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# Alternative Medicine: A Recent Overview

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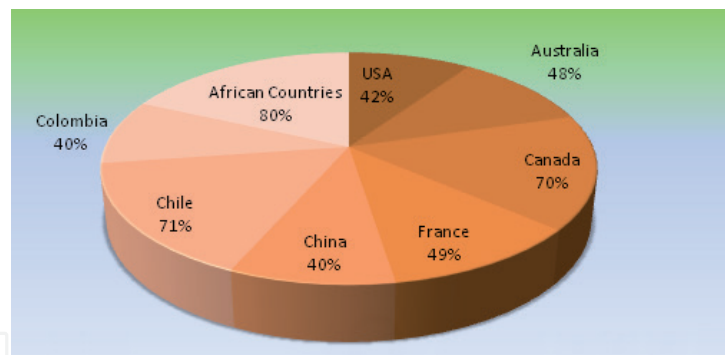
## Abstract

Alternative medicine has renewed its growing public interest in recent times due to inequality of patients and healthcare professionals' ratios with increased workload for the latter, various side effects of modern medicine, lack of complete remission from chronic diseases, high cost of new drugs, and emerging new diseases. Hence, people have become more dependent on treatment systems replying on alternative medicine or herbal medicine from traditional medicinal practitioners. Alternative medicine has grown substantially over time and encompasses several millennia of therapeutic systems. The significant areas of alternative medicine include mind–body therapies, body manipulation, and the therapies based on biological systems. Natural products based biological treatment is the most popular of them as nature has endowed us with abundance of effective pharmacologically active phytochemicals. These phytochemicals possess numerous specific clinical health benefits including antioxidant, antidiabetic, anti-inflammatory, anticancer, anti-infectious and analgesic effects. In addition, alternative medicine is easily accessible, affordable, most often noninvasive, and provides favorable benefits during terminal periods of some diseases. However, due to the lack of well-designed clinical trials, the safety and effectiveness of many alternative medicines/therapies remains elusive. This chapter will critically discuss major areas, uses, safety and regulation, current challenges & future perspectives of alternative medicine.

**Keywords:** alternative medicine, health benefit, safety & regulation, challenges & future perspective of AM

## 1. Introduction

Alternative medicine (AM) is a holistic approach recognized as a heterogeneous set of medicinal products and practices with potent healing effects. The practices remain as the most ancient yet traditions for treating different ailments continues [1, 2]. It is estimated that two-thirds of the world's population seek health care support and services from alternative sources over modern medicine. Recent statistics show that half of the global population are dependent on AM, including the USA 42%, Australia 48%, Canada 70%, and France 49% (**Figure 1**) [3, 4]. Despite current progress in modern medicine, the use of AM has been found to be radically focused on treatment of deadly pandemic diseases e.g., novel coronavirus disease 2019 (COVID 19) when there is no approved systematic targeted therapy yet [5].



**Figure 1.**  
*Utilization of alternative medicine up to 2019.*

The renewed public interest has revitalized due to the lack of curative treatment for several emerging and chronic diseases, high cost of modern drugs, time constrain from both patients and healthcare providers, microbial resistance and side effects of modern medicine [5, 6]. The most common treatments of AM are self-medication, traditional healing practices, indigenous systems of medicine particularly ayurveda, herbal preparations, yunani, homeopathy, acupuncture, naturopathy, chiropractic manipulation, etc. which have made AM more popular [1, 7]. In comparison, modern medicine focuses on symptom- related care, often utilizing pharmacological or invasive elimination procedures [8]. Although AM is not guaranteed to be safe, effective and biologically plausible [9], there is still a debate about which method can be proven as useful and secure. Old records encourage alternative modes whereas comprehensive clinical trials support conventional modes based on modern approaches [10]. However, today, many physicians accept the benefits of all forms of medicine, incorporating effective complementary and modern approaches in terms of patients, symptoms, and circumstances [11].

This scenario has necessitated development of knowledge bridge among physicians, traditional practitioners, pharmacist, and patients about AM treatments, safety use, and toxicity or contraindications. In addition, advancement of research efforts, minimizing publication bias, protecting intellectual property rights, and policymaker's contribution are required to make decisions about the future of alternative medical practice to provide cost-effective treatments. This would strengthen the position of AM industry and increase public acceptance in future [12, 13]. This chapter primarily discusses the different areas of AM, its uses, safety and regulation, current challenges and future perspectives.

## 2. Areas of AM

The National Center for Complementary and Alternative Medicine (NCCAM) has characterized the complementary and alternative medicine (CAM) as a community of various medical practices, methods and products currently excluded from modern medicine [14]. NCCAM has also categorized AM branches into five main groups: (1) traditional medical techniques, such as whole medical systems; (2) mind–body therapy; (3) biological substance-based treatment; (4) manipulative and body-based treatment; and (5) energy medicine [15].

### 2.1 Whole medical systems

A whole medical system is a complete system of theory and practice works independently or along with modern medicine. The methods contain various groups of

therapies or treatments that are practiced in diverse communities across the globe. Indian ayurveda and traditional Chinese medicine (TCM) are mainly practiced in the Eastern part of the world while homeopathy and naturopathy are predominantly used in the western region [16].

