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SYSTEMATIC REVIEW

New Perspectives in Psychopathology and Psychological Well-being by Using Forest Therapy: A Systematic Review

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Abstract:

Background:

Forest therapy is the clinical application of Shinrin-Yoku, also known as forest bathing. Specifically, the term *Shinrin-Yoku* refers to what is known as "a bath in the air of the forest", which is carried out by walking and observing the landscapes of nature. In recent years, ecopsychology has become increasingly interested in the use of forest therapy as a credible, eco-sustainable, and easily adaptable treatment. The idea is to borrow the typical techniques of mindfulness and apply them to environmental contexts to verify if this leads to a better physical and mental well-being of the individual. Given the few contexts in which forest therapy is applied, this article aims to investigate, through a review of available literature, the applications of forest therapy existing in various severe or mild disorders in order to understand if this technique can represent a credible alternative to traditional treatments, and consequently arouse the interest of future experimental research in different contexts.

Methods:

A systematic review was conducted using the PRISMA 2020 guidelines that allowed us to identify n = 7 unique papers to be included in our analysis.

Results:

Forest therapy has been shown to be an effective treatment for improving a range of psychological and physiological parameters in college students, the elderly, women with postmenopausal insomnia, patients with alcoholism syndrome, patients with post-traumatic stress disorder (PTSD), patients with chronic widespread pain, and psychiatric patients.

Conclusion:

The analyzed studies are not yet able to tell us if forest therapy is better than traditional treatments. However, the effectiveness demonstrated in the studies provides empirical evidence of the credibility of forest therapy and leads to new scenarios for more eco-sustainable, versatile, affordable, and adaptable therapies according to the needs of the patients.

Keywords: Forest therapy, Shinrin-Yoku, Mental health, Ecopsychology, Mindfulness, Forest bathing.

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1. INTRODUCTION

Ecopsychology was introduced in California in the early nineties, starting from the observation of the existence of a correlation between the growing individual and social existential distress and the increase in environmental degradation, the latter parallel to the rapid urbanization process that has radically modified the lifestyles and habits of the world population. The goal of ecopsychology is to combine ecology and psychology, promoting human awareness of being deeply connected to the Earth. Individuals who live and interact in green spaces report being more energetic, in overall good health, and having more of a sense of meaningful purpose in life [1]. Ecopsychologists remain cautious in attributing specific pathologies to environmental degradation or in arguing that known disorders, such as depression, are due solely to environmental causes. Rather, what they propose is a new clinical approach based on the idea that, in today's era of

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ecological crisis, psychological help requires more than what current therapeutic approaches offer. Furthermore, the COVID-19 pandemic has recently highlighted the need for available therapeutic interventions that are fast, practical, and low-cost to ensure that all socioeconomic classes can immediately regain their psychophysical well-being [2]. In this wake, a variety of studies on mindfulness are emerging today. The term *mindfulness* means "awareness" but in a special sense; it mainly refers to a direct experience, which is obtained by paying attention: a) with intention, b) to the present moment, and c) in a non-judgmental way [3]. This practice though being simple is highly difficult to pursue. Since the negative side of life cannot be avoided, the mindfulness perspective suggests entering into a more direct relationship with discomfort and suffering. In this sense, mindfulness works in contrast to the human tendency to avoid the "negative", with respect to the belief that by facing the negative aspects of life and processing them, one can be less conditioned and oppressed by conditions that bring discomfort, thus allowing the subject to move from a state of imbalance and suffering to one of greater subjective perception of well-being, thanks to a deep knowledge of emotional states and their mental processes.

The reasons why mindfulness has sparked such a strong interest in mental health treatment are its versatility, its diversity from other therapeutic approaches, and the interest it arouses in patients [4]. Today, mindfulness research has substantially increased and aims to integrate it more and more into interventions to improve overall health and well-being [5].

