

Nature-Based and Naturopathic Interventions for Human Health and Well-Being: Current Evidence and Future Prospects

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Abstract

The growing global burden of chronic diseases, mental health disorders, and lifestyle-related illnesses has intensified interest in preventive and holistic healthcare approaches. Nature-based interventions (NBIs) and naturopathic medicine have emerged as promising complementary strategies that promote health by integrating natural environments, lifestyle modification, nutrition, herbal medicine, physical activity, and mind-body practices. Increasing scientific evidence suggests that regular exposure to natural environments, including forests, parks, gardens, and blue spaces, improves physical, psychological, and social well-being through multiple biological mechanisms involving stress reduction, immune enhancement, autonomic nervous system regulation, anti-inflammatory responses, and improved metabolic function. Naturopathic therapies such as clinical nutrition, phytotherapy, hydrotherapy, yoga, meditation, exercise, and lifestyle counseling further contribute to disease prevention and management by addressing the underlying determinants of health rather than merely alleviating symptoms. This review summarizes current evidence regarding the effectiveness of nature-based and naturopathic interventions across major health conditions, including cardiovascular diseases, diabetes mellitus, obesity, cancer supportive care, respiratory disorders, musculoskeletal diseases, and mental health disorders. The review also discusses the biological mechanisms underlying these interventions, highlights recent clinical evidence, examines current challenges associated with standardization and scientific validation, and explores emerging opportunities involving precision medicine, artificial intelligence, digital health technologies, microbiome research, and personalized naturopathic care. Integrating evidence-based nature-based therapies into conventional healthcare systems offers a sustainable, patient-centered approach that may improve population health while reducing healthcare costs. Continued interdisciplinary research, standardized clinical protocols, and large multicenter trials are essential to strengthen the scientific foundation of these interventions and facilitate their broader implementation in modern healthcare.

Keywords: Nature-based interventions, Naturopathy, Integrative medicine, Lifestyle medicine, Herbal medicine, Forest bathing, Preventive healthcare.

1. Introduction

The prevalence of chronic non-communicable diseases (NCDs) has increased dramatically over recent decades, becoming the leading cause of mortality and disability worldwide. Cardiovascular diseases, diabetes mellitus, obesity, cancer, chronic respiratory diseases, musculoskeletal disorders, and mental health conditions collectively account for a substantial proportion of global healthcare expenditures and reduced quality of life. Rapid urbanization, environmental degradation, sedentary lifestyles, unhealthy dietary habits, psychological stress, and reduced interaction with natural environments have further accelerated the incidence of these conditions. Consequently, healthcare systems are increasingly shifting from disease-centered treatment toward preventive, personalized, and holistic models that emphasize health promotion and long-term well-being.

Nature has always played a central role in maintaining human health [1]. For thousands of years, traditional medical systems such as Ayurveda, Traditional Chinese Medicine, Unani medicine, and indigenous healing practices have recognized the therapeutic value of medicinal plants, clean air, sunlight, water, and natural environments. Modern scientific research has increasingly validated many of these traditional observations by demonstrating that exposure to natural environments produces measurable physiological and psychological benefits. This has led to the development of the concept of nature-based interventions (NBIs), which refers to structured activities or therapeutic approaches involving direct interaction with natural environments to improve health and well-being [2].

Nature-based interventions encompass a broad spectrum of practices, including forest bathing (Shinrin-yoku), green exercise, horticultural therapy, wilderness therapy, blue-space exposure, ecotherapy, and animal-assisted interventions. These approaches utilize forests, parks, gardens, rivers, coastal environments, and other natural ecosystems as therapeutic settings. Numerous epidemiological studies indicate that individuals who spend more time in green spaces experience lower rates of cardiovascular disease, depression, anxiety, obesity, hypertension, and premature mortality. Contact with nature has also been associated with improved cognitive function, enhanced immune responses, reduced stress hormone levels, better sleep quality, and increased social interaction [3]. Parallel to the growing interest in nature-based therapies, naturopathic medicine has emerged as an increasingly recognized system of complementary healthcare. Naturopathy integrates evidence-informed natural therapies, including clinical nutrition, botanical medicine, hydrotherapy, physical medicine, lifestyle counseling, yoga, meditation, and stress management. Unlike conventional medicine, which often focuses primarily on disease treatment, naturopathic medicine emphasizes prevention, restoration of physiological balance, and support of the body's intrinsic healing capacity. The six internationally recognized principles of naturopathy—healing power of nature, identifying the root cause of illness, first do no harm, treating the whole person, physician as teacher, and disease prevention—provide a comprehensive framework for patient-centered healthcare.

