



Effectiveness of Cognitive-Behavioral Therapy for Improving Sleep Quality and Reducing Insomnia Severity in Afflicted Patients

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Abstract

Background: Based on the proven role of sleep quality in promoting health, the treatment of insomnia should be premised on identification of characteristics and severity of insomnia symptoms. This study aimed to investigate the effectiveness of Cognitive-Behavioral Therapy for Insomnia (CBT-I) in improving sleep quality and reducing insomnia severity among the afflicted patients.

Methods: This was a semi-experimental study with a pre-test, post-test, and follow-up design and control group. The statistical population included all patients visiting the Sleep Disorder Clinic of Rasoul Akram Hospital and two private psychiatric clinics, selected using convenience sampling in Tehran in 2020. Twenty out of 60 patients with insomnia disorder, diagnosed based on the Diagnostic and Statistical Manual for Insomnia, were randomly selected using a lottery method. The participants were divided into the experimental and control groups. In the cognitive-behavioral group, each participant individually received a 6-week treatment intervention. All participants in both groups were evaluated at the beginning of the treatment, at the end of the treatment, and one month after the treatment. The Pittsburgh Sleep Quality Index (PSQI) and Insomnia Severity Index (ISI) were used for data collection.

Results: The results showed a significant between-group difference in the scores of sleep quality and insomnia severity at post-test stage ($p < 0.05$). Moreover, the follow-up test results suggested the stability of the effect of treatment interventions on sleep quality and insomnia severity among the experimental and control groups relative to their pre-test scores ($p < 0.05$).

Conclusion: The results indicated that CBT-I could improve sleep quality and insomnia severity in afflicted patients.

Keywords: Cognitive-behavioral therapy for insomnia (CBT-I), Sleep, Sleep initiation and maintenance disorders

Introduction

The fundamental role of sleep in health has been proven. Every person's body needs a good night's sleep after a long day to regain its strength. Sleep deficiency and insomnia are among the principal signs of many diseases and physical and spiritual problems (1). Insomnia is one of the most prevalent sleep disorders, 09213 affecting almost every person, even as a transient experience.

The most important reason for anxiety and feelings of frustration among insomnia patients is the persistence and chronicity of their disorder. In the Diagnostic and Statistical Manual of Mental Disorders-5th Edition (DSM-5), insomnia is defined as a difficulty falling asleep or staying asleep, or early morning awakening, along with functional impairment for at least four weeks (American Psychiatric Association). As a common sleep disorder, insomnia can be a challenge during the day (2). Insomnia can occur as an initial disorder or concomitantly with other physical or psychological disorders (3). According to the International Classification of Sleep Disorders, sleep disorders are classified into six main categories: 1) insomnia, 2) sleep-related breathing disorders, 3) circadian rhythm sleep-wake disorders, 4) sleep-related movement disorders, 5) parasomnias and 6) central disorders of hypersomnolence (4). There are different models for describing insomnia, focusing on various cognitive and emotional processes. These cognitive processes include excessive concern, rumination, beliefs about sleep and insomnia consequences, and selective attention (5).

A survey on an Australian population showed that 13%-23% of the adults had some form of difficulty in falling or staying asleep (6). A study showed that 35% of American adults aged between 18-79 years had insomnia complaints at least once a year. In another study, one-third of the American adults had experienced insomnia at least once, among whom 10% had more persistent insomnia complaints. Insomnia directly relates to aging and is more common among women and individuals of lower socioeconomic status (7). In a study in Iran, Ahmadvand *et al* investigated the rate of insomnia prevalence. They showed that 59% of the participants, particularly in the age range of 41-65 years, suffered from this type of sleep disorder (8).

Individuals with sleep disorders often have poor sleep

quality, which is defined as measuring how well a person is sleeping. Regarding sleep quality, it can be said that a person's movement pattern from the night to the morning is periodic, depending on their stress during the day (9). A study showed that the excessive use of cell phones is correlated with specific behavioral patterns, such as late sleep time, engagement in sending SMS, and emotional attachment. People who spend more time using technology do not get enough sleep, sleep quality is affected, and they develop such diseases as depression or overweight (10).

