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Research Article

Presenting a Structural Model of the Effectiveness of Cognitive-Based Intervention on Fat and Cortisol Profiles with the Mediating Effect of Brain-Behavioral Systems, Cognitive Flexibility in Overweight People with High Stress

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Abstract

Objective: The present study aimed to present and investigate the structural model of the effectiveness of the cognitive-based intervention on cortisol and lipid profiles, with the mediating effect of cognitive flexibility and behavioral brain systems in overweight people with high stress.

Method: The research design was experimental with a control group, pre-test-post-test, and follow-up design. Multivariate analysis of covariance was used to analyze the data. The statistical population of this research was all 190 people referred to the cosmetic surgery clinic in 2023. The research sample consisted of 30 people (15 for the experimental group and 15 for the control group) selected through the purposeful sampling method and according to the research inclusion and exclusion criteria. The respondents answered the Behavioral Activation / Inhibition Systems Scale (Carver & White, 1994) and Connor and Davidson's Flexibility Questionnaire (2003). A semi-structured interview was used to measure stress.

Results: The results of univariate covariance analysis showed a significant difference between the two experimental and control groups in the variables of brain-behavioral systems (F = 3.824, P = 0.035) and cognitive flexibility (F = 4.958, P = 0.032). Also, the effectiveness of the cognitive intervention on cortisol was 0.70. It means that 79% of the changes obtained in the post-test scores of the experimental group were due to the intervention.

Conclusion: We can conclude that stress leads to an increase in overweight and a reduction in an individual's flexibility and positive attitude toward body image. Therefore, using Yoga, breathing exercises, cognitive therapy, and treating overweight people to manage their stress correctly is necessary.

Keywords: Cognitive-based intervention, Cortisol and lipid profiles, Behavioral brain systems, Cognitive flexibility, High stress.

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Extended Abstract

Background & Objective

 Being overweight and obese is probably the most common problem of malnutrition worldwide. According to the World Health Organization (WHO), obesity is defined as an abnormal or excessive accumulation of fat in the body that disturbs a person's health. According to statistics, the average body mass index and the prevalence of obesity and overweight worldwide are increasing. In 2005, the total number of overweight adults was 937 million, and the number of obese people was 396 million, which has doubled compared to the last 20 years. It is estimated that the number will reach 1.3 billion and 573 million people by 2030. In the recent 30 years, obesity has been known as a public health concern due to depression disorders and economic and social burdens in all societies. In addition to making a person's appearance unbalanced, obesity has many complications and fatal risks for people, including increased risk of disease, changes in physical, mental, and social well-being, and mortality. (Pender,2023)The prevalence of obesity varies due to age, gender, geographical environment, socio-economic status, etc. One of the causes of obesity is psychological and social issues, most of which are created within the family. On the other hand, psychological theories such as emotion regulation have addressed the causes of obesity and state that emotional eating, such as binge eating (eating a large amount of food and losing control), is a coping strategy in response to distress (Ready, 2022). In Hedrebiton and Bomister's (1991) escape theory, overeating is associated with reducing negative emotions (feelings of helplessness, anger, irritability, and annoyance), which gradually lead to obesity (Sohrabzadeh et al., 2020). Considering the importance of this issue and according to what was mentioned, the question of the present research was whether the proposed structural model of cognitive-based intervention affects cortisol and lipid profiles, with the mediating role of cognitive flexibility and behavioral brain systems in overweight people with high stress.

Method & Materials

 The research was experimental with a control group and pre-test-post-test, and follow-up design. Statistical methods for data analysis were multivariate and univariate covariance analysis using SPLS and SPSS software. The statistical population of this research was all 190 people referred to the cosmetic surgery clinic in 2023. The research sample consisted of 30 people (15 in each group), who were selected through purposeful sampling and according to the conditions of the applicant group.

Behavioral Activation / Inhibition Scale: The behavioral Inhibition / Activation Scale has 20 self-report items developed by Carver and White in 1994. The subscale of the behavioral inhibition system in this questionnaire includes 7 items that measure the sensitivity of the behavioral inhibition system or responding to threats and the feeling of anxiety when facing the signs of threats.

Connor & Davidson's Flexibility Questionnaire: This scale consists of 25 five-choice items (never, sometimes, often, and always) that Mohammadi (2005) adapted for use in Iran. Using Cronbach's alpha coefficient, Mohammadi obtained the reliability coefficient of the scale of 0.89 and obtained the validity of the scale by the correlation method of each item with the total score of the item between 0.41 and 0.64.

Result

As the results in Table 6 demonstrate, the results of Univariate Covariance Analysis show a significant difference between the two experimental and control groups ($F = 3.824$ and $P = 0.035$). The amount of cognitive

intervention was 0.227. It means that 22.7% of the changes achieved in the post-test of the experimental group were due to the cognitive-based intervention.

