

Comparison of the Effectiveness of the Transtheoretical Model and Cognitive-Behavioral Therapy in Adolescents' Eating Behavior and Weight Loss

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Background: Nutrition education is a key component of health promotion programs, leading to marked improvements in the nutritional behaviors of adolescents. Therefore, it is of utmost importance to understand the effects of cognitive-behavioral therapy on eating behavior and weight loss in adolescents.

Objectives: The present study aimed to compare the effectiveness of the transtheoretical model and cognitive-behavioral therapy in eating behavior and weight loss in adolescents.

Method: The present semi-experimental study was conducted based on a pretest-posttest control group follow-up design. The statistical population consisted of all adolescents referring to counseling centers in Mashhad in autumn 2019. Out of this population, 45 cases were selected via convenience sampling method and assigned to three groups (two experimental groups and one control group). The research questionnaires were Cappelleri et al.'s (2009) eating behavior questionnaire. Data were analyzed in SPSS software (version 25) using the analysis of covariance test.

Results: Based on the results, the transtheoretical model and cognitive-behavioral therapy differently affected eating behavior so that cognitive-behavioral therapy was more effective than the transtheoretical model ($P < 0.001$).

Conclusions: As evidenced by the obtained results, cognitive-behavioral therapy was more effective in adolescents' eating behavior and weight loss, in comparison with the model of the change process. It is suggested that cognitive-behavioral therapy be considered in the treatment of appropriate principles of nutrition and control of adolescents' weight.

Keyword: Adolescent, Weight loss, Feeding behavior, Cognitive behavioral therapy, Transtheoretical model.

Introduction

Obesity and eating disorders as nutritional diseases are on the rise both in developed and developing countries (1). According to the World Health Organization (WHO) obesity more than doubled from 1980-2014 across the globe. It was reported that in 2014, more than 1.9 billion adults (aged 18 and over) were overweight, out of whom 600 million cases were obese. The studies in Iran as one of the seven countries with the highest prevalence of obesity also indicated an upward trend in overweight and obesity among adolescents (2, 3). The increasing spread of obesity, overweight, as well as various physical, psychological, and economic consequences, have caused eating disorders to be one of the most important psychosomatic disorders accompanied by numerous problems in physical, emotional, and behavioral domains (4). Overeating disorder is in the most common category of eating disorders (5). Being obese or overweight increases the risk of metabolic syndrome, type 2 diabetes, cardiovascular disease, some cancers, and respiratory diseases, fatty liver disease, reproductive disease, depression, and some other mental conditions (6-7). Many adolescents attempt weight loss diets and sometimes they consider themselves obese and continue their diets despite losing weight (8). In this regard, it is

clear that nutritional status is undesirable among adolescence. Accordingly, the prevalence of these nutritional problems can be reduced by increased consumption of low-fat food products, fruits, and vegetables, reduced intake of sugary drinks, and increased participation in regular physical activities in adolescent students (9).

Nutritional interventions to reduce the intake of dietary components, calorie intake, especially fats, can reduce the risk factors of obesity. In community-based interventions, it is of utmost importance to achieve a balanced diet in terms of receiving a suitable amount of calories and determining the contribution of fats to its supply (10). One of the most widely used models for planning effective educational interventions is the transtheoretical model that focuses on the modification of inappropriate behaviors or adoption of positive behaviors (11). The basic hypothesis of this model is that people do not think about accepting or rejecting a particular behavior and are not aware of the problem. In fact, they are in the pre-thinking stage and unaware of the type of behavior and may not make any effort to promote their health and change their behavior (7). Nevertheless, in the thinking phase, when they learn about the problem, they seriously contemplate a behavior

change in the next few months. The next default is that people are ready to make changes and plan to achieve behavioral goals. Moreover, during this planning, they collect information about the subject and precisely organize the information (readiness). This requires continued modification in behavior that started months ago (implementation). At this stage, if the educational intervention is performed correctly, the target behavior actually changes; nonetheless, this change of behavior does not remain completely constant, and ultimately, some efforts are made to stabilize the change made (maintenance). In addition, Prochaska proposed cognitive and behavioral processes for a transition from the stages of change. Cognitive processes are important for the recognition and prediction of progress in the early stages of change and emphasize on emotional aspects of values and cognitions related to behavior. Self-efficacy and decision-making balance have been added to the transtheoretical model in the form of a mediator of transition from cognitive and behavioral processes (13). Some interventions which were in accordance with the stages of readiness for change were more effective than other theory-based interventions. In the field of nutrition education, different studies referred to the effectiveness of education based on the transtheoretical model on nutritional behaviors of different population groups (14).

