

Nonpharmacologic Treatment of Insomnia in Primary Care Settings

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Abstract

Introduction: Prevalence of insomnia is higher in females and increases with higher age. Besides primary insomnia, comorbid sleep disorders are also common, accompanying different conditions. Considering the possible adverse effects of commonly used drugs to promote sleep, a nonpharmacologic approach should be preferred in most cases. Although generally considered first-line treatment, the nonpharmacologic approach is often underestimated by both patients and physicians. **Objective:** To provide primary care physicians an up-to-date approach to the nonpharmacologic treatment of insomnia. **Methods:** PubMed, Web of Science, and Scopus databases were searched for relevant articles about the nonpharmacologic treatment of insomnia up to December 2020. We restricted our search only to articles written in English. **Main Message:** Most patients presenting with sleep disorder symptoms can be effectively managed in the primary care setting. Primary care physicians may use pharmacologic and nonpharmacologic approaches, while the latter should be generally considered first-line treatment. A primary care physician may opt to refer the patient to a sleep medicine specialist for refractory cases. **Conclusions:** This paper provides an overview of current recommendations and up-to-date evidence for the nonpharmacologic treatment of insomnia. This article emphasizes the importance of cognitive-behavioral therapy for insomnia, likewise, exercise and relaxation techniques. Complementary and alternative approaches are also covered.

Nonpharmacologic Treatment of Insomnia in Primary Care Settings

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Main message: Most patients presenting with sleep disorder symptoms can be effectively managed in the primary care setting. Primary care physicians may use pharmacologic and nonpharmacologic approaches, while the latter should be generally considered first-line treatment. A primary care physician may opt to refer the patient to a sleep medicine specialist for refractory cases.

Conclusions: This paper provides an overview of current recommendations and up-to-date evidence for the nonpharmacologic treatment of insomnia. This article emphasizes the importance of cognitive-behavioral therapy for insomnia, likewise, exercise and relaxation techniques. Complementary and alternative approaches are also covered.

Review criteria

This narrative review was conducted by a focused PubMed, Scopus, and Web of Science search of the English language literature up to December 2020. We included articles referring to the nonpharmacologic treatment of insomnia. We considered original research and systematic review articles. Editorials, letters to the editor, and case series/reports were excluded.

Message for the clinic

- The nonpharmacologic approach should be generally considered the first-line treatment for insomnia.
- Hypnotic/sedating medication should be reserved for selected cases.
- A primary care physician may consider referral to a sleep specialist for refractory cases or if the diagnosis is in doubt.

INTRODUCTION

International Classification of Sleep Disorders, 3rd edition (ICSD-3) distinct insomnia to acute and chronic (insomnia symptoms >3 nights per week for >3 months).¹ Various symptoms of sleep disorders comprise difficulty initiating sleep, difficulty maintaining sleep, and nonrestorative sleep.² Prevalence of insomnia is alarming high as it affects 6% to 10% of the adult population.³ Insomnia is more prevalent in females and older individuals.⁴ Besides primary insomnia, comorbid sleep disorders are also common accompanying different diseases/conditions, e.g., chronic pain, nocturia, chronic cough, pruritus, emotional trauma, and pregnancy.^{5,6} Sleep difficulties are also common complaints of shift workers. If not adequately treated, insomnia can result in psychopathological conditions, hypertension, and other serious health problems.⁷ Treatment options for insomnia cover pharmacological and non-pharmacological approaches. Commonly used agents are benzodiazepine receptor agonists, sedating antidepressants, sedating antihistamines, melatonin receptor agonists, and dual orexin receptor antagonists.⁷ However, all medications are associated with their potential side effects. Being aware of the possible side effects of hypnotic/sedating drugs is particularly important in elderly patients. Regarding geriatric patients using hypnotic/sedating medication, an increased risk of falls, physical dependence, and confusion have been documented.⁸ Considering the possible adverse effects of the

above-mentioned agents, a non-pharmacologic approach should be preferred in most cases.⁹ Of the patients presenting with insomnia symptoms, most do not require sleep specialist referral and can be managed by general practitioners.¹⁰ Notably, in relation to the COVID-19 pandemic, 43.5% of sleep departments in the Czech Republic and Slovakia completely interrupted their service. In similar situations, primary care physicians may need to manage insomnia symptoms even in more complicated cases.¹¹ Multicomponent behavioral therapy and psychotherapy are considered first-line treatment according to guidelines of the American College of Physicians, European Sleep Research Society, and British Association for Psychopharmacology.^{12,13,14} The non-pharmacological treatment components are cognitive-behavioral therapy for insomnia (CBT-i), sleep hygiene, stimulus control, sleep restriction, psychotherapy and relaxation techniques, exercise, complementary and alternative approaches, e.g., phototherapy, massage, music therapy, aromatherapy, herbal medicine, acupuncture/acupressure.

