participant put his/her foot on the device's sensors. device's handle is elevated by his/her plumes until both hands were parallel with the chest and perpendicular to the body, and after a few seconds the device calculated and displayed the BMI (kg/m²) on the screen.

LEARN program: LEARN program is designed by Brownell (15, 16 and 17). The program title, LEARN, has taken from the beginning letters of the its English components including lifestyle modification (L), exercise (E), a change in the attitude (A), social relationships (R) and nutrition (N) (15, 16 and 17). LEARN program is a 16-weeks period program (plus one initial assessment session). Each session is conducted on a weekly basis lasting 90 minutes plus 30 minutes for measuring weight and review assignments. An

outline of this program consists of training healthy lifestyle, training to calculate amount of calorie intake per day, recognizing the amount of different food calories, recording weight change on a weekly basis, assessing eating patterns, identifying eating triggers, prescribing walking program and instructing its rules, learning to control the food cravings, structuring correct attitudes, learning to modify the behavior chains and restructuring the irrational thought pattern, substituting the negative self-talk by positive ones, self-monitoring, social and self-change, following scheduled program for meals, planning to eat healthy meals, getting familiar with the food pyramid, setting a goal and challenging and restraining from inefficient eating patterns.

-The Protocol of overweight on the basis of cognitive-behavior intervention: (18): In this approach, the treatment include sixteen sessions (plus one initial assessment session) including intervention corresponding to CBT treatment components' that includes: (1) nutrition, (2) exercise, (3) problem solving and coping skills. The main topics of this intervention represent as assessment, investigation on motivation, self-monitoring as well as weight monitoring, introducing the program, reviewing self-monitoring records, agreement on homework, training positive self-talk, training how to solve problems, correct eating patterns, the healthy eating style, cognitive aspects of eating, weight stabilization and weight loss maintenance, assessing body image concerns, setting realistic goals, long-term weight maintenance skills and evaluation and conclusion. In this approach, a once-a-week therapy session is continuing until an individual to get the opportunity to manage their weight before the end of the treatment. With the exception of the assessment session that lasts about 2 hours, duration of each session will be 90 minutes (plus 30 minutes for measuring weight and review assignments) (18).

-Exercise Self-Efficacy Scale (ESS): This scale is designed by Bandura (19). This scale contains 18 propositions that designed for evaluation of participants' degree of confidence whether he/she is capable of doing exercise

under different conditions or not. Gradation of propositions varies from zero (I can't exercise) to 100 (I'm sure that I can exercise) and a score of from zero to 1800 for participants, which reflect more self-efficacy for doing exercise. Internal validity of this scale, which is calculated by Cronbach's Alpha is equal to 0.94 (20). Agahheris (21) implemented this scale on a sample of 343 individuals and the coefficient of Cronbach's Alpha for the entire questions was equal to 0.93.

-Eating Self-Efficacy Scale: This scale is designed by Glynn and Ruderman (22) and consists of 25 questions that evaluate participants' perceptions of perceived control on overeating in different conditions. Participants determine their responses based on Likert scale, which lies within the range of 1(I have no problem to control my eating) to 7 (Eating control is completely easy). The total scores would be from 25 to 175 in which higher scores indicate more self-efficacy. Factor analysis of scale was specified two subscales for it: difficulty in overeating control during experiencing negative emotions, and in social situations such as dinner party or holidays. Its internal validity among a sample of 848 females was equal to 0.92 for whole scale and 0.94 for negative emotion subscale and 0.85 for social conditions (22). The cronbach's Alpha among Iranian samples were 0.94 (21).

The data were analyzed using SPSS software V. 23. The minimum, maximum, average and standard deviation indices were used in descriptive analysis and analysis of variance tests with repeated measures were used in inferential analysis.

Results:

Descriptive characteristics of physical indices of participants such as minimum, maximum, mean (M) and standard deviation (SD) of the data corresponding to physical indicators (including age, height, weight and BMI) of all the participants of the research are presented in Table 1. As it is reflected in this table, the mean age of participants was 26 years and 10 months and 9 days (with standard deviation of 6.14 years) that laid in the range of

21 to 43 years. The average height of participants was 160.03 cm, which lies in the range of 150 to 170 cm. The weight of participants lies in the range of 63.1 to 102.4 kg

(with an average of 78.25 kg) and body mass index of them lies in the range of 25.2 to 39.5 (Kg/m^2) which means obesity class II.

