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Complementary and Alternative Treatments for Tinnitus

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Abstract

Tinnitus is described as the perception of sound without any external acoustic stimulation. Any pathology of auditory pathways or any system of the human body may result with tinnitus. The pathophysiology of tinnitus accompanying the disorders of auditory system is not fully understood. In researches, a lot of therapy modalities have been used many years but there is no definitive treatments for tinnitus. Pharmacological treatments of various pharmacological interventions have been investigated for the treatment of tinnitus. However, no drug has been approved by the US Food and Drug Administration (FDA) or the European Medicines Agency (EMA) for the treatment of tinnitus. The use of complementary and alternative medicine (CAM) is very popular in most countries, and several CAM products are often used by individuals with tinnitus with or without medical guidance. Nonconventional approaches for tinnitus have increased in prevalence and acceptance among both patients and practitioners. Many of these approaches have been shown to benefit some tinnitus sufferers. Complementary treatments may be particularly well suited for treating the dysfunction associated with tinnitus, as they specifically target aspects of tinnitus that are often overlooked in conventional medicine. CAM has frequently been used to treat tinnitus. The objective of this review was to assess complementary therapies as a treatment for the tinnitus.

Keywords: tinnitus, treatment, complementary, alternative, therapy

1. Introduction

Tinnitus is a symptom that can be defined as the perception of noise without any external sound source [1]. It is estimated that around 5–15% of the population have a form of tinnitus, and tinnitus may occur at any age. It is more common in elderly individuals (particularly those aged between 60 and 69) than young adults [2]. Many people with tinnitus appear to overcome this situation; nevertheless, tinnitus becomes a serious condition for a 1% minority [3].

However, the physiopathological mechanisms of tinnitus are not well-defined, and this has so far been the biggest challenge in treatment. Broad etiological diversity and symptom subjectivity in the same patient often make it difficult to achieve good results [4]. Moreover, no specific treatment, including drug therapy, is currently accepted as being effective in the treatment of tinnitus symptoms [5].

It is for this reason that patients with tinnitus continue to look for new and more effective treatments. Many of them have turned their attention to complementary and alternative therapies [3].

Complementary and alternative medicine is now frequently being used in the treatment of tinnitus [6].

The increasing popularity of complementary drugs in the treatment of tinnitus requires meticulous assessment and testing of the studies [7].

In this section, we aim to review complementary and alternative treatments that are being used for tinnitus.

2. Methods

Complementary medicine is defined as being a medical practice, or as an intervention, that is sufficiently documented to demonstrate its safety and efficacy in specific diseases and conditions [3]. The standard treatments accepted for tinnitus are as follows: psychotherapeutic interventions such as white noise generators, behavioral/cognitive therapy, hearing aids, benzodiazepines, tricyclic antidepressants, eighth nerve section, and vascular decompression [8].

A range of complementary treatments, such as acupuncture, yoga, homeopathy, hyperbaric oxygen therapy, *Ginkgo biloba*, aromatherapy, and physiotherapy, has been used to reduce the symptoms of tinnitus [9].

2.1 Acupuncture

Complementary and alternative medicine is often used in the treatment of tinnitus, and acupuncture is one of used options [10]. Acupuncture is a method of treatment in which needles are inserted into the body and manipulated. Acupuncture (synonyms: reflexotherapy, sensory stimulation) is defined as the practice of inserting needles into the skin and underlying tissues at precise areas known as points. This is done for therapeutic or preventive purposes. Chinese texts from the first-century BC describe the treatment in systematic detail [11]. The treatment of tinnitus through acupuncture is documented in some books [12, 13]. However, there is still a lack in scientific literature of evidence to support the therapeutic efficacy of acupuncture. Studies have shown that needle stimulation creates an electric charge that has the potential of triggering a re-balancing of the system [14]. Chinese scalp acupuncture is a contemporary acupuncture technique that has been around for just 40 years. It combines traditional Chinese insertion methods with Western medical knowledge of the cerebral cortex. The treatment not only alleviates the signs of tinnitus [15, 16] but also has been proven to be a very effective technique in the treatment of various central nervous system disorders [4].