Insomnia treatment should be based on the characteristics and severity of its symptoms, and then their causes should be determined. Non-medicinal treatments are more affordable and have lesser side effects than their medicinal counterparts, which are considered effective when they help individuals to fall asleep and increase total sleep time (11). Pharmacotherapy is a conventional insomnia treatment (12). Although most insomnia disorders are treated with drugs, recent clinical findings from randomized controlled trials strongly support cognitive-behavioral treatments (13). Evidence shows the effectiveness of this treatment for primary insomnia and for patients who have insomnia induced by psychiatric disorders and chronic diseases (14). Cognitive insomnia treatment often aims to increase a person's ability to cope with insomnia-induced mental pressures. These methods aim to change assumptions and thoughts about insomnia. Theoretically, maladaptive cognitions cause emotional arousal, which develops or exacerbates insomnia. The most essential maladaptive cognitions in this area are misconceptions about the causes of insomnia, misattribution or amplification of its consequences, unrealistic sleep expectations, and diminished perception of control and predictability of sleep pattern (15).

Cognitive Behavioral Treatment of Insomnia (CBT-I) targets maladaptive behaviors and thoughts that may be provoked by insomnia or contribute to it. It is considered a golden standard for insomnia treatment as equal or more effective than hypnotics. Contrary to hypnotism, CBT-I's benefits remain even after the end of treatment (16). The cognitive-behavioral treatment for insomnia comprises five principal components: stimulus control, sleep restriction (known as sleep consolidation or bed

restriction), relaxation technique, cognitive therapy, and sleep hygiene education (17).

Moreover, the way sleep quality and insomnia severity affect mental health and performance of people is of paramount importance; therefore, the present study investigated the effect of CBT-I on sleep quality and insomnia severity in among patients.

Materials and Methods

This semi-experimental study was conducted with a pre-test, post-test, and follow-up design and a control group. The statistical population included all patients with insomnia disorder visiting the Sleep Disorder Clinic of the Rasoul Akram Hospital and two private psychiatric clinics, selected by convenience sampling, in Tehran in 2020. The participants were selected from the patients diagnosed with a sleep disorder by a psychiatrist and a sleep fellow according to the results of DSM-5-based interviews. Then, 20 out of 68 patients diagnosed with insomnia disorder were randomly selected using a lottery method and equally divided into the experimental CBT-I and control groups.

Instruments

Pittsburgh Sleep Quality Index (PSQI)

PSQI was developed by Buysse *et al* to measure sleep quality and patterns in adults over the past month. This questionnaire with 7 subscales and 18 statements can differentiate between good and bad sleep quality. The first 4 statements are related to usual bedtime, sleeping hours, usual wake-up times, and actual sleep duration. The next 14 questions are scored on a 4-point Likert scale anchored with 0=normal, 1=mild problem, 2= moderate problem, and 3=severe problem. the total score of the questionnaire varies between 0 and 21. The developers of the PSQI obtained its internal cohesion at 0.83, using Cronbach's alpha (18). Heidari *et al* reported the Cronbach's alpha and split-half reliability of 0.46 and 0.52 for the PSQI. In the present study, the obtained Cronbach's alpha of the Sleep Quality Index was 0.84 using the Cronbach's alpha (19).

Insomnia Severity Index

The Insomnia Severity Index (ISI) was developed by Morin *et al* and was comprised of seven items.

The items are scored from 0 to 4, where 4 reflects the maximum problem. Insomnia severity is categorized into no problem, mild problem, moderate problem, and severe problem, based on the ISI's guideline. The reliability and validity of this inventory have been approved by several studies. Suen *et al* reported the values of 0.74 and 0.94 for the Cronbach's alpha and sensitivity of the ISI, respectively (20). Heidari *et al* reported the Cronbach's alpha and split-half reliability of 0.78 and 0.72 for the ISI, respectively. Heidari *et al* (19).

Treatment sessions

CBT-I The CBT-I protocol was designed by Edinger JD and Carney CE (2015). This face-to-face treatment methodology was applied to the first experimental group in six 60-minute sessions. The summary of treatment sessions is as follows (21) (Table 1).

Statistical analysis

The data were analyzed using SPSS software v 22.0 (IBM Corp, USA). Descriptive statistics such as mean and percentages were used for evaluation of variables. ANCOVA was applied to determine the differences between groups.

Results

According to table 2, six and four participants in the CBT-I group were female and male. In the control group, seven and three participants were female and male. The participants in the CBT-I and control groups are also presented by age. table 3 presents the mean and standard deviation of the CBT-I and control groups. According to table 4, the analysis of variance can be performed to evaluate the variables. According to table 5, by controlling pre-test scores for research variables, the adjusted mean difference of all three groups at post-test and follow-up stages is significant for all research variables.