METHODS

Literature search

This narrative review was conducted by a focused PubMed, Scopus, and Web of Science hand search of the English language literature up to November 2020. We included articles referring to the nonpharmacologic treatment of insomnia. The following eligibility criteria were determined in advance. We considered original research, narrative and systematic review articles. Editorials, letters to the editor, and case series/reports were excluded. Terms and keywords used included the following: insomnia, sleep, cognitive-behavioral therapy, sleep hygiene, stimulus control, autogenic training, herbal medicine, phytotherapy, light therapy, acupuncture, acupressure, progressive muscle relaxation, hypnotherapy, exercise, yoga, Tai Chi, music therapy, mindfulness, depression, sleep restriction, aromatherapy, and massage. The bibliographies of relevant articles were searched for additional references.

Authors' approach

The author's insomnia management approach includes detailed sleep history taking focusing on behavior around the bed and sleep, stress, depression, and laboratory testing (including serum thyroid-stimulating hormone and free T3 and free T4). Furthermore, we consider adjusting/replacing medications that may disturb sleep (e.g., corticosteroids and SSRI antidepressants). We also make an effort to control symptoms of comorbid diseases (e.g., chronic pain, nocturia, chronic cough, pruritus). The first-line treatment in our clinical practice is nonpharmacologic, focusing on sleep hygiene and stimulus control. In the author's opinion, most of these patients do not require sleep specialist referral and can be managed by general practitioners. A primary care physician may consider referral to a sleep specialist for refractory cases or if the diagnosis is in doubt. Sleep physicians may indicate paraclinical examinations such as polysomnography and actigraphy in those patients.

NONPHARMACOLOGIC THERAPIES

Cognitive-behavioral therapy for insomnia

CBT-i is an effective nonpharmacologic multimodal combination of treatments for coping with sleep problems. It can either be effectively done by trained therapists face-to-face or as a telemedicine-based internet-delivered therapy.¹⁵ CBT-i aims to change thoughts that negatively interfere with sleep quality and improve sleep behaviors and unhealthy habits. CBT-i encompasses cognitive and behavioral interventions and relaxation training. For treatment success, good compliance of the patient is a prerequisite. Along with the motivation, patients also need to include the sleep diary as part of their daily routine.

Cognitive interventions as a form of psychotherapy aim to recognize and change the patient's maladaptive beliefs about sleep. The first step is the identification of the stressors, which are subsequently replaced with an alternative interpretation. Quite common are unrealistic expectations about sleep duration. These thoughts create tension, impair the ability to sleep, and cause a vicious cycle. Education of patients about realistic expectations from sleep may reduce anxiety and hyperarousal associated with insomnia. The therapist can

even advise the patient to make an active effort to stay awake, which may help relieve the anxiety linked to the pressure to fall asleep. The described technique is known as *paradoxical intention*.

Behavioral interventions emphasize the change in the patient's maladaptive behavior. Therapy for insomnia should involve at least one intervention session. Individual or group format therapy aims at the development of new behavioral patterns. The intervention can easily be delivered in the office setting by a general practitioner, who advises the patient to maintain a sleep diary and is instructed on sleep hygiene, stimulus control, and sleep restriction therapy. Commonly used individual components comprise sleep hygiene, stimulus control, sleep restriction, paradoxical intention, and relaxation training.

Sleep hygiene was initially introduced in 1977 by Peter Hauri, who developed a concept of sleep-promoting recommendations.¹⁶ Sleep hygiene consists of a set of behavior and environmental factors modifications (e.g., avoiding naps during the day, avoiding physical exercise close to bedtime, limiting caffeine consumption, bedroom temperature) that may improve sleep quality.¹⁷ The International Classification of Sleep Disorders (ICSD) introduced a diagnostic category called 'Inadequate Sleep Hygiene'.¹⁸ The sleep habits that contribute to inadequate sleep hygiene, according to the ICSD, are presented in Table 1. In recent years, attention is paid to 'light hygiene', a set of recommendations to alleviate the negative impact of blue light exposure on sleep quality. The wavelengths in the blue part of the spectrum (400–490 nm) suppress melatonin secretion, resulting in circadian dysregulation with delayed sleep onset.¹⁹ Patients may be advised to limit the use of blue light-emitting devices (e.g., TVs, laptops, tablets, smartphones) 90 minutes before bedtime.²⁰ An alternative can be the use of blue-light filtering glasses.²¹

Stimulus control therapy aims to (re)associate the bedroom with sleep and set a regular sleep-wake cycle.²² Specific recommendations include a set of behavior modifications (e.g., only going to bed when feeling sleepy, using the bed and bedroom for sleep and sex only, keeping a fixed wake time in the morning). Together with sleep hygiene, stimulus control education is recommended as an initial intervention for all adults with insomnia.²³

Sleep restriction may be beneficial for patients who spend a long time in bed, not sleeping. The initial goal is to achieve mild sleep deprivation by limiting the number of sleeping hours. The physician advises the patient to limit time in bed to the number of hours spent sleeping, while this time should not be less than five hours.²⁴ Using the sleep diary, the patient is instructed to gradually increase sleep time as sleep quality improves.²³ One important flaw of this approach is an increased risk of daytime drowsiness.