Discussion and Conclusion

The present study aimed to provide a structural model of cognitive-based intervention on cortisol and lipid profiles with the mediating effect of brain-behavioral systems and cognitive flexibility in overweight people with high stressIn explaining the assumptions of the research, it should be said that, it can be argued that when people suffer from stress and negative emotions such as frustration, anger, and fear, they experience mental disorders such as anxiety and various types of fear, and hence, eating and sleeping disorders, and the like occurs in them. When people experience negative emotions such as depression, they cannot tolerate it and tend to engage in various alternative activities, one of the most important of which is overeating, causing obesity and an increase in body mass index. Also, people with limited cognition of eating have physical concerns. According to this theory, binge eating is an effort to escape self-awareness and the threats, worries, and pressures associated with negative self-evaluation. Consequently, the person feels that she has to eat immediately, and because of the limited cognition in these people, behavioral inhibition disruption is created to reduce the negative mood, and the person turns to overeating. Overweight people, by default, have negative attitudes toward their appearance. But if these people can accept the reality of the issue and their current situation and consciously act on it, and be placed in a social position where people of the same age, instead of humiliating and mocking them, help to solve the problem, that is, to change and modify the lifestyle of these people, they will have a positive attitude about their body image and with the hope of change over a reasonable time, their depression will decrease, and they will not experience social isolation.

Introduction

Being overweight and obese is probably the most common problem of malnutrition worldwide. According to the World Health Organization (WHO), obesity is defined as an abnormal or excessive accumulation of fat in the body that disturbs a person's health. According to statistics, the average body mass index and the prevalence of obesity and overweight worldwide are increasing. In 2005, the total number of overweight adults was 937 million, and the number of obese people was 396 million, which has doubled compared to the last 20 years. It is estimated that the number will reach 1.3 billion and 573 million people by 2030. In the recent 30 years, obesity has been known as a public health concern due to depression disorders and economic and social burdens in all societies. In addition to making a person's appearance unbalanced, obesity has many complications and fatal risks for people, including increased risk of disease, changes in physical, mental, and social well-being, and mortality. (Pender, 2023)

The prevalence of obesity varies due to age, gender, geographical environment, socio-economic status, etc. One of the causes of obesity is psychological and social issues, most of which are created within the family. Attention deficit disorder, low self-esteem, increased hours of inactivity, academic and work pressure, and competitive stress are the causes of obesity (Foruzandeh, 2021). Mood disorders, eating disorders, sleep disorders, chronic pain, and reduced quality of life are other causes of obesity. Research shows that 20 to 70% of very obese people experience some psychological disorders, such as depression and anxiety sensitivity.

Research conducted on the theoretical foundations of overweight has shown the role of some factors in the etiology of overweight and obesity. In this regard, the choice theory states that the five basic needs, including survival, love and affection, power, freedom, and fun, are not properly met in obese people, so most of them turn to overeating for pleasure, which itself forms a defective cycle. On the other hand, psychological theories such as emotion regulation have addressed the causes of obesity and state that emotional eating, such as binge eating (eating a large amount of food and losing control), is a coping strategy in response to distress (Ready, 2022). In Hedrebiton and Bomister's (1991) escape theory, overeating is associated with reducing negative emotions (feelings of helplessness, anger, irritability, and annoyance), which gradually lead to obesity (Sohrabzadeh et al., 2020).

A meta-analysis of research in England, one of the countries with very obese people, shows that 57% of people involved in overeating and being overweight suffer from depression. Depressive disorders are a group of mood disorders with different severities. Depression is a reaction to isolation, deficiency, loneliness, or sadness. It is a disorder in which a person's mood and vitality are reduced, and the person reaches the point of distress. In such a situation, people may consider themselves worthless and lose meaning, and misery, poverty, and despair may arise (Pender, 2023). In some research conducted by Strübel et al. (2020) and Moradi (2020), a significant relationship was determined between body image and the severity of depression symptoms, a critical factor in obese people. Defects in body image are also one of the more common psychological problems of overweight people.

This image is a multidimensional phenomenon that includes cognitive (a person's thinking about her body), perceptual (touch and vision), and emotional (a person's feeling about herself) dimensions. A person's perception of her body leads to overestimation or underestimation of the size of body parts, and the resulting emotional and cognitive changes are related to feelings of dissatisfaction and concern about the person's shape and organs. Dissatisfaction with the body occurs when the mental image of the real body does not match the mental image of the ideal body (Naserani, 2018). Cortisol is also a catabolic hormone produced by the adrenal gland that helps break down protein, glucose, and lipids, maintain blood pressure, and regulate the body's immune system. Testosterone and cortisol have significant effects on protein metabolism and lipolysis, two metabolic hormones affected by obesity, which are also essential elements in the control and treatment of obesity.

These changes reduce the quality of life and increase the risk of obesity-related diseases and deaths. Testosterone and cortisol hormones have been widely studied in thin men who have not exercised, which can be used as a basis for future studies in obese men (Paahu, 2019).