The biological mechanisms underlying nature-based and naturopathic interventions are becoming increasingly well understood. Exposure to natural environments has been shown to reduce activation of the hypothalamic-pituitary-adrenal (HPA) axis, decrease circulating cortisol concentrations, enhance parasympathetic nervous system activity, improve heart rate variability, reduce systemic inflammation, and stimulate natural killer (NK) cell activity. Similarly, plant-derived phytochemicals, balanced nutrition, regular physical activity, mindfulness practices, and adequate sleep collectively regulate oxidative stress, immune function, endocrine signaling, and metabolic homeostasis [4]. These multidimensional mechanisms explain why holistic interventions frequently benefit multiple chronic diseases simultaneously rather than targeting a single pathological process.

Increasing evidence from randomized controlled trials, cohort studies, systematic reviews, and meta-analyses has strengthened the scientific credibility of many naturopathic interventions. Clinical nutrition has demonstrated substantial benefits in diabetes management, cardiovascular disease prevention, obesity reduction, and gastrointestinal health. Herbal medicines containing polyphenols, flavonoids, alkaloids, terpenoids, and other bioactive compounds exhibit antioxidant, anti-inflammatory, antimicrobial, immunomodulatory, and metabolic regulatory activities.

Likewise, yoga, meditation, breathing exercises, and structured physical activity have consistently shown effectiveness in reducing blood pressure, improving glycemic control, alleviating anxiety and depression, enhancing sleep quality, and improving overall quality of life. Despite these advances, challenges remain regarding standardization of treatment protocols, quality control of herbal products, variability in study designs, and the integration of naturopathic approaches into mainstream healthcare. Differences in practitioner training, regulatory frameworks, and healthcare policies further contribute to inconsistencies in clinical practice across countries. Consequently, continued research involving large-scale randomized clinical trials, standardized outcome measures, mechanistic investigations, and long-term follow-up studies is necessary to strengthen the evidence base. Recent technological developments also present exciting opportunities for the future of naturopathic medicine. Artificial intelligence, wearable biosensors, telemedicine, microbiome profiling, nutrigenomics, metabolomics, and precision medicine are enabling increasingly personalized healthcare interventions [5]. Digital health platforms can support individualized nutrition planning, physical activity monitoring, stress management, and continuous health assessment, while microbiome-based therapies and genomic profiling may allow practitioners to tailor interventions according to each individual's biological characteristics. Given the growing burden of chronic diseases and increasing demand for preventive healthcare, nature-based and naturopathic interventions have significant potential to complement conventional medicine. The integrating ecological health, lifestyle modification, behavioral medicine, and evidence-based natural therapies, these approaches contribute not only to disease prevention but also to the promotion of lifelong physical, psychological, and social well-being.

4. Naturopathic Therapies for Human Health

Naturopathic medicine encompasses a broad range of evidence-based natural therapies designed to support the body's intrinsic healing mechanisms while addressing the root causes of disease. These therapies are increasingly integrated into preventive healthcare and chronic disease management because of their emphasis on individualized treatment, minimal adverse effects, and long-term health promotion. Modern naturopathic practice combines traditional healing principles with contemporary scientific evidence to improve physical, mental, and emotional well-being.