Evidence shows CBT's consistent effectiveness in improving sleep problems across multiple outcomes²⁵⁻²⁷ and seems to be the optimal first-line treatment.^{12,14} Notably, no specific adverse effects were reported.²⁸

Relaxation techniques

Autogenic training is a technique of passive autosuggestion described in 1932 by a German psychiatrist Johannes Heinrich Schultz. The technique involves a series of mental exercises used to induce a state of relaxation. In their systematic review and meta-analysis, Seo and Kim concluded that autogenic training is effective for adults' stress management as it decreased anxiety and depression in 11 studies that were analyzed.²⁹ In 2011 Ann Bowden and coauthors published a study of the effectiveness of autogenic training, and 112 subjects with sleep-related problems reported an improvement in several sleep patterns, including sleep onset latency and feeling of sleep refreshment. The program consisted of 8-week training, with no specific focus on sleep.³⁰

Progressive muscle relaxation (PMR) is a deep muscle relaxation method developed by American physician Edmund Jacobson in 1938.³¹ The goal of PMR is reducing somatic tension and cognitive arousal that negatively affect sleep quality. The effectiveness of PMR in improving sleep quality has been proven in several clinical conditions, e.g., cancer, prenatal anxiety, and COVID-19.³²⁻³⁴

Mindfulness meditation is rooted in Buddhist philosophy and is based on emotional detachment with non-judgmental awareness in the present moment.³⁵ Focusing on calming and slowing down breathing is often used to achieve an emotionally and mentally clear and stable state. In 2019, Rush and colleagues conducted

a systematic review and meta-analysis of the effect of mindfulness meditation on sleep quality in 18 randomized controlled trials (RCT's), including 1654 patients. Their preliminary findings suggest that mindfulness meditation may improve some aspects of poor sleep quality.³⁶ Referring to the study by Liu and Rice, patients less experienced in meditation prefer background sounds without a distinct melody during mindfulness meditation.³⁷

Hypnotherapy is performed by professionals who received training in hypnosis. The alternated state of consciousness, called the hypnotic trance, allows for relaxation, increased suggestibility, and posthypnotic suggestion. Hypnosis has been reported as an effective therapy for several clinical conditions, e.g., relieving cancer treatment side effects and pain management.^{38,39} In 2018, Chamine and coauthors published a systematic review of 24 articles describing hypnosis interventions on sleep quality. From the analyzed studies, 58.3% reported hypnosis benefit on sleep quality. The incidence of adverse events was reported to be low.⁴⁰

Exercise

Sleep and exercise bound a reciprocal relationship involving physical and psychical pathways. Multiple explanations of how regular exercise affects sleep comprise endocrine effects on the hypothalamic level⁴¹, the interaction with circadian rhythm, metabolic and immune responses, and thermoregulatory.⁴²

Resistance exercise, aerobic training, and stretching. In 2018, Kovacevic and colleagues conducted a systematic review to determine the acute and chronic effects of resistance exercise on sleep quality. Regular resistance exercise significantly improved sleep quality, with additional benefits of a combination with aerobic exercise. On the other hand, the evidence of the acute effects of resistance exercise on sleep quality was low and inconsistent.⁴³ In 2019, D'Aurea et al. conducted a study comparing the effects of moderate-intensity resistance exercise training and stretching on chronic insomnia. The authors found both approaches to be similarly effective in objective and subjective sleep parameters. Compared with controls, either resistance exercise and stretching were effective.⁴⁴ In their study, Bullock and coworkers compared the influence of different exercise intensities on sleep quality in older poor sleepers. Their results suggest that high-intensity interval training (HIIT) was the least effective for optimizing sleep in poor sleepers compared with moderate and low (stretching) intensity exercise.⁴⁵ According to sleep hygiene, people should not perform exercise before bedtime. On the other hand, Buman and coauthors did not find an association between evening exercise and worse sleep.⁴⁶ Thus, it seems that one should evaluate evening exercise's influence on sleep quality case by case. To this end, regular exercise seems to be a good alternative treatment option for poor sleepers.