Furthermore, one of the research-based approaches is behavior change therapy in which people should learn new ways of thinking (15). Accordingly, this treatment covers a range of diet therapy, exercise, and psychological interventions (such as behavioral therapy, cognitive therapy, and metacognitive therapy) (16). Although overweight and obese people typically only undergo nutritional treatments, the conducted studies demonstrated that diet therapy alone is not effective, and people regain their previous weight in the long run (17). Therefore, cognitive-behavioral therapy has gained significant success in weight loss, as compared to other programs (18). The results of related research pointed out that in a group that used cognitive therapy approaches for weight loss, more weight-related adaptive cognitions were made available to patients, compared to non-cognitive therapeutic approaches; therefore, weight loss was relatively better. Multiple studies have assessed the positive effects of "transtheoretical model" and "cognitive-behavioral therapy" methods on many physical-behavioral components. Nonetheless, no research has been found to compare the effectiveness of implementing two methods of "transtheoretical model" and "cognitive-behavioral therapy" on eating behavior and weight loss.

Objectives

The present study aimed to compare the effectiveness of the transtheoretical model and cognitive-behavioral therapy on eating behavior and weight loss in adolescents.

Methods

The present semi-experimental study was conducted

based on a pretest-posttest control group follow-up design. The statistical population consisted of all adolescents referring to counseling centers (Arameshe Ravan and the Sahel) in Mashhad in autumn 2019. Out of this population, 45 cases were selected via convenience sampling method and assigned to three groups (Two experimental and one control group). The required sample size was calculated based on 0.40, 0.95, 0.80 test power, and 10% sample attrition for each group (19). It is noteworthy that the subjects were identified by receiving an inquiry from the counseling office about weight loss problems, Body mass index (BMI) above 25, and eating behavior. The inclusion criteria entailed the informed consent of subjects, BMI at the required level (>25), and the age range of 14-18 years based on a similar study (14). On the other hand, the exclusion criteria were as follows: the use of drugs affecting weight loss, receiving any other interventions, such as medication, focusing on weight loss and eating behavior, lack of experience in weight loss programs, and treatment of obesity. After determining the sample size, as well as the experimental and control groups, the questionnaires were distributed, implemented, and collected in three groups (pre-test). Thereafter, cognitive-behavioral therapy (eight two-hour sessions once a week) and model transgender therapy (eight 45-minute sessions once a week) were held in the first group. The control group did not receive any intervention. After two months of post-test, a follow-up was performed. The ethical considerations of the present study were as follows: 1- All subjects received written information about the research and participated in the research if they wished. 2. All participants were assured of the confidentiality of their responses. 3. To respect privacy, the participants' names and surnames were not registered.

The BMI (kg) per square meter was calculated. Weight was measured using a digital scale with a sensitivity of 100 g, and height was measured using an indispensable tape meter with an accuracy of 0.5 cm.

Three-Factor Eating Questionnaire: It is a 17-item self-report scale developed by Cappelleri et al. to assess eating behaviors (20). The questionnaire consists of three subscales of uncontrollable eating (9-1), such as "I'm always hungry, so it's hard for me to stop eating before I finish eating on a plate, cognitive restraint (10-14), such as "I consciously stay behind in meals to avoid losing weight," emotional eating (15-17). The items are rated on a four-point Likert scale (1=definitely true), (2=true), (3=false), (4=definitely false), with a higher score indicating a higher level of eating behavior (20). The validity scores of the three-factor eating behavior questionnaire in correlation with other similar scales, such as the self-restraint scale and Dutch food behaviors questionnaire, were obtained at 0.74 and 0.98, respectively, which indicates the desired validity of the questionnaire (21). The internal consistency of each subscale ranges from 0.76-0.85 based on Cronbach's alpha, signifying the good validity of the questionnaire (20). The validity and reliability of the questionnaire in

Iran were assessed by Bidadian et al. Its validity was calculated at 0.42, 0.91, and 0.78 for each component of cognitive self-control, emotional eating, and untested eating, respectively, using the internal consistency