Starting from the foundations of mindfulness, ecopsychology today focuses on forest therapy. Shinrin-Yoku, or forest bathing, is a practice that has been introduced in Japan in 1982, and it means "bathing in the forest air and observing/walking in the forest landscape" [6]. The purpose of this practice, proposed as part of a National Health Program aimed at reducing the stress levels of the population, is to experience the forest through all five senses and should not be confused with a form of exercise, such as hiking. Shinrin-Yoku is based on contact with nature as an essential need of human beings. Forest therapy, in this sense, is forest bathing applied as an intervention aimed at specific mental and physical health difficulties [7]. Forest therapy considers the specific needs of people experiencing these difficulties and focuses on alleviating the distress and repairing the mental/physical health damage they cause. There are officially licensed professionals and guides in this practice, and the worldwide network that trains professionals in the practice of this discipline is the European Institute of Forest Therapy (EFTI). Shinrin-Yoku is a deeply regenerating immersive experience in nature, able to operate a physical and mental detoxification, thanks to the numerous benefits that trees and plants have on the human nervous system [8]. One of the possible reasons why the environment has such an influence on people is due to the inhalation of plant-based chemicals produced in the forest, trees, and soil [6]. The first step to being able to practice Shinrin-Yoku correctly is to place yourself in a "natural" setting and make sure you do not bring objects, such as smartphones or any other electronic devices, which could act as a distraction. It is important to walk slowly and aimlessly for a duration of about two hours. The individual immersed in nature should then be guided by his own body, slowly discovering where the latter leads him without any time limit. As already illustrated, enjoying the present moment to the fullest can be difficult at first, so using your own feelings or emotions could be useful to let yourself be carried away and guided by the environment so as to allow you to create that human-nature bond of total immersion.

In Japan, several factors have been identified to certify a forest as a "healer", such as air temperature, humidity, brightness, radiant heat, air currents, sounds, and organic compounds produced by trees [6]. Additionally, a certified Japanese "healer" forest must include more than two forest therapy pathways. This is essential to allow the subject to choose the most suitable path based on different criteria. Given both the increasingly negative impact of urbanization on the environment [9] and the widespread psychological consequences of the coronavirus pandemic at the individual, community, national and international levels [2 - 10], it is essential to continue scientific research on the benefits of immersion in natural environments. If confirmed in its effectiveness, this practice could restore the psychophysical well-being of people in a simple and low-cost way.

In the existing literature, no interesting studies on the application of this part in the Italian context have been found. This exploratory study, therefore, aims to review the existing literature to understand how this type of therapy has been applied in other contexts and what results have been obtained in relation to psychophysical well-being so as to prepare the field for experimental research also in Italy, which, despite being one of the European countries with greater biodiversity and nature conservation, does not have in-depth studies on the implementation of forest therapy.

2. MATERIALS AND METHODS

The review was carried out in accordance with the PRISMA 2020 guidelines [11]. The research was conducted on the online databases of PubMed, Scopus, Web of Science, Science Direct and Google Scholar to identify articles, which in a span of ten years from the date of this review (2011-2021) have employed an intervention based on forest therapy, while also having a sample of participants characterized by psychophysiological disorders from mild to severe, such as university stress, postmenopausal women, elderly, depression in alcoholics, people with chronic widespread pain, veterans with post-traumatic stress disorder (PTSD), and patients with affective and psychotic disorders. We, therefore, considered the physiological and psychological measures of these different declinations, both linked to greater general well-being.

The selected articles resulting from the research phase in the databases listed above were, finally, 30 in total. After an initial screening phase, 12 full-text articles were analyzed, and in the end, only 7 met the inclusion criteria. The above description is summarized in the flow chart provided in Fig. (**1**), while the data from these studies can be extracted from Table **1** and **2**.