Tai Chi Chuan, an internal Chinese martial art, is nowadays also very popular in the Western world. A systematic review with a meta-analysis conducted in 2014 showed the potential to enhance older adults' cognitive function who practice Tai Chi.⁴⁷ A favorable impact of Tai chi on the occurrence of falls, cardiovascular fitness, and flexibility was also reported.^{48,49} In 2010, Wang and coworkers, in their systematic review, documented the effects of Tai Chi on improvement in psychological well-being, including mood, decreased stress, and anxiety.⁵⁰ Two recently published systematic reviews with meta-analyses have reported sleep quality improvement via Tai Chi training.^{51,52}

Yoga, in its ancient spiritual concept, originated in the Indian subcontinent more than 5.000 years ago, comprises meditation, breathing exercises, lifestyle advice, and body positions. The Western version, known as 'modern postural yoga' consists mainly of postures usually connected by flowing sequences.⁵³ Cramer et al., in their systematic review from 2013, documented moderate evidence for short-term effects of yoga on symptom relief in patients with depression.⁵⁴ Considering women with sleep problems, Wang and coworkers reported that yoga intervention could be beneficial in the long-term.⁵⁵ Furthermore, yoga practice has also been reported to be helpful in primary insomnia⁵⁶, and it was shown to improve sleep in the elderly⁵⁷, cancer patients⁵⁸, and women with menopausal symptoms.⁵⁹ However, European guidelines for the diagnosis and treatment of insomnia¹² do not recommend yoga for the treatment of insomnia because of poor evidence.

Complementary and alternative approaches

European guidelines for diagnosing and treating insomnia¹² do not recommend Valerian and other phyto-

therapeutics, acupuncture, aromatherapy, and foot reflexology to treat insomnia because of poor evidence. Notably, these approaches and products are popular worldwide and have been increasingly studied over the past two decades to treat sleep disorders.

Light therapy is the use of light in the treatment of physical or mental illnesses. When natural sunlight is not appropriate, light therapy boxes mimicking outdoor light might provide an alternative to adjust normal circadian rhythm. The fact that light inhibits the secretion of melatonin and that the hypothalamus through the retinohypothalamic tract controls circadian rhythms provides better insight into how light therapy can be used to treat sleep disorders.^{60,61} In studies of insomnia therapy, the mean reported light intensity was 4800 lux.⁶² With coauthors in their systematic review with meta-analysis, Van Maanen reported light therapy to be effective for insomnia symptoms and recommend it as a complementary method to insomnia management.⁶² On the other hand, light therapy can be questionable in patients with photosensitivity and epilepsy.

Music therapy is the therapeutic use of music to promote patients' mental and bodily health. Listening to music is a complicated process accompanied by the activation of different brain parts with a complex response, e.g., cognitive and emotional. Särkämö and colleagues, in poststroke patients listening to music of their own choice, reported mood improvement and cognitive enhancement.⁶³ Nilsson documented stress reduction in patients who underwent cardiac surgery after 30 minutes of listening to soft and relaxing melodies with a volume of 50 to 60 dB.⁶⁴ In their systematic review from 2017, Feng et al. documented that listening to relaxing music improves sleep onset latency and overall sleep quality in primary insomniacs.⁶⁵

Aromatherapy is based on the usage of concentrated essential oils extracted from fragrant floral parts to improve mental and physical health. Aromatherapy is usually administered by either inhalation or skin application.⁶⁶ A possible explanation for aromatherapy's efficacy ranges from subjective psychological to direct biological action.⁶⁷ Some essential oils contain terpenes that cross the blood-brain barrier and possess cholinergic activity or act on gamma-aminobutyric acid receptors.⁶⁸ Certain odors, e.g., linalool and linalyl acetate extracted from lavender, may induce sedation and relaxation.⁶⁹ In their systematic review from 2019, Lin and coauthors also highlighted the results' limitations and documented that aromatherapy can be effectively used to improve sleep quality.⁷⁰ The study mentioned above is in line with Hwang and colleagues' previously published work, which documented aromatic oils extracted from lavender and bergamot to be most commonly studied.⁷¹

Massage is a thousands of years old technique involving mechanical contact on the patient's body, commonly used in medicine, sports-related regeneration, and wellness. More than one hundred massage types are known. In the literature, the influence of massage therapy on the improvement of depression and anxiety was documented.⁷² A possible massage therapy mechanism for stress relief is decreased cortisol levels and an increase in active neurotransmitters, such as serotonin and dopamine.⁷³ Hachul and colleagues reported improved sleep in postmenopausal women with insomnia symptoms after massage therapy.⁷⁴