Studies show that acupuncture enhances tinnitus perception, decreases the intensity of the condition, and improves the quality of life of sufferers. Only a few studies report that acupuncture has a significant effect on the treatment of tinnitus, and these reported effects only provided brief respites of relief [4]. Some study participants demonstrated improvements in sleep quality, blood circulation, and muscle relaxation. After treatment with acupuncture, the subjects demonstrated reductions in the interference of the condition in their quality of life, easy masking by the environment, and forgetting the tinnitus in the presence of normal sounds during daily life more easily [6].

The Chinese scalp acupuncture technique, associated with bilateral electroacupuncture (EA), provided statistically significant improvements in decreasing the intensity level of the tinnitus and also improving a tinnitus patient's quality of life over the short term [6].

A few studies reported that acupuncture could provide immediate relief from both the loudness and discomfort of tinnitus and could thus enable a significant improvement in the patient's quality of life [4]. Other studies failed to demonstrate the efficacy of this approach [17].

Manual acupuncture, electroacupuncture (EA), scalp acupuncture, and ear acupuncture treatments will also be considered as part of the term “acupuncture.”

Consequently, in clinical applications, acupuncture treatment applied by experienced and licensed practitioners can be an option for patients with tinnitus. This is especially the case for patients who reject psychosocial behavior therapy, which is the only treatment of which there is clinical evidence of an improvement in the quality of life in tinnitus patients. Additionally, as acupuncture is a safe procedure and there is no current treatment with clinically evidenced efficacy for specific tinnitus symptoms, it is an option for treating tinnitus symptoms in patients who apply to clinics for this procedure [5].

2.2 Yoga

Certain mechanisms of subjective tinnitus are not known, and therefore various treatment modalities are useful in some patients, while they are not used in others. Feelings of depression, a poor quality of life, nervousness, hopelessness, and insomnia in patients are reported, and this situation may change depending on the severity and frequency of the condition. A relationship between tinnitus and the prefrontal cortex and limbic system should be stressed. This part of the brain is linked to emotions. Therefore, when tinnitus is severe, a connection can be made between depression, anxiety, and other psychological disorders [18].

Originating in India, yoga is an ancient and holistic system that includes physical postures (asanas), breathing exercises (pranayama), and meditation (shavasana and yoga nidra). Its name is derived from the Sanskrit word “Yuj,” which means to unite, to join, or to add. Yoga is now thought to be the science of existence. The aims of the practice are inner peace and the union of mind, body, and soul. In addition to Ashtanga, Hatha, Karma, Jnana (Gyana), Bhakti, and Kundalini, there are various forms of yoga that enable progress toward these aims. Each discipline is a specific branch of a comprehensive system. Yoga has been reported to decrease sympathetic hormones, stimulate the limbic system, and activate antagonistic neuromuscular systems. Meditation is a hypometabolic state that enables relaxation and reduces the stress caused by sympathetic overactivity. Yoga is reported to play an effective role in reducing stress and anxiety, supporting general health and improving the quality of life [19]. Yoga can reduce stress by certain poses relaxing the muscles of the body and allowing the control of autonomous nervous activity through deep breathing. During meditation, the individual begins a journey toward the inner self. Adopting certain postures allows the body to completely relax, and this helps achieve a higher state of body consciousness.

There are several studies about the therapeutic effects of yoga in cases of conditions such as anxiety, stress, depression, sleep disorders, and stress-related insomnia, as well as hypertension [20].

However, there are few studies in the literature which examine the effect of yoga on tinnitus. Of the studies that do exist, results have shown that yoga exercises performed once a week over 3 months do improve the symptoms of tinnitus. In various studies, yoga has been associated with low levels of stress and anxiety and a high quality of life [21, 22].

Consequently, the findings of studies assert that yoga therapy may play a role in reducing the symptoms of tinnitus [23].

2.3 Biofeedback-neurofeedback

2.3.1 Biofeedback

Biofeedback is a process of learning that influences the individual’s physiological processes and aims to provide the best improvements in health [24, 25]. Biofeedback

provides information regarding the current state of an individual's physiological process. This allows the individual to learn to appreciate their individual status. The purpose of biofeedback is to allow the individual more control or influence over the progression of that system [24, 25]. One of the unique characteristics of biofeedback is that the process establishes a connection between the individual's mind and body [24, 26]. Individuals are usually unaware of the status of their physiological systems.