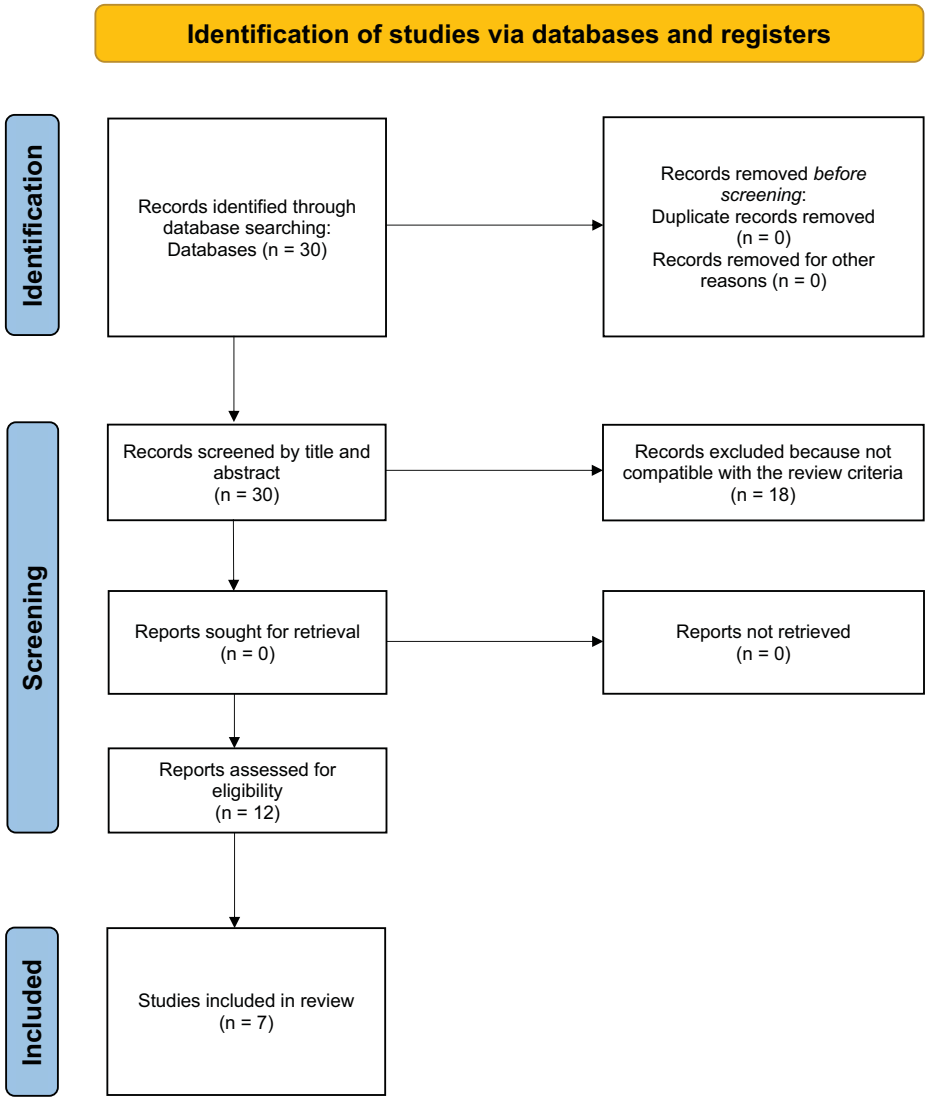

Fig. (1). PRISMA 2020 flow chart.

Table 1. Data extraction.

Authors	Year	Title	Focus	Sample	Main Results
Chengcheng Zeng, Bingyang Lyu, Songyuan Deng, Yan Yu, Nian Li, Wei Lin, Di Li, Qibing Chen [12]*	2020	Benefits of a Three-day Bamboo Forest Therapy Session on the Physiological Responses of University Students	Reducing stress levels in college students (19-24 years old)	120	The three-day bamboo forest therapy session improved the physiological well-being of college students. The potential for a long-term effect on human physiological health requires further investigation.
Hyeyun Kim, Jayoung Kim, Hyo Jin Ju, Bong Jin Jang, Tae Kyu Wang, Yeong In Kim [13]*	2020	Effect of Forest Therapy for Menopausal Women with Insomnia	Investigating the impact of forest therapy on menopausal insomnia	35	Total sleep time has been increased. Despite its limitations, forest therapy might be a good alternative to non-pharmacological treatment to mitigate insomnia in postmenopausal women.

(Table 1) contd.....