Psychological factors can play an essential role in psychological problems such as obesity. One of these variables is behavioral brain systems (Borjali et al., 2020). Activating and inhibiting behavioral systems are the basis of individual differences, and the activity of each of the behavioral brain systems provokes different reactions in people (DePascalis, Verrill, & Dantono, 2010). Gray (1982), in a study on the brain mechanisms of reward and punishment in mammals, proposes a specific personality model based on the activity of different behavioral brain systems. According to Gary's belief, individual differences in the functioning of these systems and their interaction form the basis of human temperament. Gray has identified three basic emotional systems in the brain, each of which is controlled by a distinct set of brain structures that process specific information (Olighan, 2023). These systems include a behavioral inhibition

system, an activation system, and a fight-or-flight system (Pourmohammed Rezaei & Mirzamani, 2017). A behavioral inhibition system (BIS) is activated by a conditional stimulus associated with punishment or the removal of reward, and the behavioral activation system (BAS) is activated by a stimulus associated with a reward or the termination of a punishment that directs the organism toward the stimulus. People with high sensitivity in the behavioral activation system are more inclined to experience a tendency toward behavior and positive emotion in the stimulation conditions accompanied by rewards (Sobhi Qaramelki & Shafeghati, 2015). The activator system includes the intense and rapid exploitation of the pursuit goal (drive), reward acceptance (replying to reward), and desire for potential new reward experiences (entertainment search) (Rahimi & Lachini, 2016). Gray and Pickering state that the personality differences of normal people are on a continuum with psychological disorders. Therefore, people at the two poles of the continuum of activation and inhibition are more likely to suffer from mental problems. Gray suggests that anxiety and neurotic depression are the results of high BIS activity, and unipolar depression is the result of low BAS activity (Hashemi & Abdollahzadeh, 2019).

Bruce Vezitkos (2021) investigated the relationship between personality traits, weight status, motivational factors for weight loss, and successful and unsuccessful weight loss among nurses in a research titled "Relationship between successful and unsuccessful weight loss and slimming diets." The results showed no significant relationship between personality traits and body size. The personality trait of introversion was somewhat related to normal weight, and introverts were more likely to be overweight. But no relationship was found between other personality traits and weight status. Wang et al. (2021) conducted research entitled "Evaluation of the relationship between overweight, stress, depression, and sleep in Chinese adolescents." The results showed a relationship between overweight, stress, depression, and sleep. Jun et al. (2021) conducted a study titled "Determinants of Perceived Stress in Obese People", investigating the relationship between potential factors related to overweight and perceived stress. Their results showed a significant relationship between body image and stress.

Cognitive processes refer to the rules and principles used in processing information about stimuli. Perception, thoughts, mental images, and associated memories are the outcomes or cognitive consequences obtained after changing the shapes of stimuli through cognitive processes (Omidvar, 2016). Also, cognitive therapy emphasizes that thought processes are as important as environmental influences. In this therapy, clients are helped to recognize their distorted thinking patterns and dysfunctional behaviors, and for the person to be able to change these distorted and ineffective thoughts, regular discussions and organized behavioral assignments are used (Lipka et al., 2014). Also, cognitive-behavioral therapy affects the creation and increasing capabilities such as decision-making, problem-solving, motivation, acceptance of responsibility, positive communication with others, development of self-esteem, happiness, anger control, adaptability, and reducing family conflicts (Hall et al., 2016).

We perceive our body as a psychological phenomenon through a set of multidimensional cognitive organizations. Visual images are probably the first tools for thinking and processing information. Piaget (1941) states that infants have the cognitive ability to maintain mental representations of objects that are seen and then disappear from their sight (Mousavi et al., 2016).

Brill et al. (2006) believe that the cognitive approach shows that body image is the interaction between beliefs that have been formed by previous experience about the self and gradually changed over time and

depends on factors that originate from current situations, thoughts, and events and include a maintenance or unexpected effect on body image (Ze & Etal, 2025). Any bias in evaluating information or in the value individuals place on information shapes the formation of body image.

Cognitive perspectives provide the best evidence of the impact of changing and transforming body image distress (Mousavi et al., 2016). According to Bendora's social cognitive theory, the body is experienced as a psychological phenomenon within a set of multidimensional cognitive structures. But these mental images are not fixed and emerge from the experiences. From external and background factors, we can refer to social realities such as expectations and judgments that a person thinks others form in her. Because the usual way to reduce anxiety and stress before surgery is to use medicines such as antihistamines, benzodiazepines, or a combination of both and recent studies point to the use of cognitive therapy for overweight people with high stress, it seems that this treatment reduces preoperative anxiety regarding psychological and biological factors (Mngoma & et al.,2023). The study gap is the lack of investigation of this relationship, and conducting it can improve field studies (Sherman, 2020).

Considering the importance of this issue and according to what was mentioned, the question of the present research was whether the proposed structural model of cognitive-based intervention affects cortisol and lipid profiles, with the mediating role of cognitive flexibility and behavioral brain systems in overweight people with high stress.

Method

The research was experimental with a control group, pre-test-post-test, and follow-up design. Statistical methods for data analysis were multivariate and univariate covariance analysis using SPLS and SPSS software. The statistical population of this research was all 190 people referred to the cosmetic surgery clinic in 2023. The research sample consisted of 30 people (15 in each group), who were selected through purposeful sampling and according to the conditions of the applicant group.

Ethical Statement

The participants took part in this research after the initial interviews and after filling out the informed consent form. In the end, a gift was presented as a memorial and thanksgiving. This research has been done at the personal expense of the authors. The authors acknowledge that there is no conflict of interest in this article. This article was extracted from a specialized doctoral dissertation.

Measures

Fat mass and cortisol were measured using tests and verbal questions of height and weight, and several verbal questions based on a semi-structured interview were used to measure stress.