Table 1: Participants' physical indices corresponds to descriptive characteristics (n=30)

Index	Min	Max	M	SD
Age (Year)	21	43	26.86	6.14
Height (cm)	148	170	160.03	5.31
Weight (kg)	63.1	102.4	78.25	10.95
BMI (kg/m^2)	25.2	39.5	30.18	3.73

The repeated measures variance analysis method results were presented in Table 2 to determine the effectiveness of each intervention separately. The results indicated that both of LEARN and CBT interventions could significantly decrease

the participants' BMI ($p < 0.05$) and this reduction have been maintained up to next month after the end of each intervention. Also, the partial eta coefficient indicates the high effect power of each intervention on decreasing the BMI ($\eta^2 > 0.14$) (24).

Table 2: BMI change test in three basic steps of each group

Group	Index	M	SD	df1	df2	F	P	η^2
CBT	pre-test BMI(Kg/m^2)	29.33	2.65	1	14	28.737	0.0001	0.672
	Post-test BMI(Kg/m^2)	26.73	2.94					
	follow-up test BMI (Kg/m^2)	26.74	3.09					
LEARN	pre-test BMI(Kg/m^2)	31.03	4.5	1	14	29.582	0.0001	0.769
	Post-test BMI (Kg/m^2)	28.09	4.9					
	follow-up BMI (Kg/m^2)	27.91	4.95					

The repeated measures variance analysis method results in Table 3 determined the effectiveness of each intervention separately. The results indicated that both of LEARN and CBT interventions could significantly reduce Leptin levels in participants' serums ($p < 0.05$)

and this reduction have been maintained up to next month after the end of each intervention. Also, the partial delta coefficient indicates the high effect power of each intervention on reduction of participants' leptin levels ($\eta^2 > 0.14$) (23).

Table 3: Leptin change test in three basic steps of each group.

Group	Index	M	SD	df1	df2	F	P	η^2
CBT	pre-test Leptin (ng/ml)	18.05	5.79	1	14	22.358	0.0001	0.615
	post-test Leptin(ng/ml)	12.26	3.97					
	follow-up Leptin(ng/ml)	10.60	4.17					
LEARN	pre-test Leptin(ng/ml)	33.78	9.86	1	14	12.167	0.0001	0.465
	Post-test Leptin (ng/ml)	22.02	9.33					
	follow-up Leptin(ng/ml)	21.66	9.33					

The repeated measures variance analysis method results in Table 4 determined the effectiveness of each intervention separately. The results indicated that both of LEARN and

CBT interventions could significantly increase exercise self-efficacy scores in participants ($p < 0.05$) and this elevation have been maintained up to next month after the end of

each intervention. Also, the partial eta coefficient indicates the high effect power of

each intervention on elevation of participants' exercise self-efficacy scores ($\eta^2 > 0.14$) (23).

Table 4: Exercise self-efficacy change test in each group.

Group	Index	M	SD	df1	df2	F	P	η^2
CBT	pre-test ESS	510	299.35	1	14	7.402	0.003	0.346
	post-test ESS	1110.7	401.39					
	follow-up ESS	945.33	367.36					
LEARN	pre-test ESS	510	299.35	1	14	12.867	0.0001	0.479
	post-test ESS	863.33	397.01					
	follow-up ESS	891.33	286.75					

The repeated measures variance analysis method results in Table 5 determined the effectiveness of each intervention separately. The results indicated that both of LEARN and CBT interventions could significantly increase eating self-efficacy scores in participants

($p < 0.05$) and this elevation have been maintained up to next month after the end of each intervention. Also, the partial eta coefficient indicates the high effect power of each intervention on elevation of participants' eating self-efficacy scores ($\eta^2 > 0.14$) (23).