Authors	Year	Title	Focus	Sample	Main Results
Jiyune Yi, Boncho Ku, Seul Gee Kim, Taegyu Khil, Youngsuwn Lim, Minja Shin *et al*. [14]*	2019	Traditional Korean Medicine-based Forest Therapy Programs Providing Electrophysiological Benefits for Elderly Individuals	Preventing dementia and related health problems in the elderly population	88	Programs conferred health benefits and helped prevent dementia
Ernest Bielinis, Aneta Jaroszewska, Adrian Łukowski, Norimasa Takayama [21]*	2019	The Effects of a Forest Therapy Programme on Mental Hospital Patients with Affective and Psychotic Disorders	Investigating the effect of forest therapy on individuals with affective or psychotic disorders	50	Both patients with affective and psychotic disorders have experienced improved moods. Although forest therapy is not sufficient as a single treatment for these disorders, it is excellent as an auxiliary therapy.
Jin-Woo Han, Han Choi, Yo-Han Jeon, Chong-Hyeon Yoon, Jong-Min Woo, Won Kim [13]*	2016	The Effects of Forest Therapy on Coping with Chronic Widespread Pain: Physiological and Psychological Differences between Participants in a Forest Therapy Program and a Control Group	Investigate the effects of a two-day forest therapy program on individuals with chronic widespread pain	61	The results support the hypothesis that forest therapy is an effective intervention to relieve pain and associated psychological and physiological symptoms in individuals with chronic widespread pain
Dorthe Varning Poulsen, Ulrika K Stigsdotter, Dorthe Djernis, Ulrik Sidenius [16]*	2016	'Everything Just Seems Much More Right in Nature': How Veterans with Post-traumatic Stress Disorder Experience Nature-based Activities in a Forest Therapy Garden	Evaluate the impact of forest therapy on veterans and possible reduction in symptoms due to PTSD	8	The way veterans experienced nature as a place where you are accepted as you are and their experience of the relaxed brain turned out to be important for the healing process.
Won Sop Shin, Chang Seob Shin, Poung Sik Yeoun [15]*	2012	The Influence of Forest Therapy Camp on Depression in Alcoholics	Reduce depression levels among alcoholics	92	Forest therapy experience can greatly reduce and improve levels of depression in alcoholics.

Note: *references have the same reference number as in the article body and in the *References* section.

Table 2. Statistical summary of the main measures used.

Authors	Sample	Materials, Measure, and Dependent Variables	T, Mean Values, F-Values (PRE- and Post-Forest Therapy)	P-Level and Notes
Chengcheng Zeng *et al*. (2020) [12]*	120	SBP (Systolic blood pressure) DBP (Diastolic blood pressure) HR (Heart rate) SpO2 (Peripheral oxygen saturation)	Mean ±SEs (standard errors) = 7.52±1.13 mmHg (decrease) Mean ±SEs (standard errors) = 3.22±1.1.21 mmHg (decrease) Mean ±SEs (standard errors) = 6.55±1.24 bpm (decrease) Mean ±SEs (standard errors) = 97.47±0.10% (increase)	$p < 0.05$ $p < 0.05$ $p < 0.05$ $p < 0.05$
Hyeyun Kim *et al*. (2020) [13]*	35	Cortisol (mcg/dL) Sleep efficiency (%) Waking after sleep onset (min) ODI (/h) (Oxygen desaturation index)	From 10.2±3.79 to 7.775±2.81 (decrease) From 76.9±4.8 to 89.3±4.3 (increase) From 95.5±42.1 to 47.4±22.3 (decrease) From 13.9±15.7 to 18.1±12.8 (increase)	$p < .005$ $p < 0.01$ $p < 0.01$ $p = .007$
Bielinis *et al*. (2019) [21]*	50	POMS (Profile of mood states) - Tension anxiety - Depression dejection - Fatigue - Confusion - Vigor Anxiety (STAI-S)	From 1.58±0.75 to 1.05±0.8, t=4.51 (decrease) From 1.8±0.86 to 1.11±0.69, t= 6.42 (decrease) From 1.59±0.8 to 1.27±0.6, t=3.23(decrease) From 1.77±0.56 to 2.05±0.69, t = 8.82 (increase) From 1.46±0.75 to 2.05±0.69, t= - 4.35 (increase) From 50.26±13.91 to 39.19±9.41, t= 4.88 (decrease)	$p < 0.001$ $p < 0.001$ $p < 0.001$ $p < 0.001$ $p < 0.001$ $p < 0.001$

(Table 2) contd.....