Behavioral Activation / Inhibition Scale: The behavioral Inhibition / Activation Scale has 20 self-report items developed by Carver and White in 1994. The subscale of the behavioral inhibition system in this questionnaire includes 7 items that measure the sensitivity of the behavioral inhibition system or responding to threats and the feeling of anxiety when facing the signs of threats. Scores range from 24 to 96. This questionnaire has two subscales of the sensitivity of the behavioral inhibition system and the behavioral activation system. The behavior activation system scale includes 13 items and measures the sensitivity of the behavioral activation system, and this subscale includes three other subscales: Driver with four items,

response to reward with five items, and pleasure-seeking with four items. Response to reward measures the degree to which rewards lead to positive emotions, drive measures a person's tendency to actively pursue desirable goals, and the pleasure-seeking scale measures the individual's tendency to pursue desired goals and the individual's tendency to new rewards and potentially rewarding events in momentary stimulation. The items are scored based on a four-point scale (from 1 = completely disagree to 4 = completely agree). Four additional items are included as cover items in the scale and have no role in the assessment. According to Carver and White (1994), the internal consistency of the inhibition system subscale is 0.74, and the internal consistency of the activation system is 0.71. The research conducted on the Iranian population has confirmed the validity and factor structure of the behavioral inhibition and activation system and reported the internal consistency of the subscales of the behavioral inhibition and activation system as 0.74 and 0.66, respectively (Abdi, Bakhshipour, Roudsari, & Aliloo, 2011).

Connor & Davidson's Flexibility Questionnaire: This scale consists of 25 five-choice items (never, sometimes, often, and always) that Mohammadi (2005) adapted for use in Iran. Using Cronbach's alpha coefficient, Mohammadi obtained the reliability coefficient of the scale of 0.89 and obtained the validity of the scale by the correlation method of each item with the total score of the item between 0.41 and 0.64. Samani, Jokar, and Sahragerd (2007), in a cross-sectional study, obtained the reliability of the scale in students of Shiraz with the help of Cronbach's alpha coefficient equal to 0.87. The concurrent validity of this scale with Beck depression inventory II (BDI-II) was equal to -0.39, and its convergent validity with Martino Robin's cognitive flexibility scale was 0.75 (Dennis & Vander Wall, 2010). In Iran, Shareh and colleagues (cited by Soltani, Shareh, Bahrinian & Farmani, 2013) have reported Cronbach's alpha coefficient of the whole scale as 0.71 and Cronbach's alpha coefficient of the total scale as 0.90.

Protocol of Cognitive-Based Intervention (Robert Leahy, 2015) translated by Hamidpour and Andoz (2021)

Session	Contents
First	Determining the regulations, implementing the pre-test, and stating the session rules
Second	Identifying physical, psychosocial, and spiritual dimensions as well as high-risk situations
Third	A-B-C pattern training
Fourth	Teaching problem-solving and role-playing skills, identifying physical, mental, emotional, and behavioral signs of stress, teaching problem-oriented and emotion-oriented coping for stress management
Fifth	Teaching proper communication skills, teaching how to create a positive attitude towards self and others.
Sixth	Cognitive restructuring, training restructuring, and techniques to replace negative thoughts with positive ones
Seventh	Teaching verbal and non-verbal communication skills, training immunity against stress
Eights	Summarizing the feedback and expressing the feelings of the members, the closing discussion, and implementing the post-test

Results

The demographic data showed that 51.3% participants were single, 39.7% were married, and 9% (including 36) were divorced. Also, 22% of people were between 20-25 years old, 32.5% between 26-30 years old, 24% between 31-35 years old, and 21.5% were over 35 years old. In terms of education, 70% of the respondents had a bachelor's degree and 30% had a master's degree.

In this part, the results of the data analysis are provided in tables.

Table 1. Descriptive statistics of the examined variables

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Cholesterol pre-test	control	15	199.1667	38.21540	9.86717	135.00	285.00
	experimental	15	220.0000	38.31262	9.89228	165.00	285.00
	Total	30	209.5833	39.06274	7.13185	135.00	285.00
Cholesterol post-test	control	15	182.0800	37.86041	9.77551	124.20	285.00
	experimental	15	131.8600	41.06638	10.60329	82.50	216.00
	Total	30	156.9700	46.45850	8.48212	82.50	285.00
Triglyceride pre-test	control	15	315.5000	64.06052	16.54035	225.00	475.00
	experimental	15	359.6667	57.95524	14.96398	275.00	450.00
	Total	30	337.5833	64.08670	11.70058	225.00	475.00
Triglyceride post-test	control	15	305.1333	61.90646	15.98418	207.00	475.00
	experimental	15	249.6333	74.16529	19.14939	146.25	380.00
	Total	30	277.3833	72.81589	13.29430	146.25	475.00
HDL pre-test	control	15	45.6833	8.95747	2.31281	31.50	66.50
	experimental	15	51.4667	9.13875	2.35961	38.50	66.50
	Total	30	48.5750	9.36500	1.70981	31.50	66.50
HDL post-test	control	15	42.7187	8.66690	2.23779	28.98	66.50
	experimental	15	30.7673	9.58215	2.47410	19.25	50.40
	Total	30	36.7430	10.84104	1.97929	19.25	66.50
LDL pre-test	control	15	85.7000	16.43472	4.24343	58.50	123.50
	experimental	15	95.6667	15.79632	4.07859	78.00	125.00
	Total	30	90.6833	16.62958	3.03613	58.50	125.00
LDL post-test	control	15	78.6847	16.62290	4.29202	53.82	123.50
	experimental	15	57.1393	17.79543	4.59476	35.75	93.60
	Total	30	67.9120	20.15756	3.68025	35.75	123.50
Cortisol pre-test	control	15	9.117	2.6874	.6939	5.0	13.0
	experimental	15	8.980	1.7400	.4493	5.7	12.0
	Total	30	9.048	2.2255	.4063	5.0	13.0
Cortisol post-test	control	15	8.1660	2.70425	.69823	4.14	12.38
	experimental	15	5.9353	1.95000	.50349	2.93	8.80
	Total	30	7.0507	2.57933	.47092	2.93	12.38