However, through biofeedback, individuals are given the opportunity of learning how cognitive and emotional processes affect their physiological functions. When individuals realize that they are nervous, they then can influence this physiological system. For instance, during biofeedback, the instance of muscle strain might be used to help individuals recognize that they are nervous or stressed. Thanks to biofeedback, the individual who requests feedback has the opportunity of seeing the effect of relaxation techniques on muscle strains.

Being able to affect the progress of a physiological system is called "self-regulation" [25, 26]. Learning how to affect one's own physiological functions encourages the individuals to play a more active role in their own healthcare and maintaining a healthy life [24, 26].

Biofeedback is used in the treatment of medical and mental disorders such as anxiety, hypertension, and headache. Additionally, biofeedback is sometimes used as an adjuvant to drug therapy and alcohol treatment. Furthermore, biofeedback techniques are used to not only improve sports performance but also increase optimal functionality [24, 26]. Studies conducted by Sherma (2004) support the activity of biofeedback in many medical and mental disorders [25].

2.3.2 Neurofeedback

Tinnitus is a subjective auditory perception without any physical external source. While it is known that there is a correlation between tinnitus and cochlear damage, its neurophysiology is not currently known, despite the demonstration of some correlations [27]. Damaged hair cells in the cochlea may cause an absence of neurons in the auditory system and the rearrangement of cortical maps [28, 29]. Cortical neurons, which lack certain frequencies, might become more sensitive to close frequencies [30]. Because of this hypothesis, Dohrmann et al. used auto-activity models of the brain's non-auditory and noncellular regions for testing. They did this by using magnetoencephalography (MEG) and electroencephalography (EEG) in patients with chronic tinnitus [31]. They found that the reduced power within the delta interval (1.5–4 Hz) and the alpha frequency band (8–12 Hz) was most distinct in the brain's temporal region. They therefore referred to 8–12 Hz activity as tau activity [32].

Modification of the electrophysiological properties of brain activity may actually affect tinnitus. Neurofeedback has been shown to lead to such electrophysiological modifications [33]. Biofeedback-relaxation training has been assessed for chronic tinnitus [34], and a recent study reports significant improvements in tinnitus distress following a biofeedback-based behavioral treatment [35]. These results might be attributable to biofeedback treatment as electromyography (EMG) parameters remain stable for a period of 3 months [36]. Also, some authors used the relationship between stress, the reduced alpha band, and increased beta band in terms of neurofeedback [37, 38]. It was seen that neurofeedback again increased alpha rhythm and decreased beta rhythm in tinnitus patients.

Similar results were found also in a recent study [39]. A distinct decrease in alpha band (8–12 Hz) and a significant increase in gamma frequency (48–54 Hz), compared to controls, were seen in tinnitus patients [40].

According to a study, tinnitus-related problems in patients decreased following training and in the following months, despite a negligible increase in the tau/delta

ratio. It can be concluded that the effects of neurofeedback treatment on tinnitus are enabled by other factors such as placebo, distraction from tinnitus through neurofeedback, etc. However, contrary to the placebo hypothesis in this study, significant results were achieved with patients who received up to 6 months post-treatment, indicating that the results should decrease over time. Stable long-term results for both tinnitus disorder and tinnitus-related problems were also reported in a randomized controlled study of biofeedback-based behavioral treatment [35]. The authors reported improvements in self-efficacy and coping abilities. The effects of neurofeedback on tinnitus comorbidities are therefore seen to be important.

As suggested by Weise et al., a decrease in tinnitus discomfort may be associated with control and emotional control created by neurofeedback [35]. The positive effect of neurofeedback may also be related to the rearrangement of cortical maps [41].

2.4 Hypnotherapy

Hypnotherapy is an altered state of consciousness that allows the subconscious mind to be more open to selective and positive suggestion. It can be very effective in coping with the psychological aspects of tinnitus such as anger, stress, and anxiety.

Hypnotherapy is able to involve various techniques by helping patients feel more comfortable with noise. In order to process tinnitus sounds, the subconscious is able to use sounds produced through hypnosis to make tinnitus less threatening and easier to live with by directing the mind in the same way as background noise does.

By working with the mind (particularly with the part of the subconscious that stores memory, imagination, and behaviors), hypnotherapy may help train the brain and change patients' reactions to tinnitus. An improvement can be achieved in other healthcare problems related to tinnitus by changing the way the mind reacts to tinnitus sounds [42].