Authors	Sample	Materials, Measure, and Dependent Variables	T, Mean Values, F-Values (PRE- and Post-Forest Therapy)	P-Level and Notes
Jiyune Yi *et al*. (2019) [14]*	88	EEG (electroencephalogram) - MEF [Hz] median frequency in the dominant frequency band of 4-13 Hz of the power spectrum. - Pα [μV2] Alpha band power. - Pβ [μV2] Beta power spectrum. - ATR Alpha/Theta ratio HRV (heart rate variability) Bioimpedance	Decrease MEF (δ = −0.40 with 95% CI of (−0.77, −0.03), n.s. n.s. Decrease δ = −0.15 with 95% CI of (−0.23, −0.07), Decrease (δ/XB = 4.7%)	$p < 0.01$ $p < 0.001$ and Γ = 1.08
Jin-Woo Han *et al*. (2016) [13]*	61	HRV (heart rate variability) NK cell (natural killer cell) VAS Pain (Visual analog scale for pain) BDI (Beck depression scale) EQ-VAS (Euro quality of life visual analog scale)	From 80.98 (sd= 8.06) to 77.59 (sd=7.55), t= 2.467 (decrease) From 604.20 (sd= 754.92) to 1131.56 (sd = 990.29), t = - 5.391 (increase) From 4.94 (sd= 1.62) to 3.26 (sd= 1.69), t 6.68 (decrease) From 15.06 (sd= 9.43) to 8.12 (sd= 7.05), t = 6.86 (decrease) From 62.88 (sd= 16.78) to 76.09 (sd= 16.34), t= -7.79 (increase)	$p < 0.05$ $p < 0.001$ $p < 0.001$ $p < 0.001$ $p < 0.001$
Dorthe Poulsen *et al*. (2016) [17]*	8	Qualitative interviews		
Won Sop Shin *et al*. (2012) [15]*	92	BDI (Beck depression inventory)	t= -6.27 (decrease)	$p < 0.001$

Note: *references have the same reference number as in the article body and in the *References* section.

3. RESULTS

3.1. Forest Therapy in University Students

The benefits of bamboo forest therapy on physiological responses were investigated in a sample of university students in a study conducted by Zeng and colleagues [12].

A total of 120 university volunteers (60 males and 60 females) aged 19 to 24 participated in this study and were randomly divided into four groups of equal size (n = 15 men, n = 15 women). None of the participants reported physiological or psychiatric disorders in their personal histories. Four sites were selected for the application of the therapy, including two natural bamboo forests (YA and YB), a bamboo forest park (DJY), and an urban environment (CS). During the trial period, all participants were asked to observe the landscape for 15 minutes in the morning and then walk the area for 15 minutes in the afternoon. Regarding the physiological indices, the following measurements were used: blood pressure (BP), heart rate (HR), and peripheral oxygen saturation (SpO2). Psychological reactions were assessed using the differential semantic method (SDM), a scientifically validated and practical method to evaluate the emotional reactions of subjects to the environmental space and consequently extrapolate the environmental factors that most influence mental well-being.

Overall, the participants' assessment of the bamboo forest environment was significantly better than the urban site. Research results showed that compared to urban sites (CS), bamboo forest sites (YA, YB, DJY) may be more conducive to decreasing blood pressure and heart rate, and that viewing and walking activities have had a positive impact on the physiological and psychological indices of university students.

The results also showed that the preference for natural environments was influenced by temperature, radiant heat, wind speed, noise, the absolute intensity of illumination, and concentration of negative oxygen ions. Compared to the other three experimental sites, the environment of the YB site was more natural, comfortable, open, bright, and with a pleasant ambient noise; consequently, it was better for relaxation among university students. Both psychological measures, such as mental relaxation and positive emotional reactions, and physiological measures, such as blood pressure and heart rate, have therefore improved in university students thanks to the application of forest therapy.

3.2. Forest Therapy in a Postmenopausal Woman with Insomnia

Also, Kim and his research group carried out a prospective clinical study that aimed to investigate the efficacy of forest therapy for postmenopausal women with insomnia [13].

The study was conducted on women over the age of 40 who complained of insomnia caused by menopause. Menopause was diagnosed through an interview by monitoring the menstrual cycle, while insomnia was diagnosed by a doctor through the DSM-III classification. The sample was made up of 35 women who were active and capable of performing more or less strenuous physical exercises. Forest therapy was conducted at the Hoengseong National Forestry Center, a forest education and care center located 680m above the sea level. This site has 6 trails ranging from 450 to 2000m of trees, such as larch, birch, dogwood, and pine that grow naturally. Participants enjoyed various activities, including meditation, gymnastics, 30-minute morning walks in the forest before breakfast, and 1–2-hour afternoon walks after lunch. After the course, participants received leg massages and bathed alternately in hot and cold water. The "Five Senses Experience

program" within this studio included varied activities to engage all the senses, such as walking barefoot.