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Appearance assessment pre-test	control	15	3.2571	.90060	.23253	1.57	4.71
	experimental	15	3.4792	.97161	.25087	1.73	5.18
	Total	30	3.3681	.92738	.16932	1.57	5.18
Appearance assessment post-test	control	15	4.0627	1.14855	.29655	1.57	6.47
	experimental	15	3.2886	.82130	.21206	2.22	4.30
	Total	30	3.6756	1.05710	.19300	1.57	6.47
Tendency to appearance pre-test	control	15	3.3641	.57891	.14947	2.31	4.38
	experimental	15	3.5986	.63580	.16416	2.19	4.49
	Total	30	3.4814	.60924	.11123	2.19	4.49
Tendency to appearance post-test	control	15	4.0337	1.04242	.26915	2.40	6.24
	experimental	15	3.3148	.77901	.20114	2.00	4.67
	Total	30	3.6743	.97528	.17806	2.00	6.24
Fitness assessment Pre-test	control	15	3.2158	1.08422	.27995	1.33	4.67
	experimental	15	3.5625	.99270	.25631	2.20	5.14
	Total	30	3.3891	1.03650	.18924	1.33	5.14
Fitness assessment Pre-test	control	15	4.0857	1.03749	.26788	2.50	6.40
	experimental	15	3.6973	.72357	.18683	2.30	4.82
	Total	30	3.8915	.90079	.16446	2.30	6.40
Tendency to fitness Pre-test	control	15	3.3641	.57891	.14947	2.31	4.38
	experimental	15	3.5986	.63580	.16416	2.19	4.49
	Total	30	3.4814	.60924	.11123	2.19	4.49
Tendency to fitness post-test	control	15	4.1429	.92633	.23918	3.20	6.53
	experimental	15	3.1570	.54754	.14138	2.30	4.00
	Total	30	3.6500	.90020	.16435	2.30	6.53
Weighting Pre-test	control	15	3.6667	.91937	.23738	1.00	4.50
	experimental	15	3.9580	.92343	.23843	1.56	4.95
	Total	30	3.8123	.91742	.16750	1.00	4.95
Weighting post-test	control	15	4.6033	1.22743	.31692	1.50	6.80
	experimental	15	3.8040	.92649	.23922	1.50	4.95
	Total	30	4.2037	1.14322	.20872	1.50	6.80
Satisfaction with areas Pre-test	control	15	3.4667	.57152	.14756	2.33	4.33
	experimental	15	3.7126	.68944	.17801	2.56	4.76
	Total	30	3.5896	.63466	.11587	2.33	4.76
Satisfaction with areas Pre-test	control	15	4.0632	.79867	.20622	2.41	5.30
	experimental	15	4.8453	.75231	.19425	3.76	5.96
	Total	30	4.4543	.85987	.15699	2.41	5.96

Table 2: Kolmogorov-Smirnov Test

	Statistic	df	Sig.	Shapiro-Wilk		
				Statistic	df	Sig.
Cholesterol pre-test	.112	30	.200*	.968	30	.475
Triglyceride pre-test	.121	30	.200*	.973	30	.621
HDL pre-test	.129	30	.200*	.957	30	.258
LDL pre-test	.126	30	.200*	.962	30	.339
Cortisol pre-test	.143	30	.120	.961	30	.320
Appearance assessment pre-test	.179	30	.015	.940	30	.091
Tendency to appearance pre-test	.070	30	.200*	.975	30	.677
Fitness assessment Pre-test	.171	30	.026	.930	30	.048
Tendency to fitness Pre-test	.070	30	.200*	.975	30	.677
Weighting Pre-test	.181	30	.013	.872	30	.002
Satisfaction with areas Pre-test	.108	30	.200*	.976	30	.719
Flexibility	.103	30	.200*	.941	30	.095
BIS	.209	30	.002	.813	30	.000
BAS.DR driver	.116	30	.200*	.939	30	.084
BAS.RR Responsive to reward	.121	30	.200*	.965	30	.422
BAS.FS pleasure-seeking	.164	30	.038	.904	30	.011

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Cholesterol post-test	.101	30	.200*	.966	30	.430
Triglyceride post-test	.087	30	.200*	.977	30	.736
HDL posttest	.072	30	.200*	.969	30	.499
LDL post-test	.099	30	.200*	.966	30	.428
Cortisol post-test	.124	30	.200*	.962	30	.347
Appearance assessment Post-test	.137	30	.159	.960	30	.304
Tendency to appearance Post-test	.095	30	.200*	.972	30	.601
Fitness assessment Post-test	.103	30	.200*	.967	30	.466
Tendency to fitnessPost-test	.128	30	.200*	.922	30	.031
WeightingPost-test	.132	30	.192	.947	30	.145
Satisfaction with areasPost-test	.146	30	.105	.963	30	.367

As can be seen in Table 2, since the Kolmogorov-Smirnov test values are significant in both independent and dependent variables (pre-test and post-test) (P>0.05), it can be concluded that the distribution of scores in these variables is normal.