Educational Program

The educational program was held in 8 sessions 2 hours a week. Before entering the research environment, the researcher obtained the necessary permissions from Dr. Fereshteh Tanhayi's counseling office. Thereafter, 45 cases were selected as the sample. The subjects received a pre-test of eating behavior questionnaire (20); subsequently, the experimental group was exposed to protocols for stages of change and cognitive behavioral therapy, while the control group did not receive any intervention. Following that, in the post-test stage, the questionnaire was administered to both the

method (21). Weight measurements were performed in kilograms using a digital Seka scale from Germany with errors of less than 100 grams according to WHO protocol.

experimental and the control group. The informed consent was obtained from all subjects, and they were assured of the confidentiality of their responses. The protocol of change stages and the content of each session were in accordance with research objectives and inspired by the pattern of change stages as proposed by Prochaska et al. (22).

The data were analyzed in SPSS software (version 25) using descriptive statistics, including standard deviation, and inferential statistics, such as univariate analysis of covariance, paired t-test, and Bonferroni post hoc test.

Results

Based on the findings obtained from the demographic information of the subjects, the majority of the subjects (33.3%) aged 18 years, and the three groups were homogeneous in terms of age (0.849, 4.084). Moreover, the three groups were homogeneous in terms of BMI ($F=0.615$; 0.545). The highest mean score of BMI was related to the stages of change group (27.82). Thereafter, descriptive findings of the research variables were examined in post-test and pre-test. Accordingly, the mean and standard deviation of the scores of the subjects before and after the interventions and follow-up stage are presented in Table 1.

Table 1. Descriptive findings obtained from eating behavior and weight loss variable (standard deviation of \pm mean)

Variable	Experimental	Pre-test	Post-test	Follow-up
Uncontrollable eating	Control	30.53 \pm 2.41	31.27 \pm 1.66	30.27 \pm 1.43
	TTM	30.33 \pm 3.06	27.53 \pm 2.44	26.07 \pm 2.08
	CBT	30.47 \pm 2.41	24.40 \pm 2.16	25.67 \pm 3.22
Cognitive restraint	Control	10.00 \pm 1.64	9.13 \pm 1.35	10.67 \pm 1.71
	TTM	10.67 \pm 1.79	11.20 \pm 1.32	11.73 \pm 1.16
	CBT	10.87 \pm 2.29	13.40 \pm 1.12	12.80 \pm 1.47
Emotional eating	Control	10.67 \pm 0.81	9.73 \pm 1.22	10.20 \pm 0.94
	TTM	10.07 \pm 1.58	8.00 \pm 1.30	8.73 \pm 1.16
	CBT	10.27 \pm 1.22	6.00 \pm 1.19	6.60 \pm 1.35
Weight Loss	Control	68.73 \pm 3.88	68.60 \pm 4.22	68.73 \pm 3.91
	TTM	70.07 \pm 2.91	67.53 \pm 2.66	64.80 \pm 2.75
	CBT	69.20 \pm 1.85	64.93 \pm 2.01	62.07 \pm 1.98

CBT: Cognitive behavioral therapy

TTM: Transtheoretical model

As illustrated in Table 1, in the pre-test, all three groups have the same mean scores of variables. The change in scores between the two groups of the model of

stages of change and cognitive behavioral therapy is significant; nonetheless, this change is not significant in the post-test of the control group. In addition, changing

the scores of untested eating indices, cognitive restraint, and emotional eating in the follow-up stage is not significant; however, the weight change in the follow-up stage is significant in the two groups of the model of stages of change and cognitive behavioral therapy. Thereafter, the inferential findings of this study were investigated. Shapiro-Wilks test was employed to test normality. The significance level of the Shapiro-Wilks test for indices is greater than 0.05; consequently, they have a normal distribution. Considering the normality of the indicators, the multivariate analysis of covariance (MANCOVA) was used to investigate the

research hypotheses. Before doing so, the assumption of variance homogeneity was used using Levene's test. Levene's F-test statistics were not significant for homogeneity of variances of variable error in untested eating (0.718), cognitive restraint (0.339), emotional eating (1.384), and weight loss (1.730). These findings demonstrate that the variance of errors of these variables is homogeneous in the groups.