4.1 Clinical Nutrition

Nutrition is considered the cornerstone of naturopathic medicine. A balanced diet provides essential macronutrients, micronutrients, dietary fiber, and phytochemicals that regulate metabolism, immune function, and cellular repair. Nutritional interventions focus on increasing the consumption of whole grains, fruits, vegetables, legumes, nuts, seeds, and healthy fats while reducing processed foods, refined sugars, and saturated fats.

Numerous clinical studies have demonstrated that dietary modification significantly reduces the risk of obesity, cardiovascular diseases, hypertension, type 2 diabetes, metabolic syndrome, and certain cancers [6]. Diets rich in antioxidants, polyphenols, flavonoids, carotenoids, and omega-3 fatty acids reduce oxidative stress and chronic inflammation, which are recognized as major contributors to non-communicable diseases. Personalized nutritional counseling is therefore an integral component of naturopathic treatment plans.

4.2 Herbal Medicine (Phytotherapy)

Herbal medicine is one of the oldest forms of healthcare and remains a fundamental component of naturopathic practice. Medicinal plants contain numerous bioactive compounds, including alkaloids, flavonoids, phenolic acids, terpenoids, glycosides, tannins, and essential oils, which exhibit antioxidant, anti-inflammatory, antimicrobial, antiviral, immunomodulatory, hepatoprotective, and anticancer properties [7]. Common medicinal herbs such as *Curcuma longa* (turmeric), *Withania somnifera* (ashwagandha), *Zingiber officinale* (ginger), *Ocimum tenuiflorum* (holy basil), *Camellia sinensis* (green tea), *Panax ginseng*, and *Aloe vera* have demonstrated therapeutic potential in numerous experimental and clinical studies. Herbal medicines are widely used for improving immune function, reducing inflammation, regulating blood glucose, supporting cardiovascular health, and alleviating stress-related disorders.

Despite their therapeutic potential, herbal medicines require appropriate standardization, quality control, and evidence-based dosage recommendations to ensure efficacy and safety.

4.3 Hydrotherapy

Hydrotherapy involves the therapeutic use of water at different temperatures and forms, including hot water, cold water, steam, whirlpools, compresses, and immersion baths. Water therapy improves blood circulation, relieves muscle tension, reduces joint pain, promotes relaxation, and enhances recovery from physical fatigue [8]. Cold-water therapy reduces inflammation and swelling following injury, whereas warm-water therapy promotes vasodilation, muscle relaxation, and improved tissue oxygenation. Alternating hot and cold water applications may stimulate circulation and improve autonomic nervous system regulation. Hydrotherapy has shown benefits in patients with arthritis, chronic pain, musculoskeletal disorders, sports injuries, and stress-related conditions.

4.4 Yoga and Physical Activity

Yoga integrates physical postures (asanas), breathing techniques (pranayama), meditation, and relaxation practices to promote harmony between body and mind. Regular yoga practice improves flexibility, muscular strength, balance, respiratory efficiency, cardiovascular fitness, and mental well-being.

Scientific evidence indicates that yoga significantly reduces stress hormones, improves autonomic nervous system balance, lowers blood pressure, enhances insulin sensitivity, and decreases symptoms of anxiety and depression. Physical activity further contributes to weight management, improved lipid metabolism, enhanced cardiovascular function, stronger bones, and better cognitive performance. Naturopathic practitioners encourage moderate aerobic exercise and resistance training tailored to individual health status and physical capacity.

4.5 Mindfulness and Meditation

Psychological stress is a major risk factor for numerous chronic diseases. Meditation and mindfulness-based interventions help regulate emotional responses by improving attention, self-awareness, and cognitive control. These practices reduce activation of the hypothalamic-pituitary-adrenal axis, resulting in lower cortisol secretion and improved parasympathetic nervous system activity [9]. Regular meditation has been associated with reductions in anxiety, depression, insomnia, hypertension, chronic pain, and burnout. Neuroimaging studies have demonstrated structural and functional changes in brain regions involved in emotional regulation, memory, and executive function following long-term meditation practice.