### *2.1.1 Ayurvedic medicine*

Ayurveda is an extensive medical system that contemplates the body, mind, and soul essential to maintain the individual's wellbeing. Its fundamental purpose is to maintain good health instead of struggling against the illness. Various ayurvedic herbs or medicinal plants like turmeric, ashwagandha, amla, black cumin, rhubarb root, triphala, and kumanjam have medicinal properties for treatment of various diseases or health complications like cardiovascular conditions, cancer, neurological disorders, and diabetes [17, 18]. To determine the efficacy of the ayurvedic therapies, appropriate research with rigorous investigation is required [19].

### *2.1.2 Traditional Chinese medicine*

Traditional Chinese medicine (TCM) originated thousands of years ago from ancient China and has flourished over time. Japan, Korea, and Vietnam have also developed similar systems for treatment of ailments [20]. TCM consists of several different techniques such as acupuncture, moxibustion, Chinese herbal medicines, nutrition, t'ai chi, qi gong and massage. However, the most frequent therapies are Chinese herbal medicine, t'ai chi and acupuncture [21].

#### *2.1.2.1 Chinese herbal medicine*

Chinese herbal medicine restores the balance of the whole body and equilibrates the forces of qi, yin and yang, which are basic elements of human body. Qi describes as a vital force energy which is carried throughout the body via meridians. Yin shows slow, cold and passive strength, where yang shows excited, hot, and active strength [22]. Chinese herbal formulas are known to have an advantage with regard to body regulation [23]. Several herbs tonify qi to treat patients with qi deficiency syndrome; some herbs promote yin to treat patients with yin deficiency syndrome and some reduce phlegm to treat patients with Phlegm syndrome. The medications related to Chinese herbal medicine are given in different ways like powders, tablets, and teas. Botanical extracts or plants are typically familiar to treat different diseases such as Chinese herbal medicine is often used as defensive care and improves health by stimulating an immune response before diseases arise [24].

#### *2.1.2.2 Acupuncture*

Acupuncture is a form of AM originated in China more than 2000 years ago. It is commonly used to alleviate pain or stress by inserting hair-thin needles through the skin at specific points on the body. Traditional Chinese medicine explains acupuncture as a technique for balancing the flow of energy or life force followed the principle of Yin and Yang. Acupuncture practitioners believe the human body has more than 2,000 acupuncture points connected by 12 pathways or meridians that interact with various organs such as heart, liver and kidneys [25]. Along these meridians, the energy flow rebalances by inserting the needles into specific points. In our contemporary lifestyle, numerous physical challenges arise due to the lack of proper physical activity, unbalanced food habits and lifestyle. Acupuncture has numerous positive effects against metabolic diseases, inflammation, digestive

issues, respiratory and nervous system problems [26]. In addition, releasing neurotransmitters and hormones also regulates neurochemistry, thus influencing the sensing and cognitive functions.

### *2.1.2.3 T'ai Chi*

T'ai Chi is another type of AM of traditional Chinese medicine initiated during the 13th century in China. It is a movement technique that facilitates recovery through breathing and gradual movements of the body. The advantages of t'ai chi are improved mobility and balance, and reduced tension and anxieties [27]. It has been found to improve the quality of life, particularly those who are suffering from chronic diseases [28]. Many controlled and uncontrolled trials showed the effects of t'ai chi on various health conditions and diseases such as cardiovascular disorders [29], diabetes, osteoarthritis [30], anxiety, insomnia, functional mobility and fall prevention [31, 32]. The benefits of t'ai chi are generally most significant before developing a chronic illness or functional limitations. Tai chi is very safe, and no costly equipment is needed for the practice.

### *2.1.3 Naturopathy*

Naturopathy is an integrating division of AM by combining traditional practices and health care approaches, and became popular in Europe during the 19th century. This medication system provides a unique way of treating patients, which maintains the homeostatic principle of the body, identifies the source as well as treats the diseases. Although many other allopathic or holistic therapy fields offer specific therapies to specific conditions, naturopathic practitioners tend to employ the self-healing process by maintaining healthier lifestyles, diet and nutrition [33]. Popular naturopathic therapies include physical treatments (light therapy, ultrasound and electric currents), dietary supplements, homeopathy, medical counseling, hormone therapy and personalized treatment modalities to relieve mental and emotional stress [34, 35].

### *2.1.4 Homeopathy*

Homeopathy is another type of AM system discovered in the 19th century. Homeopathy comes from the Greek word in which homoios means 'similar' and pathos indicates 'suffering'. Homeopathic drugs treat diseases by triggering the body's natural defenses instead of fighting against them. The underlying principle of homeopathy is "like cures like". In other words, when a substance is capable of inducing a series of symptoms in a healthy living system, low doses of the same substance can cure these symptoms under certain circumstances ('similia similibus curentur') [36]. Hahnemann stated that treatments for a specific disorder could cause undesirable effects identical for the disease itself to stimulate a homeostatic or complementary reaction to correct these disorders [37]. This medicine industry solely depends on a "minimum dose law," in which dosage concentrations are inversely related to the active potency. Many homeopathic medicines contain active substances overly diluted and minimal amounts of active substances throughout the resulting dosages.