Table 5: Eating Self-Efficacy Scale change in three steps in each group

Group	Index	M	SD	df1	df2	F	P	η^2
CBT	pre-test ESES	90	29.72	1	14	9.867	0.001	0.413
	post-test ESES	55.4	25.61					
	follow-up ESES	67.933	25.68					
LEARN	pre-test ESES	90.133	23.48	1	14	7.318	0.003	0.343
	post-test ESES	69.266	22.93					
	follow-up ESES	68.533	25.42					

The repeated measure variance analysis test was applied to compare the effectiveness of each intervention in Table 6. It has been revealed that there was no significant difference between two interventions on BMI, exercise self-efficacy (ESS) and eating self-efficacy (ESE) scores of participants ($P > 0.05$). But, the

reduction in Leptin were significantly more in LEARN group participants than participants in CBT group ($P < 0.05$). Also, the partial eta coefficient indicates the high effect power of each intervention on elevation of participants' eating self-efficacy scores ($\eta^2 > 0.14$) (23).

Table 6: differences between BMI, Leptin, ESS, and ESE in both groups.

		SS	df1	df2	MS	F	p	η^2
BMI	within groups	1.094	1.188	56	0.872	0.425	0.564	0.015
	Between groups	44.662	1	28	44.662	1.003	0.325	0.035
Leptin	within groups	147.798	2	56	73.949	2.146	0.126	0.071
	Between groups	3340.365	1	28	3340.365	33.320	0.0001	0.543
ESS	within groups	176008.88	2	56	88004.444	1.461	0.241	0.050
	Between groups	720028.77	1	28	720028.77	2.481	0.126	0.081
ESES	within groups	912.067	1.827	56	499.165	1.177	0.313	0.040
	Between groups	532.9	1	28	532.9	0.449	0.508	0.016

Discussion

The results presented in table 3 and 6 suggested a decrease in Leptin levels in both LEARN and CBT groups. However, decrease in leptin levels in the LEARN intervention was more than that of cognitive-behavioral group. From the perspective of reducing the levels of leptin, the findings of this research are congruent with other findings (24, 25, 26, 27), that they have been shown leptin levels have a direct correlation with body weight; therefore, it could be expected leptin levels will decrease after weight loss. Also, It has been believed that making reduction in the amount of received calorie causes to reduce serum leptin concentrations. Moreover, some research findings suggested that a reduction in leptin levels has been observed, due to weight loss with neuroendocrine changes (28, 29). These findings can be explained by this assumption that changes in cognition and behavior through mind-body connection could make changes the psychoneuroimmunology links as well as the hormones releasing by HPA (hypothalamus-pituitary - adrenal) axis. Also, HPA secretions (e.g., cortisol) would be modified by the reduction in the stress levels by the techniques which could be taught to participants through LEARN and CBT protocols. Decreases in calorie intake and the amount of energy could change the levels of insulin and hormones which can affect the basal metabolism rate and this could be led to secretions of lower levels of leptin (30, 31, 32, 33, 34). In human being, the breaking down of endocrine mechanisms in the control of leptin is accompanied by an increase in appetite, and preference of high calorie foods. But, on the other hand, increased physical activity as well as basal metabolism rate through dieting and walking programs that prescribed in the two interventions could repair those mechanisms and mede a reduction in leptin levels (10, 11). Therefore, Lee, Leinung, Rozhavskaia-Arena, Grasso (32) believe that in order to achieve obesity management, it is necessary to use permanent changes in lifestyle including nutrition and exercise due to their effect on the Leptin functions. With respect to this matter, it could be said that LEARN intervention with focus on above mentioned behavioral pathways assist to reduce leptin

levels more. And on the other hand, it is expected that cognitive-behavioral intervention accompanied by training for stress relieving skills and correcting thinking errors, training problem solving skills and coping functions strategies in the long-term by changing thought-feeling-behavior interaction could help the reductions in leptin levels and also this issue is in agreement with Bornstein et al. (35). Also, Rissanen et al. (10) believed that disinhibition in eating is accompanied to increase in appetite and high calorie foods preferences and Leptin levels. From this point of view, interventions such as CBT, and LEARN can lead to reduce eating disinhibition by training different strategies as well as correcting dichotomous thinking and through such pathways, it results in reduction in Leptin levels (16, 18, 38).