Table 1. CBT-I protocol

First session (Insomnia assessment)	A complete assessment of the nature of insomnia, educating the patients on how to monitor baseline sleep using the sleep diary reports for two weeks (Before the treatment)
Second session (Introducing components of initial behavioral treatment)	A: Introducing the logic behind the treatment and sleep training criterion B: Introducing the sleep rules - the behavioral regime of insomnia C: Calculating allowed time to stay in bed D: Providing principal sleep hygiene educations E. Managing the patients' expectations and adherence to treatment F: Assigning homework
Third session (Introducing cognitive treatment strategies)	A: Reviewing and commenting on patient's sleep condition notes and evaluating the progress B: Establishing the bases and logic of cognitive treatment for the patient C: Discussing constructive techniques
Fourth session (Continuing cognitive treatment)	Reviewing the pre-treatment session; investigating findings from sleep report form, sleep progress, and treatment guidelines; educating patients on how to record insomnia-related thoughts; investigating common cognitive distortions in insomnia patients, such as all-or-nothing, catastrophization, and mind-reading
Fifth session (Follow-up/problem-solving)	A: Reviewing and commenting on patient's sleep worksheet, recording patients' thoughts, and evaluating the progress B: Adjusting recommendations related to allowed time to stay in bed C: Reviewing and encouraging adherence to the treatment program E: Providing problem solving strategies as an example of behavioral therapy
Sixth session (Checking the end of the treatment period)	A: Reviewing previous homework, solving problems related to cognitive elements of treatment, reviewing homework of each session and providing required helps B: The sleep diary table completed by each patient is reviewed and the average sleep efficiency of each patient in the past week is recorded

Table 2. Distribution of participants by age and sex

Variables	CBT-I		Control		
	N	%	N	%	
Sex	Female	6	60	7	70
	Male	4	40	3	30
	Total	10	100	10	100
Age	44-49	1	10	0	0
	38-43	1	10	2	20
	32-37	4	40	1	10
	26-31	1	10	3	30
	20-25	3	30	4	40
	Total	10	100	10	100

Table 3. Mean and standard deviation of sleep quality and insomnia severity in experimental and control groups at pre-test, post-test, and follow-up stages

Variables	Stage	CBT-I		Control	
		Mean	Standard deviation	Mean	Standard deviation
Sleep quality	Pre-test	17	4.66	16.53	3.30
	Post-test	9.64	2.43	17.23	3.58
	Follow-up	10.66	3.85	16.95	4.18
Insomnia severity	Pre-test	24.23	4.12	24.05	4.15
	Post-test	10.11	3.83	23.65	4.00
	Follow-up	12.25	4.05	24.49	3.87

Table 4. Levene test results for sleep quality and insomnia severity scores in experimental and control groups at pre-test, post-test, and follow-up stages

Variables	Stage	CBT-I			Control			p value	
		f	Degree of freedom 1	Degree of freedom 2	Mean	f	Degree of freedom 1		Degree of freedom 2
Sleep quality	Pre-test	4.22	1	27	0.10	3.52	1	27	0.74
	Post-test	5.05	1	27	21/0	05/4	1	27	0.49
	Follow-up	2.73	1	27	0.17	2.41	1	27	0.18
Insomnia severity	Pre-test	4.50	1	27	0.06	3.20	1	27	0.11
	Post-test	3.33	1	27	0.12	1.33	1	27	0.76
	Follow-up	4.61	1	27	0.32	4.01	1	27	0.45

Tables 5. ANCOVA results for sleep quality and insomnia severity at post-test and follow-up stages with controlled pre-test scores

Variables	Source of change	Sum of squares	df	Mean of squares	F	p value	Degree of effect	Statistical power	
Sleep quality	Pre-test	Post-test	13,807.365	1	13,807.365	20.969	< 0.001	0.356	0.994
		Follow-up	561/3818	1	3,818.561	111.224	< 0.001	0.745	1.00
	Group membership	Post-test	5,086.441	2	2,442.574	148.153	< 0.001	0.796	1.00
		Follow-up	4,891.147	2	2,543.220	129.874	< 0.001	0.490	1.00
Insomnia	Pre-test	Post-test	8,632.88	1	8,632.88	33.86	< 0.001	0.546	0.932
		Follow-up	8,542.21	1	8,542.21	36.45	< 0.001	0.641	0.842
	Group membership	Post-test	2,727.03	2	1,436.52	20.51	< 0.001	0.724	1.00
		Follow-up	3,169.91	2	1,482.950	15.65	< 0.001	0.691	1.00