4.6 Sleep Hygiene

Adequate sleep is essential for maintaining metabolic, endocrine, neurological, and immune functions. Chronic sleep deprivation increases the risk of obesity, diabetes, cardiovascular disease, depression, and impaired cognitive performance. Naturopathic medicine emphasizes healthy sleep hygiene through consistent sleep schedules, reduced evening exposure to electronic devices, relaxation techniques, regular physical activity, and dietary modifications. Natural approaches such as herbal teas, aromatherapy, breathing exercises, and mindfulness meditation are commonly recommended to improve sleep quality without dependence on pharmacological agents.

4.7 Stress Management and Lifestyle Counseling

Lifestyle counseling represents one of the most valuable aspects of naturopathic medicine. Practitioners work closely with patients to identify unhealthy behaviors, environmental exposures, occupational stress, and psychosocial factors contributing to disease development. Individualized counseling promotes healthier dietary habits, smoking cessation, reduced alcohol consumption, regular exercise, adequate hydration, and effective stress management [10]. Behavioral interventions improve treatment adherence and empower individuals to actively participate in maintaining their health. Long-term lifestyle modification has consistently demonstrated greater sustainability than short-term therapeutic interventions alone.

Table 1: Major Naturopathic Therapies and Their Health Benefits

Therapy	Primary Mechanism	Major Health Benefits
Clinical nutrition	Improves metabolism and reduces inflammation	Diabetes, obesity, cardiovascular health
Herbal medicine	Antioxidant, anti-inflammatory, immunomodulatory	Chronic diseases, immune support
Hydrotherapy	Improves circulation and muscle relaxation	Pain relief, rehabilitation
Yoga	Neuroendocrine regulation and flexibility	Stress reduction, cardiovascular health
Meditation	Cortisol reduction and autonomic balance	Anxiety, depression, sleep disorders
Physical activity	Improved metabolism and cardiovascular function	Weight management, diabetes prevention
Sleep hygiene	Hormonal and immune regulation	Mental health, metabolic health
Lifestyle counseling	Behavioral modification	Long-term disease prevention

Table 2: Clinical Applications of Nature-Based and Naturopathic Interventions

Health Condition	Nature-Based/Naturopathic Intervention	Reported Clinical Benefits
Cardiovascular diseases	Mediterranean-style diet, yoga, meditation, walking in green spaces	Reduced blood pressure, improved lipid profile, enhanced cardiovascular function
Type 2 diabetes	Dietary modification, physical activity, herbal medicine, stress management	Improved insulin sensitivity, better glycemic control, reduced HbA1c
Obesity	Lifestyle counseling, outdoor exercise, calorie-controlled diet	Weight reduction, improved metabolism, decreased body fat
Hypertension	Yoga, breathing exercises, meditation, low-sodium diet	Reduced systolic and diastolic blood pressure
Mental health disorders	Forest bathing, mindfulness, gardening, yoga	Reduced anxiety, depression, stress, and improved emotional well-being
Musculoskeletal disorders	Hydrotherapy, stretching exercises, therapeutic massage	Reduced pain, improved mobility and muscle function
Cancer supportive care	Nutritional therapy, yoga, meditation, herbal supplements (medical supervision)	Improved quality of life, reduced fatigue and psychological distress
Respiratory disorders	Breathing exercises, physical activity, clean natural environments	Improved pulmonary function and respiratory efficiency

5. Biological Mechanisms Underlying Nature-Based and Naturopathic Interventions

The beneficial effects of nature-based and naturopathic therapies result from complex interactions involving physiological, biochemical, neurological, immunological, and psychological pathways. Rather than targeting a single organ system, these interventions simultaneously influence multiple biological mechanisms that contribute to improved overall health.

5.1 Regulation of Stress Response

One of the most consistently reported benefits of nature exposure and naturopathic therapies is the reduction of physiological stress. Chronic activation of the hypothalamic-pituitary-adrenal (HPA) axis increases circulating cortisol, adrenaline, and inflammatory mediators, contributing to hypertension, insulin resistance, immune dysfunction, and depression. Exposure to forests, meditation, yoga, and breathing exercises significantly decreases cortisol concentrations while increasing parasympathetic nervous system activity. These changes promote relaxation, improve emotional resilience, and reduce cardiovascular risk.