Table 3: The results of the Levene test: checking the homogeneity of variances

		Levene Statistic	df1	df2	Sig.
Cholesterol pre-test	Based on Mean	.182	1	28	.673
Cholesterol post-test	Based on Mean	.225	1	28	.639
Triglyceride pre-test	Based on Mean	.004	1	28	.950
Triglyceride post-test	Based on Mean	.705	1	28	.408
HDL pre-test	Based on Mean	.255	1	28	.618
HDL post-test	Based on Mean	.329	1	28	.571
LDL pre-test	Based on Mean	.047	1	28	.830

LDL post-test	Based on Mean	.179	1	28	.675
Cortisol pre-test	Based on Mean	6.486	1	28	.017
Cortisol post-test	Based on the Mean	5.169	1	28	.031

As can be seen in Table 3, the values of the F statistic, which indicates the value of the Levene test to check the homogeneity of the variances of the test and control groups, are not significant in any variable (P<0.05). According to the result, the presumption of equality of variances of the two experimental and control groups in the research variables is confirmed.

Table 4- Between groups Test, interaction between pre-tests and groups

Change source		Sum of squares	df	Mean of squares	F	Sig.
Cholesterol pre-test	Between Groups	3255.208	1	3255.208	2.223	.147
Triglyceride pre-test	Between Groups	14630.208	1	14630.208	3.921	.058
HDL pre-test	Between Groups	250.852	1	250.852	3.064	.091
LDL pre-test	Between Groups	745.008	1	745.008	2.867	.101
Cortisol pre-test	Between Groups	.140	1	.140	.027	.870
Appearance assessment pre-test	Between Groups	.370	1	.370	.421	.522
Tendency to appearance pre-test	Between Groups	.413	1	.413	1.116	.300
Fitness assessment pre-test	Between Groups	.902	1	.902	.834	.369
Tendency to fitness pre-test	Between Groups	.413	1	.413	1.116	.300
Weighting pre-test	Between Groups	.637	1	.637	.750	.394
Satisfaction with areas Pre-test	Between Groups	.454	1	.454	1.131	.297

The significance level of between-group interaction and pre-tests in the variables is more than 0.05; therefore, the interaction between the test conditions and the variance variable (pre-test) is not significant. It means that the regression line slope is the same for all variables.

Table 5. Between-group Test

		Sum of Squares	df	Mean of squares	F	Sig.
Cholesterol post-test	Between Groups	3255.208	1	3255.208	2.223	.147
Triglyceride post-test	Between Groups	14630.208	1	14630.208	3.921	.058
HDL post-test	Between Groups	250.852	1	250.852	3.064	.091
LDL post-test	Between Groups	745.008	1	745.008	2.867	.101
Cortisol pre-test	Between Groups	.140	1	.140	.027	.870

The significance level of interaction between groups and pre-tests in the variables is more than 0.05; therefore, the interaction between the test conditions and the variance variable (pre-test) is not significant. It means that the slope of the regression line is the same for all variables.

Table 6. Results of Univariate Covariance Analysis

Source	Sum of squares	df	Mean of squares	F	Sig.	Effect size
Corrected Model	8.419a	3	2.806	5.603	.004	.393
Intercept	4.944	1	4.944	9.871	.004	.275
group	1.404	1	1.404	2.804	.106	.097
group * RNG	3.831	2	1.916	3.824	.035	.227
Error	13.023	26	.501			
Total	616.657	30				
Corrected Total	21.442	29				