Each participant's sleep and emotional state were assessed using the Epworth Sleepiness Scale (ESS), the Stanford Sleepiness Scale (SSS), the Korean version of the Pittsburgh Sleep Questionnaire Index (PSQI) sleep quality survey questionnaire, the STOP-Bang, to underestimate sleep apnea, the Hospital Anxiety and Depression Scale (HADS), and Polysomnography (PSG) recorded before and after the forest therapy program. Regarding physiological measures, blood samples were taken, before and after forest therapy, to evaluate common blood cells (CBC), glucose, aspartate transaminase (AST), alanine transaminase (ALT), nitrogen, urinary blood, creatinine, electrolytes including sodium, potassium, chloride, C-reactive protein (CRP), interleukin 6, and cortisol. As for cortisol, the blood was taken at 8:00 in the morning because it has circadian changes. The results presented in the study showed an improvement in all physiological and psychological measures, thus determining that forest therapy can be an effective alternative to non-drug treatment for insomnia, especially in postmenopausal women.

3.3. Forest Therapy in the Elderly Population

A year earlier, in 2019, Jiyune Yi and her research group focused on developing forest therapy programs (FTP) that could be applied in urban forest areas for the elderly population to prevent cognitive decline [14].

Within the study, two different FTP protocols were developed, and the effects of FTP on specific subgroups were evaluated following the approach of Sasang Constitutional Medicine (SC). SC is a branch of Korean traditional medicine that is well established as a standard modality for diagnosis and treatment. Two FTPs were developed with an average duration of two hours per daily session for a total of 11 sessions, with one session per week. To increase the effectiveness of FTP, some therapeutic modalities of Korean traditional medicine have been adopted. The first program is called the "Walking Program (WP)", and its key design point is active forest walking to induce sweating and stimulate the Yongquan acupuncture point (K11) while walking. The second program is called the "Breathing Program (BP)", and its key design point is meditation with guided breathing and simultaneous stimulation of the cervical spine.

The following psychological measures were used: the Mini Mental-Status Examination for Dementia Screening (MMSE-DS), the Mini Mental-Status Examination (MMSE) to evaluate the global cognitive status, and a neurocognitive test using the EEG at rest.

As for the physiological measures, on the other hand, Heart Rate Variability (HRV) was measured by photoplethysmography (PPG), and bioimpedance was measured to estimate general body composition factors.

The main objective of this study was to improve neurocognitive abilities, autonomic nervous activities, and metabolic functions through FTPs in order to prevent dementia. Both BP and WP had health benefits for the elderly population in terms of neurophysiology, HRV, and bioimpedance. From the results, it appears that forest therapy may be effective in preventing cognitive decline and that the beneficial effects can be maximized when the program treatment considers the participant's psychological and physiological traits. The beneficial effects, specifically, varied according to the types of FTP; for example, BP was effective in increasing the phase angle of the upper limbs, and WP was effective in increasing the phase angle of the lower limbs. This finding suggests that forest therapy can be effective for preventing dementia and that the beneficial effects can be maximized when the therapeutic program considers the participant's psychological and physiological traits.

3.4. Forest Therapy in Adult Alcoholics

The relationship between the experience of alcoholics participating in a forestry program and the effect of this program on their levels of depression was assessed in a study conducted by Shin and his research team [15].

The study sample consisted of 92 participants, *i.e*., all adult alcoholics enrolled in the Korean Alcohol Research Center in Chungbuk Province, South Korea. The participants were randomly assigned to a treatment group and a control group. This random allocation process resulted in 47 participants in the treatment group and 45 participants in the control group. The measure used in the study was the Korean version of the Beck Depression Inventory (BDI), administered pre-and post-treatment to determine possible differences in the participants' levels of depression.

Regarding the results, compared to the control group, the test group showed a significant improvement in depression levels at the end of treatment, thus demonstrating that forest therapy can be a suitable treatment for people suffering from alcoholism and open the door to possible ideas of use also in the treatment of other forms of addiction to abuse substances.

3.5. Forest Therapy in Patients with Chronic Widespread Pain

The effectiveness of a forest therapy program specifically designed for patients with chronic widespread pain (CWP) was also assessed [16].

The program's overall goal was to provide psychoeducation in pain management and increase motivation to change one's lifestyle in the long term. The two-day program consisted, specifically, of various physical and educational activities, guided in the forest and based on cognitive behavioral therapy.

Among the various activities, there was, for example, mindfulness-based meditation and music therapy in forest environments. The hypothesis was to use nature as a safe and restorative environment in which an individual can autonomously experience cognitive change. The research sample consisted of 61 employees from a Seoul-based public organization, aged between 25 and 49 years and suffering from CWP.