5.2 Enhancement of Immune Function

Nature exposure enhances immune surveillance by increasing both the number and activity of natural killer (NK) cells, which play an essential role in eliminating virus-infected and malignant cells. Forest-derived phytoncides released by trees have been shown to stimulate immune cell activity and improve resistance against infectious diseases. Several medicinal plants further enhance immune responses by modulating cytokine production, macrophage activation, and antioxidant defense systems.

5.3 Reduction of Oxidative Stress

Oxidative stress occurs when reactive oxygen species exceed the body's antioxidant capacity, leading to cellular damage, aging, and chronic disease.

Fruits, vegetables, herbs, and medicinal plants contain abundant antioxidants such as vitamin C, vitamin E, carotenoids, flavonoids, and polyphenols that neutralize free radicals and protect cellular components [10]. Regular consumption of antioxidant-rich foods, combined with physical activity and stress reduction, helps maintain redox balance and reduces inflammation.

5.4 Anti-inflammatory Activity

Persistent low-grade inflammation is recognized as a common feature of obesity, diabetes, cardiovascular disease, neurodegenerative disorders, and cancer. Numerous naturopathic therapies suppress inflammatory mediators such as tumor necrosis factor-alpha (TNF- α), interleukin-6 (IL-6), cyclooxygenase-2 (COX-2), and nuclear factor-kappa B (NF- κ B).

This anti-inflammatory effect contributes significantly to disease prevention and improved long-term health outcomes.

5.5 Gut Microbiome Modulation

Emerging research indicates that dietary interventions and plant-derived phytochemicals positively influence gut microbial diversity. A healthy gut microbiome improves digestion, nutrient absorption, immune regulation, neurotransmitter synthesis, and metabolic homeostasis. Diets rich in dietary fiber, fermented foods, and prebiotics promote beneficial microbial populations associated with reduced inflammation and improved overall health [11].

The multiple biological pathways influenced by nature-based and naturopathic interventions explain their broad therapeutic potential across diverse chronic diseases, supporting their integration into evidence-based preventive and integrative healthcare.

6. Clinical Applications of Nature-Based and Naturopathic Interventions

Nature-based and naturopathic interventions have demonstrated considerable potential in the prevention and management of a wide range of chronic diseases. In cardiovascular diseases, dietary modification, regular physical activity, yoga, meditation, and exposure to green environments contribute to reductions in blood pressure, serum cholesterol, and systemic inflammation while improving endothelial function and cardiac health. Regular walking in parks or forests has been associated with improved heart rate variability and reduced cardiovascular risk. In patients with type 2 diabetes mellitus, naturopathic approaches emphasize low-glycemic diets, weight management, stress reduction, and increased physical activity [12]. These interventions improve insulin sensitivity, glycemic control, and lipid metabolism. Medicinal plants such as *Gymnema sylvestre*, *Momordica charantia*, *Trigonella foenum-graecum*, and *Cinnamomum verum* have shown promising antidiabetic properties in both experimental and clinical studies.