## **2.2 Mind–body therapy**

Mind can control physical and biological processes, and the mind–body modality regulates the connections between mind, body, spirit, and attitude.

Many of the treatments involved in the mind and body's stimulation aim to maintain sound health and heal diseases. Mind–body therapies include relaxation, meditation, yoga, breathing hypnotherapy, cognitive behavioral therapy, and visualization. Music, movement, and dance therapy have shown to have beneficial roles for patients with anxiety [38, 39], while hypnosis, acupuncture, and music therapy serve as a successful therapy for depression and anxiety in cancer patients [40].

### **2.3 Biology-based therapy**

Natural and biological-based practices refer to the substances made from nature or living things, such as herbs, special dietary and orthomolecular substances to improve, control, and regulate human health. Among these, herbal preparations, are the most common variety of CAM in the United States [9]. The mechanism of this therapy is to stimulate the immune system of the body and help to fight against cancer, infection, and other diseases. Common supplements used for biology-based therapy are botanicals, nutritional supplements, such as vitamins and minerals, probiotics, prebiotics, fatty acids, proteins, amino acids, and functional foods [41].

### **2.4 Manipulative and body-based therapy**

Manipulative and body-based practices rely on structures and systems of the body, such as bones and joints, the soft tissues and the circulatory as well as lymphatic systems. It is one of integral tools of alternative medicine in which body can regulate and heal itself [35]. Various manipulative and body-based techniques are currently used – such as massage (normalizes the soft tissues), reflexology, cranio-sacral therapy, chiropractic (affiliated between spinal structure and role), rolfing, and osteopathic manipulation [42]. These therapies are thought to stimulate the body's energy and enables toxins to leave the body.

### **2.5 Energy therapy**

Energy therapies are based on the belief that vital life energy flows through the body. The goal of energy therapy is to restore energy balance in the body by unblocking flow of energy. The ancient Chinese healing traditions, energy therapies were well-established as a technique for easing pain, reducing anxiety, and mitigating side effects of cancer treatment. Energy therapies focus either on energy field originating into the body (biofields) or from other sources (electromagnetic fields). There are different energy medicine techniques, including hands up and down and remote therapies [43]. Biofield therapy aims to trigger the energy that covers and penetrates the body and has not been experimentally proven to exist. Certain types of energy treatment control biofields by putting pressure or controlling the body by bringing the hands in or through therapies touch [44]. Different ancient Chinese arts like qigong, which put together subtle physical action, deeper breath, and mental intensity, regulate the human body. The approach integrates body and soul efficiently and productively [45]. Another type of energy therapy denoted as bioelectromagnetic therapy is based on an electromagnetic field used to treat or prevent diseases, and promote health and longevity. It may be given singly or in combination with many other methods. This therapy involves different magnetic fields, pulsed fields, direct or altered electric sources to treat many kinds of ailments like asthma, cancer and migraine pain [46].

### 3. Uses of AM in different ailments

Alternative medicine became much popular over the past several decades. The use of this medicine has always been commonly seen among Chinese and other Asian patients in the countries such as Korea, Taiwan, Singapore, India and Hong Kong. A number of AM has been often used to manage some chronic diseases namely diabetes, cancer, cardiovascular diseases (CVD), asthma, menopause, rehabilitation, autism spectrum disorder etc. [47–53]. Patient characteristics, socio-demographic status, and gender are the predominant determinants of AM use. The following describes the multiple uses of AM in different fields.

#### 3.1 Control of blood glucose

Diabetes mellitus (DM) is the most prevalent and chronic metabolic disorder. The worldwide prevalence of diabetes has risen approximately from 4.7% to 8.5% over the last 34 years [54]. To control blood glucose levels, numerous modern antidiabetic drugs have been discovered and introduced in the market. However, most of the drugs may have some drawbacks when it is used for long time, such as drug resistance, drug addiction, adverse side effects and so on [55]. In addition, the therapeutic expenditures and dissatisfaction with mainstream have prompted the search for alternatives [47]. Intriguingly, the treatment strategies of diabetes is in favor of alternative practices. Along with conventional drugs, diabetes patients are treated by diet and exercise [56]. Therefore, it has drawn much attention as the effects of AM particularly herbal medicine has been found effective in diabetes prevention, management and/or delay its complications.

The alternative treatment of diabetes is mainly accomplished by non-pharmacological ways including diet therapy, relaxation, kinesitherapy, acupuncture therapy, psychotherapy, hydrotherapy, yoga etc. [57]. Natural Health Products (NHP) based therapy including vitamins and minerals, herbal remedies, homeopathic medicines, traditional medicines, such as traditional Chinese medicines, probiotics, and other products like amino acids and essential fatty acids are also commonly used for the effective management of diabetes [47, 58]. All are used in both type 1 and type 2 diabetes and found to improve diabetic condition significantly, or even, it can revert from prediabetes to normal stage [59, 62]. For example, the traditional Chinese medicine Shenzhu Tiaopi granule (SZTP) decreased the conversion rate of 8.52% from impaired glucose tolerance (IGT) to type 2 diabetes and 15.28% from with placebo, and normalized blood glucose from patients with IGT [59]. NHP have also been shown to improve diabetes complications by reducing 0.5% glycated hemoglobin within 3 months [47]. The following products are used in the treatment, and prevention of diabetes and its complications:

- Ayurveda polyherbal formulation, *Citrullus colocynthis*, *Coccinia cordifolia*, Eicosapentaenoic acid, *Ganoderma lucidum*, Ginger (*Zingiber officinale*), *Gynostemma pentaphyllum*, *Hintonia latiflora*, lichen genus *Cladonia* BAFS “Yagel-Detox”, marine collagen peptides, soybean extract etc. are used for T2DM management [60]
- Traditional Chinese medicine herbs are also used for DM treatment like, fructus mume, gegenqinlian decoction (GQD), jianyutangtang (JYTK) with metformin, jinlida with metformin, sancaijiangtang, shen-qi-formula (SQF) with insulin, tang-min-ling-wan (TM81), xiaoke (contains glyburide), zishentongluo (ZSTL) and *Trigonella foenum-graecum* (fenu-greek) [61]

- A few products, such as vitamin D, vitamin E, L-carnitine, cinnamon, gymnema, green tea, fibre, bitter melon, momordica, chromium, and vanadium have been the subjects of special interest in diabetes [62].
- *Panax ginseng* and *P. quiquefolius* (ginseng) play significant role in controlling diabetes by altering hepatic glucose metabolism, however, evidence of its clinical use in patients with diabetes is scarce [63]

For decreasing stress-related hyperglycemia, mind–body medicine, such as yoga, reflexology, chiropractic or osteopathic manipulation, homeopathy, shiatsu, registered massage therapy or craniosacral therapy have been shown short term significant benefits in clinical use, however, specific mind–body interventions and long-term improvements in glycemic control have not been found in larger randomized controlled trials (RCTs) [64].

### 3.2 Management of inflammation

The body naturally responds to various stresses including infection, irradiation, chemical, or physical injury [65]. Short term inflammation protects the body, while long term inflammatory response in the body damages healthy cells, tissues, and organs leading to the development of some diseases, such as arthritis, alzheimer's disease, and even cancer [65, 66]. The common treatment option for inflammatory diseases have been limited to nonsteroidal anti-inflammatory (NSAIDs) medications such as COX-2 inhibitors or steroid hormones (e.g., corticosteroids). Although most of the NSAIDs are considered to be safe however, it may aggravate other diseases such as stomach ulcer, hemorrhage, liver or kidney impairments for long term use [67]. The National Kidney Foundation reported that in each year, approximately 10% of kidney failures are directly associated with the substantial overuse of NSAIDs [68]. AM has been used for hundreds and even thousands of years in the management of chronic inflammation through antioxidative alternative medicine-based therapies, mainly diet- and natural products based therapies [69]. Strong scientific evidence supports the use of some products such as omega-3 essential fatty acids (EFAs) ( $\omega$ -3) as an alternative and/or complementary agent to NSAIDs [70]. Capsaicin, oil of camphor, is commonly being used for muscle soreness and it has also local application for painful traumatic injuries [68]. Epidemiological studies and associated meta-analyses strongly suggest that long term consumption of diets rich in plant polyphenols (red and blueberries, green and black tea) protects the body from cancers, cardiovascular diseases, diabetes, osteoporosis and neurodegenerative diseases [71, 72].

Other alternative practices namely exercise, mind–body treatments like t'ai chi, qigong, yoga, meditations, massage, acupuncture, and moxibustion may decrease pain intensity by reducing circulatory concentrations of proinflammatory cytokines like IL-6, IL-18, C-reactive protein and other circulatory inflammatory cytokines like IL-1 $\alpha$ , and TNF- $\alpha$ , through controlling the expression of these proinflammatory and inflammatory marker genes [73, 74].

Music therapy plays an important role in alleviating pain of various etiology. A systematic review of 42 RCTs documented the effect of music therapy on relieving preoperative anxiety and stress as well as postoperative pain in cardiac surgery [75]. A Cochrane database of systemic review of 51 studies concluded that listening to music reduced pain intensity and opioids requirements [76]. Thus, the above findings strongly support the importance of different alternative approaches to pain and inflammation management, and better understanding on the mechanism and function associated with AM may provide new insights to treat inflammatory diseases.



### 3.3 Asthma treatment

Asthma is a common, multifactorial respiratory disease with chronic inflammation of the respiratory system affecting more than 300 million people world-wide and 25 million people in the United States, including 1 in 10 US children (10%) [77]. Common symptoms of asthma include: wheeze, cough, shortness of breath, and chest tightness. Despite advancement of modern medicine and its treatment modalities, many people are turning to alternative medicine as an another option for treating respiratory diseases.

Several types of alternative medicine are used in asthma treatment such as herbs and supplements, yoga, relaxation therapy, and biofeedback [50, 78]. Herbal products and dietary supplements have been used for thousands of years to treat lung problems. Ethnobotanical Survey in Nigeria found 87 local medicinal plant species from 39 families and these plant species are being used for treating cough associated respiratory diseases [79]. Whole plants, leaf, roots, fruit etc. are preferentially used to combat the diseases [9]. Korean ginseng root extract has potential role for treating lung inflammatory disorders. Some Chinese herbs, like ding-chan tang, may decrease inflammation and relieve bronchospasm [80]. The fruits of *Momordica charantia* L. are commonly used for cold, cough, tuberculosis, and asthma [81]. Again, caffeine is a natural and mild bronchodilator, which can improve airway function in people with asthma. Further, supplements like magnesium and fish oil (omega-3 fatty acids), vitamin C, D, and E may reduce inflammation and alleviate asthma symptoms. Moreover, both breathing exercises in yoga and massage therapy can control breathing and relieve stress [50, 82]. Although much of the research is currently under investigation or found to elicit significant improvements of the diseased conditions yet some findings indicate that many natural and over-the-counter products have potential side effects.