Discussion

The results of the study showed that the CBT-I effectively improves sleep quality and reduces insomnia severity in patients, leading to a significant increase in sleep quality ($p < 0.05$) and a significant decrease in insomnia severity. Moreover, a significant increase was observed in sleep quality scores ($p < 0.05$), and a significant decrease

was observed in insomnia severity ($p > 0.05$) at post-test and follow-up stages relative to the pre-test stage. The literature review showed consistency between the present study and previous studies. Based on the literature results, the findings of the present study are consistent with the findings of Azimi *et al*, Farrokhi *et*

al and Atadokht (22-24).

Farrokhi *et al* investigated the effectiveness of multicomponent CBT-I in improving the sleep quality of the elderly with insomnia disorder. The results showed that the mean scores of insomnia and delay in falling asleep significantly decreased in the experimental group. In addition, the total sleep score increased dramatically in the experimental group (24). Azimi *et al* investigated the effectiveness of CBT on emotional regulation strategies in patients with insomnia and depression. The results showed a significant difference in the scores of catastrophization, rumination, positive refocusing, other-blame, and self-blame between the experimental and control groups (22).

Sleep quality refers to the comfort that a person experiences during sleep and a person's periodic movement pattern from night to morning (9). Reduced sleep quality and difficulty falling asleep are indicated in individuals with insomnia disorder because of insomnia-induced stress, daily fatigue, fear of not falling asleep, and ruminations. The International Classification of Sleep Disorders categorizes sleep disorders into six main categories: 1) insomnia, 2) sleep-related breathing disorders, 3) circadian rhythm sleep-wake disorders, 4) sleep-related movement disorders, 5) parasomnias, and 6) central disorders of hypersomnolence (4).

Different studies strongly recommend using CBT to solve sleep disorders (13). Evidence shows the effectiveness of this treatment for primary insomnia and for patients who have insomnia induced by psychiatric disorders and chronic diseases (14). Cognitive insomnia treatment often aims to increase a person's ability to cope with insomnia-induced mental pressures. This is because mental pressures, induced by insomnia and associated concerns, reduce sleep quality. The CBT-I can contribute to enhancing sleep quality by reducing these mental pressures. These methods aim to change assumptions and thoughts about insomnia. The most essential maladaptive cognitions in this area are misconceptions about the causes of insomnia, misattribution or amplification of its consequences, unrealistic sleep expectations, diminished perception of control and predictability of sleep patterns. Theoretically, maladaptive cognitions cause emotional arousal, which develops or exacerbates insomnia. As a result, all of these processes can be identified and

controlled using CBT-I, leading to improved sleep quality in insomnia patients (15). The general objective of the CBT is to enhance self-consciousness, better self-perception, and improve self-control through appropriate growth of cognitive-behavioral skills. CBT helps identify destructive thoughts and beliefs, which are incredibly negative, biased, and self-critical and culminate in sleep problems and severity of sleep disorders. Self-monitoring processes, self-learning, and replacing these inefficient thoughts and beliefs with positive and balanced thoughts contribute to considerable insomnia severity reduction and insomnia improvement. Moreover, replacing undesired fundamental feelings with more desired emotions leads to using more appropriate methods to deal better with extremely complex situations (2).

Conclusion

According to the findings of the present study, using CBT to overcome negative thoughts and emotions that induce and exacerbate insomnia is of paramount importance which can help patients identify these cognitive-behavioral thoughts, emotions, and challenges and then replace them with efficient, positive thoughts, and emotions. This also contributes to considerable improvement in symptoms of insomnia disorder and accompanied problems in individuals. Moreover, when individuals with insomnia disorder recognize the presence of autonomous thinking, rumination, cognitive distortions, and worries which prevent them from falling asleep, they can use some techniques in CBT-I such as the Socratic dialog, challenging these inefficient thoughts, and avoiding unstructured data to eliminate these harmful and anxiety-provoking thoughts that distort their sleep and its quality.

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