This therapy aims to create a deep state of relaxation while protecting normal mental activity. It also allows for better implementation of cognitive-behavioral therapy and some psychological techniques. Modern practice focuses on the studies of Milton Erickson [43], who, derived from many practical techniques, was a keen advocate of the superiority of indirect over direct suggestion. Its efficacy has been evidenced in a series of clinical cases for various conditions, ranging from irritable bowel syndrome [44] to preoperative anxiety [45]. Meta-analysis demonstrates enhanced results for cognitive-behavioral therapy when it is used as a supporting treatment [46].

Auditory cores of the midbrain receive a significant amount of afferents from high centers [47], and subjective experiences of sensory phenomena are modulated to produce striking effects that may cause changes in the levels of auditory cortex activity [48]. Also, as in all chronic disorders, personal perceptions of tinnitus by the affected patient have a strong influence on his/her life. In the light of these two ideas, it can be expected that tinnitus would be suitable for a psychological approach, and indeed, most hypnotherapists consider tinnitus as a treatable condition.

Using hypnosis in the management of tinnitus is not a new concept. Some techniques and case reports which have been debated for over 30 years were published in the literature 20 years ago. Despite hypnosis having quite a long history, few peer-reviewed studies have been conducted on the suitability of various techniques and even the validity of hypnosis as a management strategy. In cases where such a study is present, it is difficult to make a comparative evaluation as there is no standard agreed treatment method. While some individuals assert that tinnitus might be related to chronic pain and treated this way, others use time regression to take the patient back to a time before the onset of tinnitus. Other approaches are to emphasize a session-based approach or the use of self-hypnosis [49].

Hypnotic inner absorption involves concentration and focused attention. When the mind is engaged and focused in this way, it can lead to changes through the use of mind power. The use of hypnosis and self-hypnosis may allow people to gain more control over their behaviors, thoughts, emotional reactions, and even their physiological reactions and physical health.

One study shows that although tinnitus was not altered in 5 of 14 patients, hypnosis did lead to slight relief and reports of the noise being more bearable in the others. There was no improvement in tinnitus matching levels or visual analogue scales in one patient. In another study by Mason, there was no difference between two groups in terms of tinnitus loudness, tinnitus severity, linear analogue scale, and the need for further treatment. The main benefit of hypnotherapy is the fact that it can provide relief and sense of relaxation, making tinnitus more bearable [3].

2.5 Hyperbaric oxygen treatment

Tinnitus is the perception of sound in the absence of evident acoustic stimulation. There are traditional medical treatments for tinnitus; however, they have not proven to be satisfactory. As an alternative therapy, hyperbaric oxygen (HBO2) treatment may improve tinnitus, but benefits provided are not clear [50].

Hyperbaric oxygenation permits a controlled increase in the partial oxygen pressure of the blood. This technique can be used for tinnitus and sudden deafness, which has been caused by the development of a lack of oxygen in the inner ear and brain, and the resulting limited energy supply. Current results support the implementation of hyperbaric oxygen treatment as an alternative therapy when standard treatments fail. Some studies have reported an improvement of 60–65% in tinnitus with hyperbaric oxygen treatment. HBO treatment should be initiated at the earliest opportunity, particularly in tinnitus cases that are accompanied by a sudden loss in hearing. Treatment success in case of sudden deafness depends on the rapid application of HBO. HBO treatment extends the range of treatment possibilities for tinnitus and sudden deafness [51].

2.6 Homeopathy

Tinnitus is a common condition that lacks a practical and effective pharmacological treatment. When tinnitus cannot be overcome through traditional means, patients increasingly turn toward “alternative” or “complementary” drugs [52].

Through the use of a “satisfying dose” for treatment purposes, homeopathic principles may use large “homeopathic” doses of a substance that triggers a symptom in order to stimulate a physiological reaction against the symptoms, thereby eliminating the discomfort. Substances in “active” homeopathic (D60) tablets include pharmacological doses of tinnitogenic medicines such as sodium salicylate, ascaridole, conine, and quinine [3].