### 3.4 Management of cancer

The most common modern treatment modalities for cancer are surgery with radiation and/or chemotherapy, and immunotherapy. However, these therapies possess severe side effects including fatigue, skin problems, hair loss and low blood count [83]. Thus, many cancer patients and health care practitioners prefer AM as a potential therapeutic management [84]. AM may provide numerous health benefits by managing disease symptoms, preventing illness, or improving immune function [85]. The widely accepted and safe alternative practices are acupuncture, aromatherapy, massage therapy, exercise, hypnosis, meditation, music therapy, relaxation techniques, tai chi and yoga [86].

The uses of AM vary among different cancers. The highest uses of AM are found in breast cancer patients (93%), followed by colorectal cancer (83%), prostate cancer (77%), and lung cancer (77%). Each of the 4 cancer types, dietary supplements were the prominent alternative modality (52% to 82%), followed by energy medicine (39% to 55%), mind-body medicine (16% to 52%), and body-based therapy (14% to 42%) [87–88]. Although AM is not powerful enough to replace modern medicine, it may be used parallelly with modern medicine for better management in cancer patients. The following alternative practices are commonly used in different symptoms related care

- Hypnosis, massage, meditation, prayer, relaxation techniques are predominantly used to relief patients from anxiety [89]
- Exercise, message, relaxation techniques and yoga reduce fatigue and improve quality of life in cancer patients [90]

- Acupuncture, aromatherapy, hypnosis and music therapy prevent nausea as well as vomiting
- Acupuncture, aromatherapy, hypnosis, massage and music therapy are helpful in relieving pain [84, 86]
- Exercise, prayer, relaxation techniques and yoga may help cancer patients to sleep better [86, 91].

There are also some alternative modalities used in cancer patient's treatment, which are outlined as

- Dietary treatments including gerson, ketogenic, peskin, budwig, alkaline, paleo, vitamins and minerals, and herbalism [92].
- Biologic products-based therapy including different kinds of tea (e.g., green, medicinal, chaga mushroom, Essiac), natural health products such as ginger, curcumin, flaxseed oil; and miscellaneous products like pancreatic enzyme therapy, medicinal cannabis, laetrile B17, and probiotic foods and supplements [48].
- Energy therapies based on therapeutic touch and reiki, which use surrounding subtle known energy field and penetrate the human body [93]
- Alternative medical systems that are mainly traditional Chinese medicine, Indian medicine, homeopathy, chiropractic etc. used in different cancers [23, 48].
- Improvements in physical and psychosocial well-being and increasing hope to the cancer patients e.g., osteopathy, and Aboriginal medicine.
- Certain natural products (taxol, vinca alkaloids) are also much famous [94].

### **3.5 Management of blood pressure and CVD**

CVDs are the leading cause of deaths all over the world. The recent advances in modern western medicine have been made available for treating CVDs, however, the complications and disease recurrence still occur, which compromise quality of life. Noticeably, AM has drawn great attention to treat such chronic CVDs for long term benefits by relieving symptoms, rehabilitation, and even in preventing these diseases.

Many of the natural products can act more directly on cardiovascular homeostasis by improving lipid profiles and vascular reactivity, and reducing the undesirable immune response [95, 96]. Diet should be regarded as a cornerstone of preventive medicine and, at least in part, as a viable treatment for blood pressure (BP), CVD and other chronic diseases [49]. Certain dietary supplements like fish oil, multivitamins, and coenzyme Q10 are considered the best preventive medications [97].

Beyond dietary strategies, certain additional non-pharmacological treatments have been shown to lower BP. These alternative approaches can be broadly classified into three categories: behavioral therapies, including meditation, yoga, biofeedback, and relaxation or stress-reduction programs; noninvasive procedures or devices, including device-guided breathing modulation and acupuncture; and

exercise-based regimens, including aerobic, resistance, and isometric exercise methods [98].

Traditional medicine methods, including acupuncture, electroacupuncture, and transcutaneous electrical acupoint stimulation, have been increasingly adopted by health-care professionals despite the lack of evidence on its effects on CVDs [99].

Medicinal herbs namely *Allium sativum*, *Ginseng*, *Aesculus hippocastanum*, *Ginkgo biloba*, *Salvia miltiorrhiza* have been used in patients with atherosclerosis, hyperlipidemia, systolic hypertension, cerebral and venous insufficiency, angina pectoris, and congestive heart failure [100–102]. In fact, numerous bioactive compounds present in the herbs can prevent vascular smooth muscle cell phenotypic switching, endothelial dysfunction, platelet activation, lipid peroxidation, ROS production, and macrophage atherogenicity, and thus, it may have the ability to modulate the CVD incidence [49, 103]. However, the role of these herbs in CVDs still needs more clinical evidence and elucidation of definite mechanism of actions.