Acupuncture and *acupressure* arise from traditional Chinese medicine, characterized by the insertion of metallic needles into or through the skin or applying mechanical pressure at specific sites. The techniques mentioned above are believed to restore the proper flow of vital energy, known as qi. The study by Jinhuan and coauthors has shed more light on the effects of acupuncture for insomnia. They analyzed fifteen studies involving 1108 patients and found acupuncture superior to placebo in treating insomnia.⁷⁵ On the other hand, in 2019, He and coworkers published an overview of 34 systematic reviews assessing acupuncture to treat insomnia. They recommended a cautious interpretation of the promising results, as the included studies' quality was generally low.⁷⁶ Regarding existing evidence of the acupressure effect on sleep quality, one systematic review with meta-analysis reported an improvement in the Pittsburgh Sleep Quality index compared with sham treatment. However, the authors also identified a high risk of bias due to the absence of blinding patients.⁷⁷

Herbal medicine represents a commonly used complementary/alternative approach to health promotion or disease treatment. It refers to the utilization of plants or herbal nutritional supplements for therapeutic purposes. Forms in which herbs can be administered usually comprise herbal teas or plant extracts. Herbal

dietary supplements are widely used worldwide. E.g., up to one-quarter of adults in the US report the use of an herb to treat a medical condition.⁷⁸ Some empirical studies explain the possible sedative-hypnotic effect of some medical plants via interaction with the neurotransmitter gamma amino-butyric acid and its receptors.⁷⁹ In 2015, Ni, with coauthors in their systematic review with meta-analysis of RCT's found Chinese herbal medicine (CHM) superior to placebo with respect to its effect on selected sleep quality parameters. However, due to heterogeneity, the typical effect of CHM for insomnia could not be determined. As such, the original studies' overall poor quality requires a cautious interpretation of the results.⁸⁰ One of the most commonly used herbal medicines for insomnia is *Valeriana officinalis*. In a recent study, Shinjyo and colleagues, in their systematic review with meta-analysis, concluded that valerian root could be a safe and useful herb to treat sleep problems. Notably, they also reported no severe adverse events associated with valerian intake. Of note, 'drinking a tea ritual' before bed can help relieve stress and promote restorative sleep.

CONCLUSION

Insomnia is an everyday challenge in primary care. Pharmacotherapy can be beneficial in selected cases. However, considering the possible adverse effects of hypnotic/sedating medications, a non-pharmacological approach (e.g., cognitive-behavioral therapy) should be the first-line treatment. A primary care physician may consider referral to a sleep specialist for refractory cases. To improve sleep quality, patients may need to change their lifestyle, alter long-term habits, follow sleep hygiene recommendations, perform regular physical activity, and protect themselves from stress.

References

1. American Academy of Sleep Medicine. International Classification of Sleep Disorders, 3rd ed, American Academy of Sleep Medicine, Darien, IL 2014.
2. Morin CM, LeBlanc M, Bélanger L, Ivers H, Mérette C, Savard J. Prevalence of insomnia and its treatment in Canada. *Can J Psychiatry* 2011;**56** :540-548.
3. Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. *Sleep Med Rev* 2002;**6** :97-111.
4. Klink ME, Quan SF, Kaltenborn WT, Lebowitz MD. Risk factors associated with complaints of insomnia in a general adult population. Influence of previous complaints of insomnia. *Arch Intern Med*1992;**152** :1634-1637.
5. Kec D, Bednařík J, Ludka O, Hamerníková V, Vlčková E. Treatment of insomnia in the context of neuropathic pain. *Cesk Slov Neurol N*2019;**82** :513-517.
6. Sedov ID, Cameron EE, Madigan S, Tomfohr-Madsen LM. Sleep quality during pregnancy: A meta-analysis. *Sleep Med Rev*2018;**38** :168-176.
7. Cunningham D, Junge M. Chronic insomnia: diagnosis and non-pharmacological management. *BMJ* 2016;**355** :i5819.
8. Lam S, Macina LO. Therapy Update for Insomnia in the Elderly. *Consult Pharm* 2017;**32** :610-622.
9. Medalie L, Cifu AS. Management of Chronic Insomnia Disorder in Adults. *JAMA* 2017;**317** :762-763.
10. Kec D, Ludka O, Hamerníková V, Kubánek J, Bednařík J, Vlčková E. Current trends in the treatment and diagnosis of chronic insomnia. *Čes a slov Psychiat* 2020;**116** :39-149.
11. Genzor S, Sova M, Mucska I, Lnenicka K, Nadjarpour S, Šonka K. Impact of the COVID-19 pandemic on sleep medicine in the Czech Republic and Slovakia. *Cesk Slov Neurol N* 2020; **83** :421-423.
12. Riemann D, Baglioni C, Bassetti C, et al. European guideline for the diagnosis and treatment of insomnia. *J Sleep Res*2017;**26** :675-700.