As the results in Table 6 demonstrate, the results of Univariate Covariance Analysis show a significant difference between the two experimental and control groups (F = 3.824 and P = 0.035). The amount of cognitive intervention was 0.227. It means that 22.7% of the changes achieved in the post-test of the experimental group were due to the cognitive-based intervention.
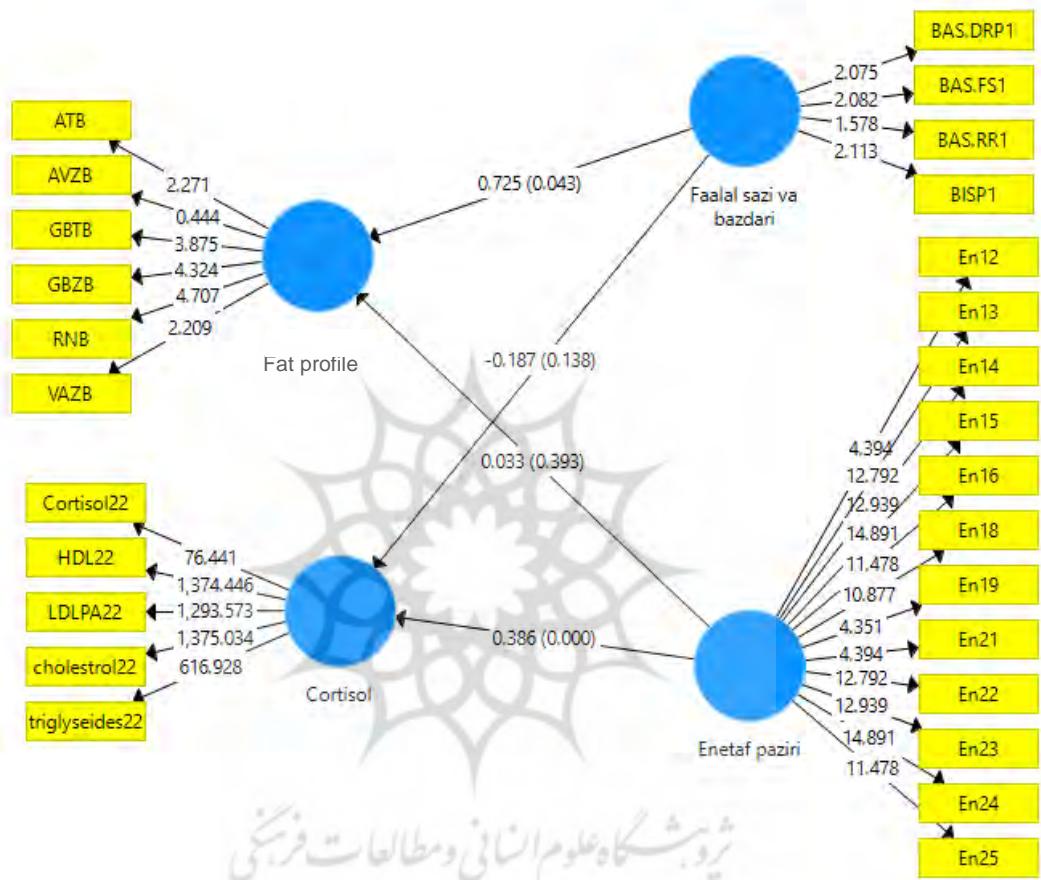

Figure 1. The research proposed model

Discussion and Conclusion

The present study aimed to provide a structural model of cognitive-based intervention on cortisol and lipid profiles with the mediating effect of brain-behavioral systems and cognitive flexibility in overweight people with high stress. This result is in line with the findings of Moafi et al. (2021), Hosseini et al. (2021), Abedi Parija et al. (2021), Beros wezikois (2021), Wang et al. (2021), and Joen et al (2021).

In explaining the assumptions of the research, it should be said that it can be argued that when people suffer from stress and negative emotions such as frustration, anger, and fear, they experience mental disorders such as anxiety and various types of fear, and hence, eating and sleeping disorders, and the like occurs in them. When people experience negative emotions such as depression, they cannot tolerate it and tend to engage in various alternative activities, one of the most important of which is overeating, causing obesity and an

increase in body mass index. Also, people with limited cognition of eating have physical concerns. We can explain these results by the theory of escape from binge eating episodes. According to this theory, binge eating is an effort to escape self-awareness and the threats, worries, and pressures associated with negative self-evaluation. Consequently, the person feels that she has to eat immediately, and because of the limited cognition in these people, behavioral inhibition disruption is created to reduce the negative mood, and the person turns to overeating. But what happens over time is that people develop a negative attitude about their body image. As a result, they feel more stressed about the likelihood of having a dangerous disease or a lack of health. Overweight people, by default, have negative attitudes toward their appearance. But if these people can accept the reality of the issue and their current situation and consciously act on it, and be placed in a social position where people of the same age, instead of humiliating and mocking them, help to solve the problem, that is, to change and modify the lifestyle of these people, they will have a positive attitude about their body image and with the hope of change over a reasonable time, their depression will decrease, and they will not experience social isolation.

In explaining the role of flexibility in overweight people, it should be said that in today's society, there is a lot of cultural and social emphasis on attractiveness and physical fitness. According to social pressures on slimness and widespread opinions about body structure, dissatisfaction with negative body image is very common in society, especially among women. On the other hand, psychological problems in societies are increasing day by day in a way that depression and behavioral disorders can be found among different people more than before. Sands (2017) stated that body image is conceptualized based on a multifaceted structure. Physical deformity is a complex concept that includes biological factors, internal psychology, and external social factors. The combination of perceptual, attitudinal, and behavioral evaluations of body image, trying to lose weight, and nutritional disorders will be better than each of the evaluations alone.

Psychological factors can play a significant role in experiencing psychological problems such as obesity. One of these factors is perceived stress, which can play a role in obesity or relieve the conditions of obesity. Perceived stress is one of the explanatory components of the possibility of adopting coping styles by people in stressful situations. Perceived stress severity refers to a person's belief in the seriousness of stress. People can be more or less susceptible to obesity according to the coping style they use against perceived stress. Also, attitudes and behaviors towards eating are determined by multiple factors, such as psychological factors, including emotions, and these variables play a significant role in the formation of stress and obesity.