A Cochrane database of systematic review of 23 RCT's concluded that listening to music has beneficial effects on BP, heart rate and respiratory rate, and also on anxiety and pain in persons with coronary heart disease [104].

Therefore, alternative medicine use in patients with CVDs seems to be common, however, a more patient-physician communication about the use of AMs and evidence-based research are required.

### 3.6 Alternative medicine for management of anxiety or sleep disorders

Anxiety disorders are the most common psychiatric disorder, with an estimated lifetime prevalence is 29% in the general population [105]. The high prevalence and complex comorbidity of anxiety or sleeping problems such as insomnia makes a concern particularly in elder people because it affects physical and mental health, and worse the quality of life by relating with significant clinical implications in obesity, diabetes, hypertension, cardiovascular and neurological diseases [106]. It is well documented that treatment of anxiety or insomnia may provide positive effects, not only by alleviating comorbidity but also by preventing new incidents.

Insomnia patients can be treated by alternative therapies namely herbs, supplements, relaxation and meditation, acupuncture, and exercise. Among these therapies, biologically-based products such as herbal or nutritional medicine, and mind-body therapies, are the most commonly used interventions. For instance, herbal supplements particularly Valerian root and Chamomile may help to fall asleep faster and boost the quality of sleep however, more research is needed for the safety and efficacy [107]. Melatonin is the key natural hormone in the sleep-wake cycle produced by the pineal gland, regulates numerous biological functions including circadian rhythm, sleep, stress response, aging, and immunity [108]. Aromatherapy with lavender (*Lavandula angustifolia*) increases serum melatonin levels as evident from nonrandomized clinical trials on older adults [109]. Furthermore, acupuncture, relaxation and meditation, and regular exercise may improve sleep quality, sleep onset latency, total sleep time, and insomnia severity [110–112]. Lately, high levels of anxiety, fear, depression, panic, emotional outburst and sleep disturbances has been observed in COVID-19 positive patient, particularly from isolation and quarantine events [113]. Some sedatives and antianxiety drugs are used to manage these symptoms however, it may inhibit the respiratory system and worsen the condition [114]. Evidence suggests that progressive muscle relaxation technique can reduce anxiety and improve sleep quality in patients with COVID-19 beyond the side effects [115].

Music has a powerful effect on our emotions, therapy such as mind–body medicine has a direct influence in antianxiety effect. Listening to music may have an immediate positive impact on stress-related physiological, cognitive, and emotional processes [116]. It enhances parasympathetic activity, increase physiological coherence, reduce the cortisol ratio, and boost immunity. A systematic review of 23 studies on physiological parameters, the anxiolytic effect of music therapy is proved in all the studies [117]. Moreover, it has been shown that music can increase comfort, decrease anxiety thereby can improve sleep disorder [118]. Hence, healthy and safe alternative practices may at least in part, replace the strong anti-anxiety medications thereby improving the quality of life in these patients.

### **3.7 Treatment of menopause**

Hormone therapy is one of the most effective treatment for managing symptoms of menopause. However, many women need to avoid hormone therapy due to health risks from stroke, heart attack and cancer. In these cases, AM is preferred for symptom management [51].

There are various alternative interventions for the treatment of menopause. They fall into two main categories: a) mind–body practices that combines mental focus, controlled breathing, and body movements resulting in relaxation of body and mind. It has significant health benefits by reducing pain, stress, anxiety, and mood. Some common mind–body practices are meditation, hypnosis, cognitive behavioral therapy, biofeedback, yoga, and tai chi, and b) natural products-based intervention by using herbs, vitamins, minerals, and dietary supplements [51, 119]. Apart from these categories, some interventions based on system-wide AM have been commonly used such as traditional Chinese medicine, reflexology, acupuncture, and homeopathy [120]. Several studies indicate that mind–body practices such as hypnotherapy, meditation, relaxation etc. are beneficial in reducing problematic menopausal symptoms [119, 121]. Therefore, AM may improve the quality of life particularly, the women who are transitioning to menopause. Finally, though natural products, such as herbs, vitamins, minerals etc. are commonly used for remedy of symptoms related menopause, consistent evidence to support their safety and efficacy still remains elusive [122].

### **3.8 Management of rehabilitation**

Patients in rehabilitation of musculoskeletal conditions often use alternative medicine treatments. Commonly used treatments including massage therapy, acupuncture, manipulation medicine, yoga and pilates, mind–body medicine, effleurage, petrissage, friction, tapotement, and vibration [52, 123, 124].

Massage therapy is one of the most commonly used therapies for athletes to enhance recovery and performance, particularly postexercise [123]. The benefits from therapeutic massage are enormous such as relieve of muscle tension and stiffness, healing of strains and sprains; reduce muscle pain, swelling and spasm; improve flexibility and motion, enhance blood flow and so on [125, 126].

### **3.9 Treatment of autism spectrum disorder**

Autism spectrum disorder (ASD) is a heterogeneous group of neurodevelopmental conditions, which is characterized by impaired social interactions and communications, restricted, repetitive, and stereotyped patterns of behavior and interests [127]. It is assumed that both genetic and environmental factors play a key role in ASD etiology, but no clear pathogenesis has been identified yet [128]. Although autism is a lifelong disorder and there is no causal treatment currently

known, AM may stand as an therapeutic option for alleviating symptoms of patients with autism spectrum disorder.