Participants were assigned to an experimental group (n = 33) that participated in a forest therapy program or to a control group (n = 28) on a non-random basis.

The three forest therapy camps were held at Saneum Natural Recreational Forest in Yangpyeong County, Gyeonggi Province.

This forest was very lush, and the valley boasted one of the most beautiful views in the county. Each forest therapy camp lasted two days. During those two days, participants engaged in various indoor and outdoor activities aimed at providing relaxation, refreshment, and attention recovery. The activities were supervised by a team of professionals consisting of a psychiatrist, a rheumatologist, a forest guide, and a forest therapist.

Physiological measurements included cardiac measurements, such as heart rate and heart rate variability (HRV), measured using a supplied long-term electrocardiogram to detect measurements throughout the experimental period, and measurements of NK cell cytotoxic activity. As for the psychological measures, the following were administered: a visual analog scale for pain (VAS Pain), the Beck Depression Inventory (BDI), and the EuroQol visual analog scale (EQ-VAS), all administered pre-and post-treatment.

The results demonstrated that forest therapy program participants, compared to the control group, exhibited greater relaxation as indicated by an increase in HRV and greater immune competence as indicated by an increase in NK cell activity. Participants in the forest therapy group also reported stronger decreases in pain and depression than participants in the control group. Therefore, the present research findings add to the evidence base for the health benefits of forest therapy and confirm its relevance and clinical importance for CWP patients.

3.6. Forest Therapy in Veterans with Post-Traumatic Stress Disorder (PTSD)

A study to investigate the effects of forest therapy on veterans with post-traumatic stress disorder (PTSD) was conducted by Poulsen and colleagues in 2016 [17]. Specifically, the study adopted a phenomenological approach that sought to understand participants' perceptions, perspectives, and understanding of the situation.

8 male veterans, aged between 26 and 47, were included in the project. Nature-based therapy (NBT) was carried out at the Nacadia Forest Therapy Garden of the University of Copenhagen, located in the Hørsholm Arboretum. The NBT program lasted 10 weeks, with 3 hours of therapy three times a week.

Each session began at the entrance to the arboretum, followed by a stroll through the arboretum to the therapeutic garden. Here, the veterans concentrated on different activities that stimulated the senses, and finally, in each session, there was an interval dedicated to “private time” in which the participants could choose for themselves where they wanted to be and what they wanted to do in nature. The program began and ended with a gathering around a campfire in the therapeutic garden. The NBT, specifically, was based on the following three elements: (1) awareness and applied awareness activities, (2) nature-based activities (NBA), and (3) individual therapy sessions. The NBA contained several types of assignments, some with a particular physical approach, such as splitting wood and planting trees, while others were moderately physically demanding and involved in performing routine tasks in the arboretum with the gardener. Through short narratives about, for example, special plants, bird breeding, and seasonal changes in the forest, the veterans have imparted knowledge of nature. Individual therapy sessions focused on guiding veterans on solving problems and conflicts in their daily lives through therapeutic conversations. Four semi-structured interviews were conducted with each participant: one at baseline, one after 5 weeks, one after 10 weeks, and one year after the treatment.

The whole study was based on a general consideration: the relationship of veterans with natural environments could be analyzed using the attention restoration theory (ART). According to this theory, the human mind has two types of attention: direct attention and spontaneous attention [18]. Direct attention is activated when the individual needs to focus on a specific stimulus. This process is mostly intentional and requires conscious effort. With prolonged use, direct attention can be depleted, which can cause direct attention fatigue [19, 20]. Veterans' feeling of low physical and mental energy could be seen as a consequence of their constant vigilance and can be compared to the condition of “direct attention fatigue” [17].

The experience of forest therapy in the light of the results of the interviews, therefore, showed that nature offered veterans relaxation and allowed them to regain physical and mental energy. Over the course of the therapy program, veterans' preferences for places changed from wanting to be alone and in a place that offered shelter in the beginning to looking for new places where they were together with other veterans or people in general in public spaces. It would be reasonable to see this change as a development in the mental and physical abilities of veterans [17].

NBT thus seemed to allow veterans to find their way of transferring the use of nature and the NBA into their daily lives. A year after the end of the NBT, most veterans were still using nature and the NBA to manage their mental health.

3.7. Forest Therapy in Patients with Affective Disorders or Psychotic Disorders

In the wake of the various studies, Bielinis and his colleagues [21] decided to investigate the possible benefits of forest therapy for patients in psychiatric hospitals.