In a study, despite survey results showing the preference of homeopathic preparations over placebo in 14 of 28 subjects, a variance analysis showed that neither VAS scores nor audiological measurements could provide significant improvements in tinnitus symptoms as a response to tinnitus. It could not be shown that homeopathy was more effective than the equivalent placebo in the treatment of tinnitus [52].

In another work, results of a placebo-controlled randomized study were published. A study by Simpson on tinnitus disorder, awareness, loudness, and audiological measurements (narrow-band masking) did not show any difference between the groups treated with homeopathic preparations, including sodium salicylate, ascaridole, conine, and quinine and placebo [3].

2.7 Low-power laser

A low-power laser (LPL), with the power of around 1% of a surgical laser, has been reported to be able to accelerate the healing of injured peripheral nerves and soft tissues and to reduce inflammation and pain [53]. Many studies have revealed that the primary absorption area of LPL within a neuron was probably mitochondrion. When laser light is absorbed, protons are released from the mitochondrion to the cytoplasm. It is thought that protons suppress the permeability of sodium and potassium channels that decrease the frequency of nerve action potential. In animal experiments, the compound action potential of the eighth nerve was suppressed by the irradiation of LPL, through a round window directly to the cochlea [53]. The wavelengths used are between 810 and 890 nm within the interval of 40–60 mW. They are passed through the external auditory canal toward the cochlea.

Three studies have failed to demonstrate a significant response to low-power laser [54].

In a study conducted in 2002, active or placebo laser treatment was transmissionally applied for 6 minutes once a week to 68 ears in 45 patients with unilateral or bilateral tinnitus. Laser was applied four times for a period of 4 weeks. A survey was conducted to evaluate the loudness, duration, quality, and discomfort of tinnitus before and after irradiation. Loudness and pitch match were obtained for tinnitus, and auto-acoustic emissions were also examined. No significant difference was observed between active and placebo laser groups in terms of loudness, duration, quality, and the level of discomfort of tinnitus. One patient had acute hearing loss after the third irradiation of active laser treatment. In consequence, transmeatal low-power laser irradiation with 60 mW is not as effective in tinnitus treatment [54].

Another study was conducted to evaluate the efficacy of 5 mW laser irradiation in the treatment of chronic tinnitus, and 66 ears of 45 patients with chronic unilateral or bilateral tinnitus were treated in these studies. Transmeatal low-power (5 mW) laser irradiation was found to be beneficial in the treatment of chronic tinnitus [55]. Many other studies achieved the same results [56].

2.8 Ear canal magnets

According to Takeda, previous studies on the ionization fluctuation of the inner ear on the proteins and phospholipids of hair cell membranes have revealed a potential relationship between ion disorders and tinnitus [57]. Apparently, satisfactory outcomes were achieved with the use of rare-earth magnets in affecting ion disorders and in the treatment of tinnitus. However, it seems that references to these claims do not support them. Takeda's methods include placing a 4 mm diameter circular 1800 G samarium-cobalt magnet between two thin pieces of cotton and against a tympanic membrane 2 mm thick. An uncontrolled, prospective observational study conducted with 50 patients reported an improvement in the ears of 66% of tinnitus patients [57]. This study was not able to demonstrate any beneficial effect on tinnitus with the use of ear canal magnets. No improvement was seen in either minimum loudness match, minimal masking level changes, or subjective changes in tinnitus severity [3, 57]. In a double-blind study by Takeda on tinnitus treatment in 50 patients that involved the placement of rare-earth magnets, no evidence of significant benefits could be provided with this form of treatment [58].

2.9 Ultrasound

Using ultrasound for treating tinnitus was found inadvertently. A patient who underwent ultrasonic examination of the maxillary antrum claimed to have had

their tinnitus relieved during the process. Improvement is short term but repeatable. It is known that some types of ultrasound might alter cell morphology, biochemistry, or behavior through hydrodynamic shearing forces produced by characterization activity, or typically, by a significant increase in the temperature [59]. However, the exact mechanism which provides benefits for tinnitus is not known. In a study by Rendell et al., there was no significant difference in the loudness match of tinnitus, grading scales analysis, and the verbal reports of the placebo group and the group treated with ultrasound.

Another study by Carrick et al. demonstrated a distinctly more frequent sense of improvement in patients who have used active devices [3]. This study aimed to determine whether or not a low-dose ultrasound applied to mastoid bone provided subjective improvements in the tinnitus levels of long-term patients.