Biologically based therapy including dietary supplement (vitamins and minerals), and herbal medication (meadowsweet, calendula, chamomile, marshmallow root and lemon balm etc.) can be used for treating ASD. In addition, mind–body medicine (i.e., prayer, yoga, music, dance, and art in general), manipulative and body-based practices (i.e., massage, chiropractic care, and acupuncture), and energy medicine (i.e., reiki or homeopathy) are useful for treating ASD [129]. Music therapy may have strong impact in autistic children. Cochrane meta-analysis showed that listening music significantly improved the cooperation and communication ability in autistic children [130]. Another study remarked that music therapy might provide a basic and supportive therapy for children with delayed speech development [131].

Though some trials demonstrated the importance of chosen alternative therapies (e.g., equine therapy) and have gained attention by the scientific community, there is insufficient evidence to assess the safety and efficacy of AM [9, 132]. Therefore, combination of standard medical therapies along with safe alternative approaches like diet, exercise and lifestyle modification might benefit patients from functional disorder like autism.

### 3.10 Prevention or treatment of COVID-19

COVID-19 is considered as a life-threatening disease, which is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [133]. To date, it has been accounted as a global public health emergency and declared as a pandemic by World Health Organization (WHO) as there is no specific antiviral treatment available in the modern medicine system [5, 19]. Although several attempts have been initiated after the disease onset, truly effective vaccine is still unavailable [134, 135]. A few vaccines exist in the market but the safety and efficacy need further scrutiny using multi-site clinical data [134]. Under this circumstance, a more rational phytotherapeutic choice to the disease may be a cheaper option for prophylaxis or treatment against this virus [136]. Strikingly, the phytochemicals of *Momordica charantia* L. and *Azadirachta indica* have been recently shown adequate inhibitory potential against SARS-CoV-2 when compared with FDA reference drugs such as ribavirin, remdesivir and hydroxychloroquine [137]. In China itself, the total number of confirmed cases treated by TCM has reached 60,107 [138]. Indian government ministry of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) recommended homeopathy and ayurveda for prophylaxis and unani medicines for symptomatic management of COVID-19 [139, 140]. In Bangladesh, herbal and fruit extracts have been used to get relief from COVID-19. Infected people are advised to drink masala tea, ginger tea, and lemon with hot water for recovery [141].

It has been shown that Chinese, Indian and Iranian herbal medicine with 1000 years' experience in the prevention of pandemic and endemic infectious diseases are worth learning, and provide alternative candidates for controlling patients with COVID-19 infection [19, 142]. As there are no effective treatments for COVID-19, it provides one of the biggest opportunities to test different plants and discover new targeted bioactive compounds for therapeutic management of this disease.

## 4. Safety and regulatory issue of AM

Though approximately 80% ailing people in developing countries rely on AM as a source of primary healthcare or traditional medical practice [143], there is limited scientific evidence regarding the potential toxicity of a variety of AM [9].

In fact, most of the AM are untested and the safety and efficacy are either poorly or not even monitored at all [144]. Moreover, doctors and nurses are not trained enough to describe the potential side effects and contraindications to their patients [145]. Again, not all health professionals favor the concept of integrative health approaches, neither do they have the confidence in dealing with CAM due to lack of knowledge on standardization of practices and overall benefits of holistic approaches. In contrast, most of the patients who use CAM are hesitant to inform their primary health care provider about the methods for fear of disapproval [145]. Further more, biological substances are not tested rigorously to ensure their safety and efficacy in the context of pharmaceutical products because FDA approval is not mandatory in case of a new therapeutic component [146]. Manufacturer only need to attest as a dietary supplement's safety, purity, and contents by expressing on the label before marketing. However, some medicinal plants might be inherently toxic. Herbal products may also cause adverse side effects including hypersensitivity reactions, cardiovascular events, neurologic dysfunction, hepatic and renal failures, and the development of malignant disease due to the presence of mercury, lead, arsenic, corticosteroids and poisonous organic substances [147, 148]. Adverse events may also arise from the lack of knowledge by selecting wrong species of medicinal plants, incorrect dosing, interactions with other drugs and error in the use of herbal medicines [144]. For example, the herb arnica, black seed and feverfew stimulate uterine contractions and possible miscarriage in pregnant women [149, 150]. In addition, ginkgo *Ginkgo biloba* and chamomile (*Matricaria chamomilla*) may increase the risk of bleeding in patients taking nonsteroidal anti-inflammatory drugs like aspirin, and anticoagulant-warfarin. Even many forms of AM are rejected by orthodox medicine as the safety and efficacy of the drugs have not been confirmed in clinical trials [144].

The regulation on AM varies widely from country to country because each country has their own regulations policy. In most countries, the AM market is poorly regulated, and the medical products are often neither registered nor controlled [151]. However, relatively few countries have developed policies and regulations on TM/AM. Among the 194 Member States of WHO, only 98 countries have a national policy on TM/AM, and 109 countries regulate herbal products. The WHO African and South-East Asian countries (>80%) have the highest percentage of national or state level laws and regulations for traditional and AM whereas, European (40%) and American (43%) region have the lowest percentage [152]. In the United States, TM/AM legislation is the responsibility of state, provinces or territorial jurisdictions, and regulation varies from jurisdiction to jurisdiction.