The study sample consisted of 50 volunteer patients from the Olsztyn Provincial Psychiatric Care Unit. To determine whether forest therapy could induce positive effects on anxiety levels and mood quality, a pre- and post-test design was used that evaluated the curative effect in two groups of patients: those with affective disorders and those with psychotic disorders. Specifically, the forest therapy intervention consisted of a recreational walk in a suburban forest near the psychiatric hospital in the city of Olsztyn. To assess any health improvements, the following psychological questionnaires were administered: the Profile of Mood States (POMS) and the State-Trait Anxiety Inventory (STAI). Patients were encouraged to participate in forest walks with additional exercises in the forest environment (walking, stretching, and

landscape observation). This intervention took place under the supervision of a qualified therapist; patients spent an hour and forty-five minutes in the forest. Before and after the interventions, patients were given psychological questionnaires, which allowed them to evaluate their perceived sensations before and after the forest therapy.

The observed changes in psychological indicators in psychiatric hospital patients indicated that forest therapy intervention could positively affect their mental health.

Different reactions were also observed according to the experimented group. In the case of people with psychotic disorders, the greatest effect of therapy was observed on vigor, while in the case of patients with affective disorders, the greatest effects were observed concerning the traits of confusion and depression. Changes in psychological indicators, therefore, depend on the characteristics of a given disorder.

4. DISCUSSION

Available evidence suggests that forest therapy is effective and versatile in treating a range of medium to mild conditions (such as university stress, insomnia in menopause, dementia in the elderly, and depression in alcoholics) as well as more serious conditions (such as chronic widespread pain, PTSD, and affective and psychotic disorders). Many of the measurements used in the studies show a significant improvement after treatment with forest therapy. Not only have psychological aspects, such as anxiety and depression, been found to be improving, but also various physical aspects, as demonstrated by a significant increase in the activity of Natural Killer cells, indicating the strengthening of immune defenses [6]. It should not be underestimated, however, that forest therapy allows effective interventions without drugs and, therefore, without potential side effects for patients, even if this requires further studies and investigations. Further studies should include major and diverse types of participants subjected to different types of experiences in different environments and a broader inventory of the elements and variables available. Despite various limitations, the existing literature agrees on the safety and tolerability of the therapeutic effects obtained through Shinrin-Yoku. No side effects have been reported. Existing data do not yet allow us to determine whether forest therapy treatments can make long-term improvements. However, in some specific cases (such as those described), forest therapy has been proven to be very effective, to the point that the subjects continued to do so even after the experiment [16].

LIMITATIONS

This review has some limitations. As there are few scientific papers and studies on forest therapy available, it is difficult to say with certainty that this is a practice that produces positive effects and is effective in an objective sense under the conditions imposed by the studies previously analyzed. Further studies and investigations are required to verify and standardize the use of forest therapy, possibly in correlation both to clinical conditions of the subjects and different types of forests themselves. Studies have also often reported a weather limit, so future research is needed to test the impact of the forest environment on human psychophysical well-being in different seasons. Finally, the participants in the studies examined mostly had a high level of education and a good standard of living and health, which is not universal; the results, therefore, can only represent the situation of a single part of the population.

CONCLUSION

Given the few studies, it is not yet possible to assess whether forest therapy can be considered a replacement therapy for disease in its entirety. Although forest therapy is not necessarily better than conventional therapies, it has, however, demonstrated similar efficacy in the studies analyzed. All this provides empirical evidence of the credibility of forest therapy and opens new scenarios for more eco-sustainable, versatile, and adaptable therapies. The applications of forest therapy examined in this work are currently very promising; therefore, it would be desirable to introduce forest therapy protocols in the official guidelines and ensure that clinics provide green spaces, as this specific form of therapy could be useful as an integrated accompaniment in conventional therapies to ensure greater effectiveness and psychophysical well-being. The limitations presented by the study should not be underestimated but taken into account by all who approach the research and use of this form of therapy. Finally, in light of this review, we also hope that future experimental research is conducted in the Italian context, characterized by incredible biodiversity and nature conservation.

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Not applicable.

STANDARD OF REPORTING

PRISMA Guideline have been followed.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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SUPPLEMENTARY MATERIAL

PRISMA checklist is available as supplementary material on the publisher's website along with the published article.

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