In another study, 40 patients volunteered to enroll in a double-blind study. They received 10-minute treatment with an ultrasound generator, and then the same placebo device, in two separate visits. Devices were separated randomly during the first visit. In every visit, the patients stated whether tinnitus was completely healed, slightly healed, did not change, or was made worse by the treatment. Forty percent of the patients who completed the study were healed through ultrasound, and 7% through placebo. Low-power ultrasound provided a greater improvement when compared to placebo [60].

2.10 Electromagnetic stimulation

The suppressive effect of electromagnetic stimulation on tinnitus was observed in patients with cochlear implants. Other studies have found a suppressive effect on tinnitus by using direct current stimulation of the cochlea. Stimulation via the round window membrane is the most effective method; however, the suppression lasts only throughout the current flow, and only anodal stimulation is effective. Risks of this treatment include tissue damage and surgery. The three studies conducted have not demonstrated significant benefits over electromagnetic stimulation. Another study by Roland revealed that the active device provided a significant improvement in the symptom score and tinnitus match, and a 9% improvement was seen in the placebo group when compared to 45% of patients treated with electromagnetic stimulation [61].

Results of another study conducted to determine whether or not pulsed electromagnetic stimulation on mastoid bone provided an improvement in tinnitus level of patients with long-standing tinnitus were reported. Fifty-eight patients volunteered for a double-blind, placebo-controlled study. Active and placebo devices were separated randomly in these patients' first visit. At the end of the 1-week treatment, each patient stated whether tinnitus was completely removed, healed, did not change, or was made worse by the treatment. Forty-five percent of the patients who completed the trial showed improvement with the active device. Furthermore, 9% of them reported improvement with the placebo. It is therefore thought that electromagnetic stimulation could be an effective treatment with some tinnitus patients [62].

2.11 Herbal practice

2.11.1 *Ginkgo biloba*

Ginkgo is a tree that grows in China. The first publication on the use of *Ginkgo biloba* leaves for medical purposes dates back to a 1505 AD text by Liu Wen-Tai called Ben Cao Pin Hue Jing Yaor. The text states that high-quality, standardized

extracts derived from the leaves of this tree improved cerebrovascular blood flow and were used to treat cerebral insufficiency, memory disorders, and tinnitus [3].

Ginkgo biloba extract helps minimize the damage induced by free radical accumulation in the cochlea, which is caused by a potent glutamate antagonist acting as a potent antagonist. EGB761 is the most common isolate of *Ginkgo biloba* that increases circulation in the body. It is beneficial for vascular insufficiency and cognitive function [63]. It has been recommended as a mechanism for the treatment of tinnitus by improving blood circulation to the Corti's organ [64]. In a rodent model, even minimal doses of EGB761 provided a statistically significant decrease in behavioral manifestation of tinnitus induced by sodium salicylate toxicity [65].

Reports such as these assert that *Ginkgo biloba*, one of the most ancient herbs, enables significant improvements in patients with tinnitus. Other contradictory studies have not defined any effect for tinnitus [66].

2.11.2 Zinc

Zinc is an important trace element present in all organs, tissues, fluids, and secretions of the body. It is distributed throughout the central nervous system, including the auditory pathway in synapses from the cochlea to the eighth cranial nerve [67]. Zinc is the fundamental component of Cu/Zn superoxide dismutase (SOD). It is important for the proper functioning of more than 300 enzymes, as well as the synthesis and stabilization of deoxyribonucleic acid (DNA), ribonucleic acid (RNA), and proteins. It also plays a structural role in the function of ribosomes and membranes. Otolaryngology-related studies were used to examine the effects of abnormal zinc levels as a cause of anosmia [68] and burning mouth syndrome [69]. Three potential mechanisms relating to tinnitus are linked to zinc [70]: Cochlear Cu/Zn SOD activity, synaptic transmission, and depression. The literature suggests that the prevalence rates of zinc deficiency are more suitable for elderly individuals and individuals with a tinnitus range from 2–69% [70, 71]. Even though not all studies have shown clinically significant results [72, 73], a limited number of studies point to the beneficial effects of zinc on tinnitus [67, 71, 74]. It is possible to improve the overall effect of treatment by classifying tinnitus patients through the measurement of their serum zinc levels.