In the United Kingdom (UK), there is no regulation that restricts the practice of AM except of chiropractic and osteopathy. However, now the UK Government has gradually acknowledged the need for extensive regulation of AM. Chiropractic and osteopathy have adopted statutory self-regulation, though this has proved expensive for individual members of these professions. A recent House of Lords has recommended that the herbal medicine and acupuncture professions should also develop a system of statutory regulation. Some occupations, such as aromatherapists, are in the process of forming a common professional body as a first step towards self-regulation [153].

Hence, it would be helpful to increase training opportunities for health care professionals and share information to their patients about potential interactions of AM with modern treatments. Finally, the knowledge of the usage, safety and efficacy of AM as well as the evolution of awareness may increase the ability of health care providers to follow the legislation.

## **5. The current marketplace of AM**

The global demand for AMs was reported at USD 69.2 billion in 2019 and is rising every day. Different energy healing therapy comprises reflexology, reiki, and havening techniques are increasingly used in anxiety and mental disorder patients in different countries. Nowadays, many magnetic therapies such as bioflex magnets, mattresses, and magnabloc for pain reduction are used. Other alternative therapies like yoga, meditation, and spa have been well attributed globally due to their popularity, which led to development in the number of yoga studios, meditation centers, spas, and complementary healing facilities institutes in the particular communities [154–156]. Moreover, some alternative medicine services are now offered as benefits in state Medicaid programs, Medicare, and private health insurance plans [157, 158]. Study shows that at least 50% American medical schools are currently offering courses in alternative medicine to their medical students. Among which 25.0% of the courses referenced personal growth or self-care through alternative practices, while only 11.0% referenced inter-professional education activities involve interaction with alternative medicine providers [159]. In the promotion of CAM, a governmental initiative can play a crucial role. In India “Ministry of Ayush” has been set up by national authorities to govern research, development, increased funding opportunities, education, and other facilities pertaining to ayurveda, yoga, naturopathy, and homeopathy [154]. Therefore, the expensive existence of mainstream treatment and governmental facilities devoted to alternative therapies may encourage companies to invest in alternative medicine markets.

## **6. Major challenges for AM**

Alternative treatment has improved our awareness and centered our view of medical treatment, but it still faces tremendous challenges. After two eras of robust efforts by the NCCAM at the National Institute of Health (NIH) on behalf of AM research, it remains an extreme challenge for scientists to analyze thousands of years’ worth of clinical research issues to demonstrate the safety as well as efficacy of AM [160]. The complex and complicated, multivariate and multifaceted factors of AM systems require continual innovations for comprehensive and well-designed studies. The control trends of existing biomedicine restrict alternative treatment research, which must be expanded and extended [161]. The exploration and eventual discovery of plausible scientific mechanisms, theoretical and historical investigations are essential to further and fully understand the holistic role of alternative medicine and claim it within the realm of modern medicine [162]. In many cases, alternative therapies are commonly documented as false cases due to proper public awareness [124, 146]. Many modern medical practitioners and physicians are reluctant to discuss the importance of new effective AM with patients. A study showed 89% of patients were self-referred to an alternative practitioner and 72% did not inform to their physicians about their AM use [163]. In addition, alternative treatments defy the scientific procedures in terms of objectivity, measurement, codification, and classification because it comprises physical and spiritual realms, that cannot be subjected to scientific analysis [154]. So, it is essential to generate important insights into comparative clinical efficacy trials to improve patients’ treatments, especially for long-term results.

## **7. Conclusion**

AM has been practiced in numerous countries before the advent of modern medical science but its usage is not supported by the medical community due to lack

of evidence-based safety and effectiveness evaluation. Despite the promising results reported with various natural and biologic products, the clinical efficacy of such alternative therapies is yet to be determined. More than half of the world's population does not have access to modern medicine where most funding for healthcare in the developing world goes to 20% of the population and it can certainly be presumed that healthcare costs will be expected to double over the next decade. Low-cost intervention, such as lifestyle modifications, diet, supplement therapy and behavioral medication, can be used as a replacement for prescribed high-cost medications and technological innovation. More research of AM treatments in humans are needed to elucidate whether alternative treatments can have beneficial effects when they are used alone or have additional benefit while used with modern treatment methods. As a result, its usage requires exploration and eventual discovery of plausible scientific mechanisms, theoretical and historical investigations, continual innovations, comprehensive and well-designed studies in order to validate, advance and fully understand the holistic roles of AM and position it appropriately within the context of modern medicine. It is imperative that medical practitioners and physicians need to be aware about potential alternative therapies and discuss benefits and potential adverse effects or limitations with patients. With concerted efforts involving different relevant stakeholders including medical and research councils in different countries, systematic approaches could be developed and incorporation of standardized procedures, awareness of validated, authenticated and easily accessible scientific resources can substantially improve the current scenario of AM and meet the increasing healthcare needs of global population.

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## **Conflict of interests**

The authors declare that they have no conflict of interests.



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