As another result of this study, the scores corresponding to eating and exercise self-efficacy were increased after both interventions. So, both interventions could lead to the correctness in individuals` self-efficacy against the eating conditions as well as their ability in doing exercise. The results suggests that both of implemented interventions in this study, in terms of controlling the amount of eating and increasing doing exercise, could ensure the individual to control the components related to self-efficacy by themselves. Accordingly, it seems due to behavioral components training CBT and LEARN interventions put their concentration on activation of mastery experience which is one the self-efficacy components and through this those interventions have firstly been increasing exercising and eating self-efficacy. On the one hand, due to cognitive and behavioral interventions as well as application of such skills including stress relieving in LEARN and CBT programs, both interventions culminates in reduction of negative emotional states. In LEARN intervention, due to unproductive behavioral chains breakdown, participants` self-efficacy has increased and positive self-talk training related to cognitive-behavioral intervention, due to correction of thinking errors, has improved and as a result, perception of exercise self-efficacy has increased more. Bandura, also believes that processing of multiple sources of information related to an

individual's ability causes him/her to deal with estimation of the amount of required effort and based on it, the individual successfully perform to do that sort of behavior and adjust his /her expectations based on the goals (19).

The findings of this study are compatible with those of Wamsteker et al. (36), Ash et al. (37) and Konard et al. (5). So that their findings showed that lifestyle interventions such as LEARN and CBT will end to exercise and eating self-efficacy. On one hand, Taylor et al. (38) believe that an individual's belief and health output are in interaction with each other due to mind-body connection; therefore, functionality of each part is capable of making improvement on the other one's status. So, it is expected with receiving health status, the subsequent weight loss and improvement in physical functionality will increase self-efficacy of overweight and obese individuals.

Also, training strategies related to getting rid of feeling guilty, concern, self-awareness and self-blame that due to any intervention which somehow have been trained to upgrade information resources, such as an increase in the sense of self-efficacy dominance, and reduce the negative emotional states and physical misconstrue of mode of the paths lead to the preservation of individuals' self-efficacy.

Also, the results of this research show that the average BMI in both groups faced a significant decrease and results reflected the impact of the type of intervention represents at a lower BMI. This finding is in agreement with the results of some researches (e.g. 37, 39, 40, 41, 42, 43, 44, 45, 46, 47). It has been proven that using multifaceted approaches are more appropriate when it comes to achieve a more track record of success, since those interventions play a role in different factors causing obesity and overweight. Therefore, use of approaches such as nutrition, physical activity, behavior, attitude modifications can be result in healthy weight management (48). It seems that in addition to physical activity and proper nutrition and healthy that is equally carried out in both interventions, any psychological intervention with respect to the target components has beneficial effects on the amount of intake and consumed energy. So that Cooper and Fairburn (50) believe that weight

loss will occur in behavioral intervention due to the persistence of physical activity, following the low-fat diet and active surveillance on weight and subsequently stabilization of weight reduction will achieve. On the other hand, Dobson and Dozois (51) also believe that since the cognition affect behavior and any change in behavior occur due to change in cognition; the cognitive-behavioral approach has the capability to change malfunction behaviors that take part in weight gain by analyzing an individuals' thoughts and behaviors based on following comprehensive cognitive therapy patterns and in this way, it leads to reduce weight and BMI (51, 52). In addition, it is safe to say that due to connection between a decrease in Leptin levels and decrease in BMI, we are witness of a reduction in BMI among individuals who were under the effect of both interventions (53). On the other hand, training people to know points about the impact of changing diet, hormonal changes during a monthly cycle, physical activity on permanent mode in weight modification can give them a point of view to control their behaviors. Also as an overall conclusion it can be said that both interventions would be efficient in improvement of bio-psychological components on the cycle-with the impact on mind-body connection (38, 54).

Limitations

Limitations of this research can be significant, noting that samples from healthy women of reproductive age had been formed the groups, so the results of this research might have limitations to generalize in other populations.

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