13. Wilson S, Anderson K, Baldwin D, et al. British Association for Psychopharmacology consensus statement on evidence-based treatment of insomnia, parasomnias, and circadian rhythm disorders: An update. *J Psychopharmacol* 2019;**33** :923-947.
14. Qaseem A, Kansagara D, Forciea MA, Cooke M, Denberg TD; Clinical Guidelines Committee of the American College of Physicians. Management of Chronic Insomnia Disorder in Adults: A Clinical Practice Guideline From the American College of Physicians. *Ann Intern Med* 2016;**165** :125-33.
15. Seyffert M, Lagisetty P, Landgraf J, et al. Internet-Delivered Cognitive Behavioral Therapy to Treat Insomnia: A Systematic Review and Meta-Analysis. *PLoS One* 2016;**11** :e0149139.
16. Hauri P. Current Concepts: The Sleep Disorders. The Upjohn Company, Kalamazoo, Michigan, 1977.
17. Stepanski EJ, Wyatt JK. Use of sleep hygiene in the treatment of insomnia. *Sleep Med Rev* 2003;**7** :215-25.
18. American Academy of Sleep Medicine. International classification of sleep disorders, revised: Diagnostic and coding manual. Chicago, Illinois: American Academy of Sleep Medicine, 2001.
19. Grønli J, Byrkjedal IK, Bjorvatn B, Nødtvedt Ø, Hamre B, Pallesen S. Reading from an iPad or from a book in bed: the impact on human sleep. A randomized controlled crossover trial. *Sleep Med* 2016;**21** :86-92.
20. Touitou Y, Touitou D, Reinberg A. Disruption of adolescents' circadian clock: The vicious circle of media use, exposure to light at night, sleep loss and risk behaviors. *J Physiol Paris* 2016;**110** :467-479.
21. Janků K, Šmotek M, Fárková E, Kopřivová J. Block the light and sleep well: Evening blue light filtration as a part of cognitive behavioral therapy for insomnia. *Chronobiol Int* 2020;**37** :248-259.
22. Bootzin RR. Stimulus control treatment for insomnia. *Proc Am Psychol Assoc* 1972;**7** :395-396.
23. Maness DL, Khan M. Nonpharmacologic Management of Chronic Insomnia. *Am Fam Physician* 2015;**92** :1058-64.
24. Kyle SD, Aquino MR, Miller CB, et al. Towards standardisation and improved understanding of sleep restriction therapy for insomnia disorder: A systematic examination of CBT-I trial content. *Sleep Med Rev* 2015;**23** :83-8.
25. Trauer JM, Qian MY, Doyle JS, Rajaratnam SM, Cunningham D. Cognitive Behavioral Therapy for Chronic Insomnia: A Systematic Review and Meta-analysis. *Ann Intern Med* 2015;**163** :191-204.
26. Rios P, Cardoso R, Morra D, et al. Comparative effectiveness and safety of pharmacological and non-pharmacological interventions for insomnia: an overview of reviews. *Syst Rev*. 2019;**8** :281.
27. Mitchell LJ, Bisdounis L, Ballesio A, Omlin X, Kyle SD. The impact of cognitive behavioural therapy for insomnia on objective sleep parameters: A meta-analysis and systematic review. *Sleep Med Rev* 2019;**47** :90-102.
28. Brasure M, Fuchs E, MacDonald R, et al. Psychological and Behavioral Interventions for Managing Insomnia Disorder: An Evidence Report for a Clinical Practice Guideline by the American College of Physicians. *Ann Intern Med* 2016;**165** :113-24.
29. Seo E, Kim S. Effect of Autogenic Training for Stress Response: A Systematic Review and Meta-Analysis. *J Korean Acad Nurs* 2019;**49** :361-374.
30. Bowden A, Lorenc A, Robinson N. Autogenic Training as a behavioural approach to insomnia: a prospective cohort study. *Prim Health Care Res Dev* 2012;**13** :175-85.
- 31 Jacobson E. Progressive Relaxation. Chicago, IL: University of Chicago Press, 1938.

