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REVIEW OF THE EFFECTS OF COGNITIVE TRAINING INTERVENTION ON SLEEP QUALITY IN OLDER ADULTS WITH INSOMNIA

Iris Haimov
Department of Psychology and the Center for Psychobiological Research, The Max Stern Yezreel Valley College (Israel)

Abstract

Objectives: The risk of both, reduction in sleep quality and cognitive decline, increases with advanced age, raising the question of whether cognitive training intervention could improve sleep quality in older adults with insomnia. The current review aims to characterize existing literature on the possible effects of cognitive training intervention on sleep quality in older adults with insomnia. Evidence suggests that among older adults with insomnia cognitive training intervention (either personalized or in a group) improved sleep quality. The possibility of improving sleep quality among these patients via a non-pharmacological treatment is an encouraging new concept that requires in-depth testing.

Keywords: *Older adults, sleep quality, insomnia, personalized cognitive training intervention, group cognitive training intervention.*

1. Insomnia in older adults

Insomnia, the most common sleep disorder, is defined by difficulty initiating or maintaining sleep that are associated with daytime consequences which occur at least 3 nights a week for at least 3 months despite adequate opportunity to sleep (American Psychiatric Association, 2013; Van Someren, 2021). Late-life insomnia is a chronic sleep disorder which affects over 40% of older adults, according to epidemiological data, and may have a significant negative impact on quality of life and psychological wellbeing (Patel et al., 2018). Late-life insomnia is specifically associated with poor health and cognitive decline (Espiritu, 2008; Patel et al., 2018). Unfortunately, the first-line treatment for insomnia, Cognitive Behavior Therapy for Insomnia (CBTI), is only moderately effective in cases of late-life insomnia (Epstein et al., 2012). It is thus crucial to identify the best treatment for improving sleep quality of older adults suffering from late-life insomnia.

2. Cognitive performance of older adults

Aging not only brings about changes in sleep quality but has also been found associated with cognitive impairments: for example, deterioration in the performance at various cognitive tasks (Lufi et al., 2015; Lufi & Haimov, 2019). Several studies have shown that the cognitive impairments observed in older adults with insomnia is far more severe than those observed in older adults without insomnia (Haimov, 2006; Haimov et al., 2007, 2008).

One effective tool for the prevention of cognitive decline in healthy aging individuals is cognitive training. This includes any intervention aimed to improve, maintain, or restore mental function in which the individual repeatedly practices mentally challenging tasks in a structured manner. Numerous studies have demonstrated the beneficial effects of cognitive training on cognitive functions (e.g., memory, attention, processing speed, and executive functions) and on distal, untrained domains (e.g., reading and walking) among both aging populations (Shatil, 2013) and populations with cognitive deficits (Shatil et al., 2010). Cognitive training can be implemented in 2 ways: in either a personalized setting or a group setting. Recently, personalized cognitive training exercises have been progressively integrated into computerized training: computers and game consoles as well as smartphones and tablets (Bonnechère et al., 2020). Moreover, group programs of cognitive training have been developed alongside computerized personalized cognitive training (Srisuwan et al., 2019).

3. The relationship between sleep quality and cognitive functioning

The interplay between sleep and cognitive functioning has been investigated extensively over the past 2 decades. A multitude of findings have demonstrated the central role of sleep in brain plasticity, memory consolidation, and optimal cognitive engagement (Diekelmann & Born, 2010; Walker & Stickgold, 2004). On the other hand, learning may have positive effects on sleep architecture (Cerasuolo et al., 2020; Fogel & Smith, 2006; Huber et al., 2004).

4. The beneficial effects of cognitive training on sleep quality of older adults with insomnia

Literature review reviled that only 2 studies to date have investigated the beneficial effects of prolonged cognitive training (either personalized or in a group) on sleep quality of older adults with insomnia (Haimov & Shatil, 2013; Keramtinejad et al., 2019). First, Haimov and Shatil (2013) demonstrated in a pioneering study the beneficial effects of personalized computerized cognitive training on sleep quality and cognitive function among older adults with insomnia. Their study revealed that, among this population, an improvement in sleep quality is predicted by an improvement in cognitive performance.

In their study (Haimov & Shatil, 2013), participants in the cognitive training group (n = 34) completed a homebased, personalized, computerized cognitive training program (using the CogniFit cognitive training program). Participants in the active control group completed a home-based program involving computerized tasks that do not engage high-level cognitive functioning (‘‘Word and Paint’’). Both programs were similar in time commitment of 20–30 minutes per session and both regimens were similarly structured - three sessions each week (with a no-training day between sessions), for a duration of 8 weeks (24 training sessions). At the beginning of the study all participants completed a broad spectrum of questionnaires. In the two weeks immediately before the onset of the intervention and following the end of the intervention, baseline and post-training objective sleep quality data were collected i.e., during these two weeks participants’ sleep was continuously monitored by actigraph and participants filled a daily sleep diary. In addition, before the onset of the intervention and following the end of the intervention participants’ cognitive performance was evaluated using the CogniFit computerized neurocognitive evaluation program.

Results of this study (Haimov & Shatil, 2013) revealed between-group improvements for the cognitive training group on both sleep quality (sleep onset latency and sleep efficiency) and cognitive performance (avoiding distractions, working memory, visual memory, general memory and naming). Hierarchical linear regressions analysis in the cognitive training group indicated that improved visual scanning is associated with earlier advent of sleep, while improved naming is associated with the reduction in wake after sleep onset and with the reduction in number of awakenings. Likewise, the results indicate that improved ‘‘avoiding distractions’’ is associated with an increase in the duration of sleep. Moreover, the results indicate that in the active control group cognitive decline observed in working memory is associated with an increase in the time required to fall asleep.

In the second study, Keramtinejad et al. (2019) examined the beneficial effects of prolong group cognitive training intervention on subjective sleep quality and cognition performance among older adults suffering from both insomnia and mild cognitive reduction and revealed that group cognitive training promotes their cognitive function and their sleep quality.

The participants in their study (Keramtinejad et al., 2019) comprised 108 insomniacs older adults with mild cognitive reduction. Participants were randomly allocated to an experimental group (n=54) and a control group (n=54). Experimental group samples were undergoing group cognitive training intervention for two months. Data were collected using Mini-Mental State Examination (MMSE) questionnaire, Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI) and Clinical Dementia Rating Scale (CDR). Data were collected one month before-and after the intervention. Results revealed that the group cognitive training intervention promotes the cognitive function and improved subjective sleep quality in the intervention group compered to the control group.

5. Conclusions

As insomnia is a highly common chronic condition among older adults, the possibility of a non-pharmacological treatment which can improve their sleep quality is auspicious and should be further examined. Both personalized and group cognitive training should be investigated as one such promising non-pharmacological option which could benefit both the initiation and the maintenance of sleep. To further address the beneficial effect of cognitive training on sleep quality throughout the aging process, future studies should evaluate both methods of cognitive training among a broader elderly population. These studies may pave the way for the development of effective non-pharmacological interventions that may improve sleep quality among older adults with insomnia.

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