Table 2. Results of univariate analysis of covariance to compare the components of eating behavior and weight loss among the three groups

Variable	Component	SS	df	MS	F	P-value	Eta squared
Eating behavior	Uncontrollable eating	316.63	2	158.32	33.69	0.001	0.63
	Cognitive restraint	134.55	2	67.28	41.74	0.001	0.68
	Emotional eating	95.91	2	47.95	33.13	0.001	0.62
Weight Loss	Fixed value	0.47	1	0.47	0.73	0.39	0.01
	Pre-test	379.68	1	379.68	589.98	0.001	0.93
	Intervention	128.48	2	64.24	99.77	0.001	0.83
	Error	26.39	41	0.64			
	Total	202652	45				

According to the results of covariance analysis displayed in Table 2, the significance level of the test for all three components of eating behavior and weight loss was less than 0.05. Therefore, at the confidence level, 95% assumed equality of post-test scores of unceded eating components ($F=33.699$, $P<0.05$), cognitive restraint ($P<0.05$, $F=1$), emotional eating

($F=33.131$, $P<0.05$), and weight loss ($F=99.773$, $P<0.05$) were not confirmed among the three groups. Therefore, it can be stated that there was a significant difference among the three groups in post-test scores of eating behavior and weight.

Table 3. Comparison of mean scores of eating behavior in three groups: transtheoretical model and cognitive-behavioral therapy and control group with Bonferroni test

Variable	Group (i)	Group (j)	Mean Difference (I-J)	Standard Error	P	95% confidence interval	
						Low	Upper
Uncontrollable eating	Control (i)	TTM (i)	3.54	0.82	0.001	1.49	5.59
	Control (i)	CBT (j)	6.70	0.81	0.001	4.66	8.74
	TTM (i)	CBT (j)	3.16	0.79	0.001	1.17	5.14
Cognitive restraint	Control (i)	TTM (i)	-2.19	0.48	0.001	-3.39	-0.99
	Control (i)	CBT (j)	-4.36	0.47	0.001	-5.56	-3.17
	TTM (i)	CBT (j)	-2.17	0.46	0.001	-3.33	-1.01

Emotional eating	Control (i)	TTM (i)	1.65	0.45	0.002	0.51	2.79
	Control (i)	CBT (j)	3.67	0.45	0.001	2.53	4.80
	TTM (i)	CBT (j)	2.02	0.44	0.001	0.91	3.12
Weight Loss	Control (i)	TTM (i)	2.40	0.29	0.001	1.65	3.14
	Control (i)	CBT (j)	4.13	0.29	0.001	3.40	4.86
	TTM (i)	CBT (j)	1.73	0.29	0.001	0.99	2.46

Table 3 depicts that the mean scores of unceded eating and weight loss in adolescents in both experimental groups were significantly lower, compared to those obtained in the control group ($P < 0.01$). Moreover, significant difference was detected between the two experimental groups (transtheoretical model and cognitive-behavioral therapy method) in terms of effectiveness in untested eating and weight loss. According to the results of the aforementioned table, it is clear that cognitive-behavioral therapy exerted a more

significant effect on the untested eating component and weight loss in adolescents and led to better recovery and effectiveness in adolescents, as compared to the model of stages of change. The paired t-test was used to investigate the shelf-life of the change stages model and cognitive-behavioral therapy on eating behavior and weight loss in adolescents. The results of this test are presented in Table 4.

Table 4. Results of paired t-test to investigate the persistence of interventions on eating behavior and weight loss in adolescents

Variable	Intervention	Stage	M	SD	Mean difference	t	P
Uncontrollable eating	TTM	Post-test	27.53	2.44	1.46	1.88	0.08
		Follow-up	26.07	2.08			
	CBT	Post-test	24.40	2.16	-1.27	-1.42	0.17
		Follow-up	25.67	3.22			
Cognitive restraint	TTM	Post-test	11.20	1.32	-0.53	-1.22	0.24
		Follow-up	11.73	1.16			
	CBT	Post-test	13.40	1.12	0.60	1.23	0.23
		Follow-up	12.80	1.47			
Emotional eating	TTM	Post-test	8.00	1.30	-0.73	-1.38	0.18
		Follow-up	8.73	1.16			
	CBT	Post-test	6.00	1.19	-0.60	-1.16	0.26
		Follow-up	6.60	1.35			
Weight	TTM	Post-test	67.53	2.66	2.73	13.25	0.001
		Follow-up	64.80	2.75			
	CBT	Post-test	64.93	2.01	2.87	31.55	0.001
		Follow-up	62.07	1.98			