32. Gok Metin Z, Karadas C, Izgu N, Ozdemir L, Demirci U. Effects of progressive muscle relaxation and mindfulness meditation on fatigue, coping styles, and quality of life in early breast cancer patients: An assessor blinded, three-arm, randomized controlled trial. *Eur J Oncol Nurs* 2019;**42** :116-125.
33. Rajeswari S, SanjeevaReddy N. Efficacy of Progressive Muscle Relaxation on Pregnancy Outcome among Anxious Indian Primi Mothers. *Iran J Nurs Midwifery Res* 2019;**25** :23-30.
34. Liu K, Chen Y, Wu D, Lin R, Wang Z, Pan L. Effects of progressive muscle relaxation on anxiety and sleep quality in patients with COVID-19. *Complement Ther Clin Pract* 2020;**39** :101132.
35. Crane RS, Brewer J, Feldman C, et al. What defines mindfulness-based programs? The warp and the weft. *Psychol Med* 2017;**47** :990-999.
36. Rusch HL, Rosario M, Levison LM, et al. The effect of mindfulness meditation on sleep quality: a systematic review and meta-analysis of randomized controlled trials. *Ann N Y Acad Sci* 2019;**1445** :5-16.
37. Liu B, Rice VJ. A pilot study investigating preferred background sounds during mindfulness meditation: What would you like to hear? *Work* 2019;**63** :155-163.
38. Adachi T, Fujino H, Nakae A, Mashimo T, Sasaki J. A meta-analysis of hypnosis for chronic pain problems: a comparison between hypnosis, standard care, and other psychological interventions. *Int J Clin Exp Hypn* 2014;**62** :1-28.
39. Syrjala KL, Jensen MP, Mendoza ME, Yi JC, Fisher HM, Keefe FJ. Psychological and behavioral approaches to cancer pain management. *J Clin Oncol* 2014;**32** :1703-1711.
40. Chamine I, Atchley R, Oken BS. Hypnosis intervention effects on sleep outcomes: a systematic review. *J Clin Sleep Med* 2018;**14** :271-283.
41. Takahashi JS, Hong HK, Ko CH, McDearmon EL. The genetics of mammalian circadian order and disorder: implications for physiology and disease. *Nature reviews Genetics* 2008; **9** :764-75.
42. Chennaoui M, Arnal PJ, Sauvet F, Léger D. Sleep and exercise: a reciprocal issue? *Sleep Med Rev* 2015;**20** :59-72.
43. Kovacevic A, Mavros Y, Heisz JJ, Fiatarone Singh MA. The effect of resistance exercise on sleep: A systematic review of randomized controlled trials. *Sleep Med Rev* 2018;**39** :52-68.
44. D'Aurea CVR, Poyares D, Passos GS, et al. Effects of resistance exercise training and stretching on chronic insomnia. *Braz J Psychiatry* 2019;**41** :51-57.
45. Bullock A, Kovacevic A, Kuhn T, Heisz JJ. Optimizing Sleep in Older Adults: Where Does High-Intensity Interval Training Fit? *Front Psychol* 2020;**11** :576316.
46. Buman MP, Phillips BA, Youngstedt SD, Kline CE, Hirshkowitz M. Does nighttime exercise really disturb sleep? Results from the 2013 National Sleep Foundation Sleep in America Poll. *Sleep Med* 2014;**15** :755-61.
47. Wayne PM, Walsh JN, Taylor-Piliae RE, et al. Effect of tai chi on cognitive performance in older adults: systematic review and meta-analysis. *J Am Geriatr Soc* 2014;**62** :25-39.
48. Wolf SL, Barnhart HX, Kutner NG, McNeely E, Coogler C, Xu T. Reducing frailty and falls in older persons: an investigation of Tai Chi and computerized balance training. Atlanta FICSIT Group. Frailty and Injuries: Cooperative Studies of Intervention Techniques. *J Am Geriatr Soc* 1996;**44** :489-97.
49. Wang C, Collet JP, Lau J. The effect of Tai Chi on health outcomes in patients with chronic conditions: a systematic review. *Arch Intern Med* 2004;**164** :493-501.
50. Wang C, Bannuru R, Ramel J, Kupelnick B, Scott T, Schmid CH. Tai Chi on psychological well-being: systematic review and meta-analysis. *BMC Complement Altern Med* 2010;**10** :23.