2.11.3 Melatonin

Melatonin is a hormone produced at night by the pineal gland. Its main function appears to be regulating the sleep–wake cycle. However, not all effects of melatonin have been completely defined [75]. It is readily available as a nonprescription remedy and is widely used to help patients with sleep disorders. Many studies have examined whether or not its use can be connected with tinnitus. In a randomized, prospective, double-blind, placebo-controlled study conducted with 23 patients, melatonin was subjectively reported to be beneficial in tinnitus treatment. Greater benefits were observed with patients with sleep disorders. Other studies have revealed similar results [76–79].

2.11.4 Vitamin B12

There are some reports that show a relationship between vitamin B12 deficiency and auditory pathway disorders. In a study, it was observed that vitamin B12 replacement treatment provided an improvement in the tinnitus of some patients. It was also concluded that vitamin B12 serum levels should be monitored routinely while evaluating chronic tinnitus patients. A potential mechanism in a few cases

of severe vitamin B12 deficiency is increased cardiac output, arterial pressure, and anemia caused by vitamin B12 deficiency. This increased flow is perceived as a ringing in the ear. Vitamin B12 deficiency is a potentially treatable cause of pulsatile tinnitus. As another potential mechanism, vitamin B12 is required for the mutase activation of methylmalonyl coenzyme A, which is necessary for myelin synthesis [63]. In this way, cobalamin deficiency may lead to combined peripheral and central nervous system dysfunction.

2.11.5 Garlic

Connections have been made between garlic and some lipid-lowering effects. A few studies have revealed some potential effects of garlic in increasing fibrinolytic activity and lowering blood pressure [80]. It is believed that the main effects of garlic on tinnitus are due to its potential of improving blood flow to the cochlear artery by reducing plaque formation, stabilizing blood pressure, and increasing the antioxidant capacity of the blood. This effect is only theoretical, and there are therefore no scientific studies which examine the potential effects of garlic on tinnitus.

2.12 Herbal mixtures

The diversity and lack of standardization in terms of the preparation of herbal treatments' diversity make it almost impossible to come to a meaningful conclusion regarding their efficacy. No study has yet been conducted using scientific methodology, and so any claims about the benefits of herbal treatments are merely anecdotal.

2.12.1 Traditional Korean medicine and traditional Chinese medicine

The use of the herbal medicines *bojungikgitang* and *banhabaekchulchonmatang* in the treatment of tinnitus has its origins in the principles of traditional Korean medicine. Generally, tinnitus is thought to develop due to dysfunctional irregularities in the intestines and visceral organs. *Bojungikgitang* is used in the treatment of chi energy deficiency, and *banhabaekchulchonmatang* is used to treat gallbladder problems, which are thought to be associated with tinnitus. These two remedies are very common in Korea and have been approved by the Korea Food and Drug Administration as herbal medications in adults for the treatment of tinnitus.

Despite the lack of scientifically solid studies, there are anecdotal reports that suggest that traditional Chinese medicine is successful in relieving tinnitus. *Er Ming Fang* (EMF01) is a Chinese herbal mixture that contains various different herbs. Research studies have not demonstrated any benefits with salicylate-induced tinnitus in rats [81].

Yokukansan is an herbal medicine used in traditional Japanese medicine. It is thought to be an effective treatment for undifferentiated somatoform tinnitus [82].

2.13 Aromatherapy

Tinnitus patients are sometimes attracted to nontraditional or alternative treatments. However, there is no convincing evidence of the efficacy of any complementary therapy in the treatment of tinnitus [83]. However, considering the lack of traditional treatment options, and the placebo reaction which is observed with tinnitus, low-risk therapies such as aromatherapy should not be dismissed, and they are often sought by patients.