As displayed in Table 4, there is no significant difference between post-test and follow-up scores of untested eating, cognitive restraint, and emotional eating in both stages of the transtheoretical model and cognitive-behavioral therapy. This suggests that the scores of the subjects in the follow-up stage have remained constant, which points to the persistence of the effectiveness of the two methods of the model of change and cognitive-behavioral therapy on the eating

behavior of adolescents. Furthermore, the significance level of paired t-test for weight variable in both methods of the transtheoretical model and cognitive-behavioral therapy was less than 0.05, indicating a significant difference between adolescents' weight in post-test and follow-up stages. According to average weights in the follow-up stage, it is evident that in both groups, the weight has decreased, signifying that the two methods of change stages model and cognitive-behavioral therapy

have a shelf life on weight loss in adolescents.

Discussion

The present study aimed to compare the effectiveness of the transtheoretical model and cognitive-behavioral therapy in adolescents' eating behavior and weight loss. The model of stages of change and cognitive-behavioral therapy differently affected eating behavior, and cognitive-behavioral therapy was more effective in eating behavior, as compared to the transtheoretical model. Moreover, among the mentioned components, uncontrollable eating was mostly affected by cognitive behavioral therapy. Furthermore, it was found that the two methods of the transtheoretical model and cognitive-behavioral therapy exert persistent effects on adolescents' eating behavior. In addition, the results pointed to the different effects of the change stages model and cognitive-behavioral therapy on weight loss so that cognitive-behavioral therapy was more effective on weight loss, in comparison to the change stages model. Therefore, the results indicated that cognitive-behavioral therapy was more effective in adolescents' eating behavior and weight, compared to the transtheoretical model. The results were consistent with the findings reported by Wu et.al (23), Dibaei et al. (23), and Schutz et al. (25) since the model of stages of change and cognitive behavioral therapy affect eating behavior and weight loss. However, no research has been found on differences in the effect of the change stages model and cognitive-behavioral therapy on eating behavior and weight loss.

Adolescence is one of the most important periods of one's life regarding the construction of body image and identity. According to Painot et al. (26), in this stage of life, adolescents peruse identity, acceptance, and independence, and are interested in attending mass activities; therefore, body image assumes crucial importance for them. Consequently, it is essential to gain knowledge about the consumption of proper nutrition, the type of profitable nutrition, and the maintenance of weight loss. Therefore, it is important to put the weight loss framework and organize eating behavior according to the factors of uncontrollable eating, cognitive restraint, and emotional eating. In so doing, inappropriate feedback is not created and does not cause a disturbance, illness, and depression. To this end, interventions in the stages of cognitive-behavioral change and therapy provide a golden opportunity for adolescents to gain knowledge of proper nutrition, the type of profitable nutrition, and maintain weight loss (27). The role of false beliefs and cognitions is to achieve adaptive thoughts and behaviors so that the combination of subjects' mental and practical behavior has changed toward eating, as well as losing and controlling weight. Accordingly, their post-test scores significantly differed from their pre-test scores. In addition, cognitive-behavioral therapy led to improved quality of life, reduced depression symptoms and physical symptoms related to suffering, and improved performance in adolescents. Moreover, it had a more

profound impact on weight loss and uncontrollable eating, compared to the change stages model (28).

According to the model of stages of change, it is suggested that eating abnormalities and adolescents' consumption of nutrition in educational sessions should be challenged to significantly affect positive eating behavior in adolescents. Another limitation of the present study was the domain of society which was limited to adolescents in Mashhad and reduced the generalizability of the obtained results. Therefore, it is suggested that further studies be conducted in other age groups (e.g., youth and elderly) and in other parts of the country.

Conclusion

As evidenced by the obtained results, it can be concluded that cognitive-behavioral therapy had a more significant effect on adolescents' eating behavior and weight loss, in comparison with the model of the change process. It is suggested that cognitive-behavioral therapy be considered in the treatment of appropriate principles of nutrition and control of adolescents' weight.

Conflicts of interest

The authors declare that they have no conflict of interest regarding the publication of the present study.

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