Nature-based therapies are also beneficial for obesity management. Green exercise, outdoor recreational activities, and lifestyle counseling encourage sustained physical activity while reducing psychological stress associated with weight gain. Nutritional interventions focusing on whole grains, fruits, vegetables, legumes, and healthy fats further support weight reduction and metabolic health. Mental health disorders, including anxiety, depression, and stress-related illnesses, are among the conditions most responsive to nature-based interventions. Forest bathing, gardening, meditation, yoga, and ecotherapy reduce cortisol secretion, improve emotional resilience, enhance mood, and promote cognitive restoration [13]. These interventions are increasingly incorporated into mental healthcare programs because they offer safe, low-cost, and sustainable therapeutic options. Supportive cancer care has also benefited from naturopathic approaches. Nutritional support, yoga, mindfulness, herbal supplements under medical supervision, and moderate physical activity help reduce treatment-related fatigue, improve sleep quality, decrease anxiety, and enhance quality of life among cancer patients. Although these therapies do not replace conventional oncological treatment, they may serve as valuable complementary interventions. Nature-based therapies also improve respiratory health by encouraging physical activity in cleaner outdoor environments, enhancing lung function, and reducing stress-related respiratory symptoms. Likewise, hydrotherapy, yoga, stretching exercises, and anti-inflammatory dietary interventions have demonstrated benefits in managing musculoskeletal disorders such as osteoarthritis, chronic back pain, and rheumatoid arthritis, evidence increasingly supports integrating naturopathic and nature-based therapies into preventive healthcare and chronic disease management as complementary approaches that improve overall physical and psychological well-being.

7. Current Challenges and Future Prospects

Despite encouraging scientific evidence, several challenges limit the widespread acceptance and implementation of nature-based and naturopathic interventions. One major limitation is the variability in study design, treatment duration, intervention protocols, and outcome measurements across clinical studies. Many investigations involve relatively small sample sizes and short follow-up periods, making it difficult to establish standardized clinical recommendations. Quality control remains another important concern, particularly regarding herbal medicines. Variations in plant species, geographical origin, harvesting conditions, extraction methods, and storage significantly influence phytochemical composition and therapeutic efficacy. Standardization of herbal formulations and rigorous quality assurance are therefore essential for ensuring reproducibility and patient safety. Regulatory frameworks governing naturopathic medicine differ considerably among countries. While several nations have established professional licensing systems and educational standards, others lack formal regulation, resulting in inconsistencies in practitioner qualifications and clinical practice. Greater international collaboration is required to develop standardized educational curricula, clinical guidelines, and evidence-based treatment protocols. Future research should focus on large multicenter randomized controlled trials, long-term safety evaluations, dose optimization studies, and mechanistic investigations to strengthen the scientific evidence supporting naturopathic therapies. Advances in molecular biology, metabolomics, nutrigenomics, microbiome science, and systems biology will provide deeper insights into the mechanisms underlying natural therapies. Artificial intelligence and digital health technologies are expected to transform naturopathic healthcare by enabling personalized nutrition planning, remote patient monitoring, wearable health tracking, and predictive disease prevention strategies. Integration of genomic information with lifestyle interventions may facilitate precision naturopathy, allowing treatments to be tailored according to individual genetic and metabolic profiles. Growing public awareness regarding preventive healthcare, sustainability, and environmental conservation further supports the future integration of nature-based interventions into public health policies. Programs encouraging green prescriptions, urban green spaces, therapeutic gardens, and community wellness initiatives have the potential to reduce healthcare costs while improving population health.

8. Conclusion

Nature-based and naturopathic interventions represent an important component of modern integrative healthcare by emphasizing prevention, lifestyle modification, and the body's inherent capacity for healing. Accumulating scientific evidence demonstrates that therapies such as clinical nutrition, herbal medicine, yoga, meditation, hydrotherapy, forest bathing, horticultural therapy, and green exercise positively influence cardiovascular health,

metabolic function, immune regulation, mental well-being, and overall quality of life. These interventions exert their therapeutic effects through multiple biological pathways, including stress reduction, antioxidant activity, anti-inflammatory mechanisms, improved autonomic regulation, and modulation of the gut microbiome. Although considerable progress has been made in validating these approaches, further high-quality clinical trials, standardized treatment protocols, and long-term safety assessments remain necessary to strengthen the evidence base. Future developments in precision medicine, artificial intelligence, digital healthcare, and personalized nutrition are expected to further enhance the effectiveness and clinical integration of naturopathic therapies. As healthcare increasingly shifts toward preventive and patient-centered models, nature-based and naturopathic interventions are likely to play an expanding role in improving human health, promoting resilience, and supporting sustainable healthcare systems worldwide.

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