51. Si Y, Wang C, Yin H, et al. Tai Chi Chuan for Subjective Sleep Quality: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Evid Based Complement Alternat Med* 2020;**2020** :4710527.
52. Li H, Chen J, Xu G, Duan Y, at al. The Effect of Tai Chi for Improving Sleep Quality: A Systematic Review and Meta-analysis. *J Affect Disord* 2020;**274** :1102-1112.
53. Feuerstein G. The Yoga Tradition: Its History, Literature, Philosophy, and Practice. Prescott: Hohm Press, 2008.
54. Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: a systematic review and meta-analysis. *Depress Anxiety* 2013;**30** :1068-83.
55. Wang WL, Chen KH, Pan YC, Yang SN, Chan YY. The effect of yoga on sleep quality and insomnia in women with sleep problems: a systematic review and meta-analysis. *BMC Psychiatry* 2020;**20** :195.
56. Khalsa SB. Treatment of chronic insomnia with yoga: a preliminary study with sleep-wake diaries. *Appl Psychophysiol Biofeedback* 2004;**29** :269-278.
57. Halpern J, Cohen M, Kennedy G, Reece J, Cahan C, Baharav A. Yoga for improving sleep quality and quality of life for older adults. *Altern Ther Health Med* 201;**20** :37-46.
58. Mustian KM, Janelins M, Peppone LJ, Kamen C. Yoga for the Treatment of Insomnia among Cancer Patients: Evidence, Mechanisms of Action, and Clinical Recommendations. *Oncol Hematol Rev* 2014;**10** :164-168.
59. Afonso RF, Hachul H, Kozasa EH, et al. Yoga decreases insomnia in postmenopausal women: a randomized clinical trial. *Menopause* 2012;**19** :186-193.
60. Lewy AJ, Wehr TA, Goodwin FK, Newsome DA, Markey SP. Light suppresses melatonin secretion in humans. *Science* 1980;**210** :1267-9.
61. Berson DM, Dunn FA, Takao M. Phototransduction by retinal ganglion cells that set the circadian clock. *Science* 2002;**295** :1070-3.
62. van Maanen A, Meijer AM, van der Heijden KB, Oort FJ. The effects of light therapy on sleep problems: A systematic review and meta-analysis. *Sleep Med Rev* 2016;**29** :52-62.
63. Särkämö T, Tervaniemi M, Laitinen S, et al. Music listening enhances cognitive recovery and mood after middle cerebral artery stroke. *Brain* 2008;**131** :866-76.
64. Nilsson U. The effect of music intervention in stress response to cardiac surgery in a randomized clinical trial. *Heart Lung* 2009;**38** :201-7.
65. Feng F, Zhang Y, Hou J, et al. Can music improve sleep quality in adults with primary insomnia? A systematic review and network meta-analysis. *Int J Nurs Stud* 2018;**77** :189-196.
66. Park S, Park K, Ko Y, et al. The effects of aroma inhalation therapy on fatigue and sleep in nurse shift workers. *J EastWest Nurs Res* 2012;**18** :66-73.
67. Burns A, Byrne J, Ballard C, Holmes C. Sensory stimulation in dementia. *BMJ* 2002;**325** :1312-3.
68. Perry N. Cholinergic transmitter activities in European herbs: potential in dementia therapy. *Int J Geriatr Psych* 1996;**11** :1063-9.
69. Buchbauer G, Jirovetz L, Jäger W, Dietrich H, Plank C. Aromatherapy: evidence for sedative effects of the essential oil of lavender after inhalation. *Z Naturforsch C J Biosci* 1991;**46** :1067-72.
70. Lin PC, Lee PH, Tseng SJ, Lin YM, Chen SR, Hou WH. Effects of aromatherapy on sleep quality: A systematic review and meta-analysis. *Complement Ther Med* 2019;**45** :156-166.

71. Hwang E, Shin S. The effects of aromatherapy on sleep improvement: a systematic literature review and meta-analysis. *J Altern Complement Med* 2015;**21** :61-8.
72. Moyer CA, Rounds J, Hannum JW. A meta-analysis of massage therapy research. *Psychol Bull* 2004;**130** :3-18.
73. Field T, Hernandez-Reif M, Diego M, Schanberg S, Kuhn C. Cortisol decreases and serotonin and dopamine increase following massage therapy. *Int J Neurosci* 2005 ;**115** :1397-413.
74. Hachul H, Oliveira DS, Bittencourt LR, Andersen ML, Tufik S. The beneficial effects of massage therapy for insomnia in postmenopausal women. *Sleep Sci* 2014;**7** :114-6.
75. Zhang J, He Y, Huang X, Liu Y, Yu H. The effects of acupuncture versus sham/placebo acupuncture for insomnia: A systematic review and meta-analysis of randomized controlled trials. *Complement Ther Clin Pract* 2020;**41** :101253.
76. He W, Li M, Zuo L, et al. Acupuncture for treatment of insomnia: An overview of systematic reviews. *Complement Ther Med* 2019;**42** :407-416.
77. Waits A, Tang YR, Cheng HM, Tai CJ, Chien LY. Acupressure effect on sleep quality: A systematic review and meta-analysis. *Sleep Med Rev* 2018;**37** :24-34.
78. Bent S, Ko R. Commonly used herbal medicines in the United States: a review. *Am J Med* 2004;**116** :478-85.
79. Cho SM, Shimizu M, Lee CJ, et al. Hypnotic effects and binding studies for GABA(A) and 5-HT(2C) receptors of traditional medicinal plants used in Asia for insomnia. *J Ethnopharmacol* 2010;**132** :225-32.
80. Ni X, Shergis JL, Guo X, et al. Updated clinical evidence of Chinese herbal medicine for insomnia: a systematic review and meta-analysis of randomized controlled trials. *Sleep Med* 2015;**16** :1462-81.

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