Since the complications of being overweight are numerous and affect both physical and mental dimensions, addressing them in the form of field studies can help to control them and inform the people involved. In this study, attention has been paid to the psychological component of obesity. Many overweight people are unhappy with their appearance, which makes them feel bad about themselves and hate themselves; therefore, their self-perception gets negative, and they are afraid of socializing with others and experience various types of depression in the long term.

Also, in explaining the role of behavioral systems in overweight people, it should be said that the results of research in the past few decades show that a large number of people in society, especially the female population, are seeking to change their body image. The research results showed that active people have a better body image than inactive people. It seems that participation in physical activities increases the physical abilities and physical fitness of a person, which in turn changes the type of evaluation and estimation of one's

capabilities. This relationship has a positive aspect that ultimately leads to an increase in self-esteem and a positive attitude toward the body. Also, this issue leads to an increase in self-acceptance or self-worth and self-characteristics regardless of perceived merit levels. Overweight people, by default, have negative attitudes towards their appearance. But if these people can accept the reality of the issue and their current situation, consciously act on it, and be in a social position where people of the same age instead of humiliating and mocking help them solve the problem and change their lifestyle, they will have a positive attitude about their body image, and with the hope of change over a reasonable period, their depression will decrease and they will not experience social isolation.

Body weight is an important health-related characteristic that has a complex relationship with the image of body ugliness. Hildebrandt (2010) also showed that people who are not physically active in their free time are more likely to suffer from muscle disorders. Lifestyle, paying attention to diet, and physical activity are among the determining factors of a person's health, and considering the way of life and mechanization of life, it is better to pay attention to physical activity, at least in free time. Physical activity can, to some extent, prevent diseases caused by obesity, and it is better to train the young generation about the positive role of physical activity in a person's health to prevent the occurrence of many diseases that may threaten them and society's health in the future.

Finally, it should be said that the term "beliefs about appearance" is a cognitive structure that includes ineffective attitudes regarding a person's appearance in her daily life. Beliefs about appearance determine the relationship between body image and appearance schemas that are made of ineffective and irrational attitudes. A person's beliefs about herself, including her body image, generally affect all other beliefs, her emotions, and her behaviors. Also, less and more negative body image satisfaction are correlated with higher irrational thoughts. Beliefs can be logical or irrational. Logical beliefs are beliefs that are desirable, useful, and flexible. These beliefs are based on reality and have been confirmed in practice. Irrational beliefs are thoughts and opinions that are not compatible with reality and are formed based on suspicion and personal opinions. These beliefs are associated with compulsion, commitment, and absolutism.

Many people are dissatisfied with their bodies, and a high percentage of these people refer to cosmetic surgeons due to dissatisfaction with the appearance of their organs. On the other hand, cosmetic surgery due to mental disorders can also affect this tendency. Dissatisfaction with one's appearance and body leads to incorrect evaluations and negative thoughts and emotions, and provides a basis for reducing self-confidence. In such a case, these people limit their social relationships and may even become isolated and anxious in their social encounters. Social isolation and distance from the surrounding people can cause social anxiety and cause them to grow and expand their negative evaluations so that they even imagine one or more of their organs as ugly and hateful; as a result, their sense of self decreases. The set of these factors that have led to the weakening and reduction of a person's general health can encourage a person to change the appearance of an organ that a person considers ugly and ridiculous. And if cosmetic surgery provides them with at least satisfaction with the related organ, it is possible for them to be satisfied with their appearance and body.

Generally, psychopathic applicants (regardless of their type of psychopathy) are very preoccupied with themselves and how others see them. They often feel very vulnerable to the harmful effects of their bad relationships with others, their exaggerated symptoms in their bodies, and the destructive effects of their psychotic thinking. It should also be said that people with neurotic characteristics use such surgeries more to

eliminate their unhappiness and achieve ideal thoughts. The reason for using these surgeries is to overcome the amount of stress and reduce it.

The researcher's final explanation based on experimental and theoretical research related to this hypothesis is as follows. People in the social and cultural environment are exposed to media advertisements, the sheer amount of information shared on social media makes people have reasonable expectations about fitness, and as a result, most people have come to know that changes in appearance are possible. But the changing process depends on various factors, which usually results in a long-term process. As a result, they will have a positive attitude toward their current body image and will not be stressed. Therefore, realistic expectations lead to situational awareness and stress reduction in overweight people. Based on the presented indicators, it is suggested that the variable of mental image is very high in illness tendency, health tendency, mental weight, fitness tendency, and fitness assessment of absolutist thoughts of people, which consequently increases dissatisfaction with the body. Psychologists seek effective treatments through cognitive therapy using problem-oriented and active-oriented approaches and better coping skills. They believe these are essential factors in helping overweight people cope and feel better.

Like other studies, the present research has some limitations as well. For example, in this research, the gender variable was omitted as a moderator. Also, the range of overweight, i.e., low, medium, and high, was not separated. In this regard, therapists are advised to pay attention to the role of psycho-social factors in the prevention, etiology, continuation, and correction of disordered eating attitudes and eating disorders, and psychotherapy, such as interpersonal therapy, cognitive flexibility training, and emotional regulation, is suggested. Also, other variables such as flexibility, support resources, etc., have not been investigated in this research. Researchers are advised to consider the relationship of these variables in their future research.

Acknowledgments

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