| NCCAM classifications | CAM therapies | |
|-------------------------------------|---|--|
| Alternative medical systems | Acupuncture | Acupuncture by experienced and licensed practitioners might be an option for tinnitus patients, which can help decrease the intensity of tinnitus and improve the quality of life for patients. This treatment tends to only be for the short term. Nonetheless, it remains a possible treatment for patients and is a relatively safe procedure for patients to consider |
| | Homeopathy | In homeopathy, through the use of a “satisfying dose” for treatment purposes, homeopathic principles may use large “homeopathic” doses of a substance that triggers a symptom in order to stimulate a physiological reaction against the symptoms, thereby eliminating the discomfort. This remedy may be beneficial to a person who has tinnitus with associated deafness |
| | Hyperbaric oxygen treatment | Hyperbaric oxygen (HBO) treatment as an alternative therapy when standard treatments fail. HBO treatment should be initiated at the earliest opportunity, particularly in tinnitus cases that are accompanied by a sudden loss in hearing. Treatment success in case of sudden deafness depends on the rapid application of HBO |
| Mind–body medicine | Yoga, hypnosis, biofeedback, neurofeedback, imagery | Mind–body medicines have been associated with low levels of stress and anxiety and a high quality of life. These therapies can be very effective in coping with the psychological aspects of tinnitus such as anger, stress, and anxiety. The main benefit of mind–body treatments is the fact that they can provide relief and sense of relaxation, making tinnitus more bearable |
| Biologically-based therapies | Dietary and herbal supplements Aromatherapy Chinese herbal medicine Chinese medicine Dietary medicine Clinical nutrition including multivitamins and minerals Western herbal medicine | The use of biologically based therapies to treat tinnitus is common, particularly with <i>Ginkgo biloba</i> , magnesium, melatonin, vitamin B12, and zinc. It is likely that some supplements will help with sleep for some patients. However, they are generally not effective, and many produced adverse effects. Dietary supplements could have a positive outcome on tinnitus reactions in some people. These therapies for chronic tinnitus may exert additional efficacy by improving psychological sensation of tinnitus and sleep quality. Future randomized controlled double-blind studies should be performed to elucidate its efficacy |
| Manipulative and body-based methods | Magnet/laser therapy | Application of magnets and ultrasound has been found to be placebo therapies for tinnitus or to have limited scientific supports for their effectiveness. Additional studies are needed |
| Energy therapies | Bioalan (Bioelectromagnetics) | Recent and ongoing research studies have attempted to assess whether transcranial magnetic stimulation could be an effective tinnitus treatment. This application is based on the thought that tinnitus is associated with an irregular activation of the temporoparietal cortex (a part of the brain) and thus that disturbing this irregular activation could result in transient reduction of tinnitus |

Table 1. The National Center for Complementary and Alternative Medicine (NCCAM) complementary and alternative treatments [87].

The basis of holistic and complementary treatments is primarily the fact that they reduce the symptoms of patients or minimize the discomfort associated with such symptoms. Aromatherapy, which is the most common alternative approach, requires a combination of essential oils and massage to reduce the symptoms of the disorder and make the patient feel better.

Aromatherapy uses frankincense, which dates back to ancient Babylon, and various oil groups (e.g., rowan, chamomile, frankincense, lavender, and mint) [84]. Hippocrates suggested that the way to health was to have aromatic baths and massages. It is known that virgin cedarwood oil was used for hygienic purposes 5000 years ago by the Egyptians [85]. Both the lavender plant and its essential oil were used by abbess Hildegard of Bingen at the beginning of the twelfth century. It is thought that the essential oils of turpentine, cinnamon, frankincense, juniper, rose, and sage were known and used in the fifteenth century [84].

According to the results of this study, it is considered that the majority of patients benefited from aromatherapy, while the benefits were shown to be non-specific rather than directly associated with tinnitus. Patients reported that the aromatherapy helped them to relax and that other somatic symptoms were eased.

Even though aromatherapy has a negative effect on being able to ignore tinnitus, relaxation was also seen to be advantageous in other studies on relaxation approaches [86].

A list of The National Center for Complementary and Alternative Medicine (NCCAM) complementary and alternative treatments can be found in **Table 1**.

3. Conclusion


Tinnitus does not have an established treatment as its pathophysiology has not been completely understood. Patients who cannot sufficiently benefit from medical treatments often try complementary and alternative treatments. In the studies conducted, it was demonstrated that such approaches provided benefits for some tinnitus patients. Through a holistic approach combined with medical know-how, patients can gain control over their problems, decrease, or even eliminate the effects of these problems. For that reason, the prevalence and acceptance of nontraditional approaches for tinnitus have increased among both patients and practitioners. Consequently, it is recommended that patients who cannot sufficiently benefit from medical treatments be referred to acknowledged experts for complementary and alternative treatments.

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