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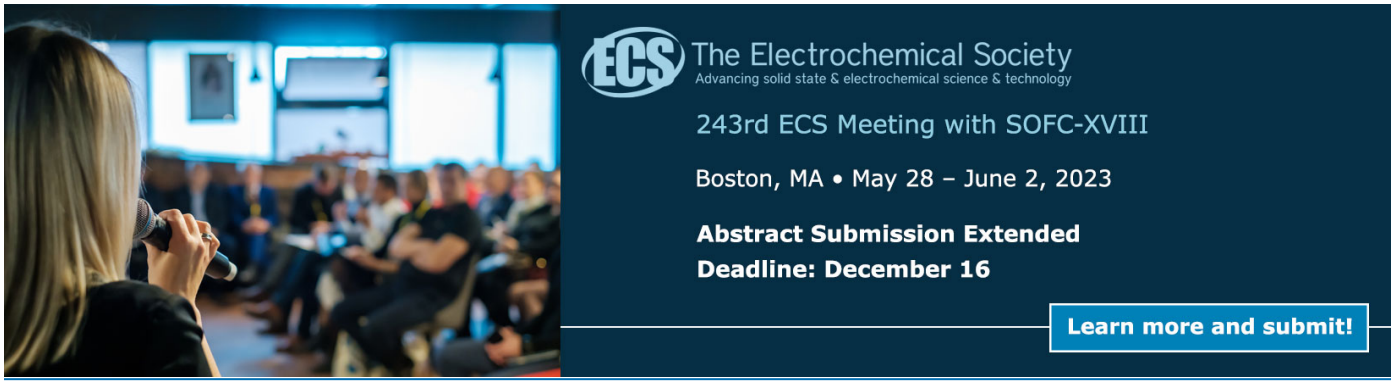

The role of forest therapy in promoting physical and mental health: a systematic review

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Abstract. Forest therapy is a form of activity used to pursue health benefits from the forest. The term "forest therapy" is often used reciprocally with the terms "forest bathing" and "Shin-rin Yoku". Even with many studies on forest therapy, there remains scarce scientific evidence of a standardised method used in Forest Therapy caused by variations in such treatment programmes. This study aimed to analyse methods used in forest therapy from works of literature from 2017 to 2021. This literature was compiled using Publish or Perish, sorted using the Zotero programme, and visually clustered with the VosViewer programme. 393 research papers were sorted manually based on three criteria: they directly practised forest therapy or forest bathing and analysed its benefit on human health, which was written in English, and accessed online. The 29 items that fit our criteria were further synthesised. Synthesis of these works of literature resulted in the categorisation of methods used for FT intervention. FT methods used by researchers were forest walks, forest viewing, the combination of forest walks and viewing forest landscapes, therapy programmes involving five human senses, doing relaxing activities in the forest and traditional medicine-based therapy. On the other hand, there was also combined methods used. All of these methods benefitted human health. The limitation of this finding is the broad types of forest used for forest therapy. Further research is suggested regarding this matter.

1. Introduction

There has been an escalation in research focusing on the benefits of interaction between humans and the environment in recent times. There has been a significant trend in research on the simultaneous pursuit of health and happiness, replacing forest protection and non–wood production with forest recreation and healing as a priority of forest use [1]. The Nature Therapy Concept defines it as activities aimed at obtaining preventive medical benefits by exposing oneself to natural stimuli that give psychological relaxation and improve immune functions to prevent sickness. Based on Figure 1, the conceptual model of nature therapy starts with a stressed condition considering the effect of urbanisation and increase in population, subsequently followed by the restorative effect of nature. After exposure to nature, there is a hypothesis of improvement in psychological relaxation and immune recovery responses, although the effect differs for each individual. These responses are later incorporated in the EBM (Evidence-based medicine), developing into the preventive medical effect [2]. Forest therapy is a form of activity used to pursue health benefits from the forest. Interacting with nature has been shown in studies to enhance both physical and mental health. Some research on the effects of forest treatment has been conducted to

establish this type of therapy as an evidence-based option [3]. The term "forest therapy" and "forest bathing" or "*Shin-rin Yoku*" have been used interchangeably in the past. The activities connected with forest treatment vary in these studies. Forest Therapy (FT) is often distinguished from forest bathing as a reinforced approach that is augmented by guided practices programmes that can stimulate participants' involvement in various therapeutic activities in the forest for health (psychological and physiological) benefits [6]. Forest therapy and forest bathing have a significant effect on psychological and physiological health [7,8]. Considering the broad definition of forest therapy and various research that had looked into forest therapy as alternative medicine, there is a lack of empirical proof due to different forest compositions and healing or treatment regimens. This study aimed to examine and categorise the methods (programmes) used in forest therapy and forest bathing and their effect on human health from online research papers published from 2017 to 2021.

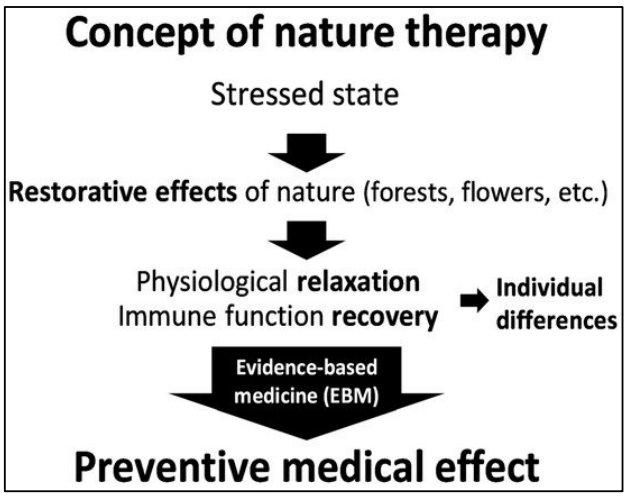

Figure 1. Concept of nature therapy [2].

2. Methods

A systematic review of 393 research papers that containing keywords "forest healing", "forest bathing, "*Shin-rin Yoku*", and "human health" in Google Scholar from 2017 to 2021 was made. This literature was compiled using Publish or Perish, sorted using the Zotero programme, and visually clustered with the VosViewer Programme. Research papers were sorted manually based on three criteria: they directly practised forest therapy or forest bathing and analysed its benefit on human health, were written in English and accessed online. These criteria are formed based on our aim to categorise methods used in FT practices.

VosViewer software was used in this analysis. VosViewer is a valuable tool for visualising keywords, giving the analyst a better grasp of the relationship between essential terms in a subject of study. VosViewer's clustering and visualisation technique of correlations between keywords is based on the abstracts of the chosen papers [11]. This analysis uses binary counting keywords with five times the minimum occurrence of each term. In the network visualisation, items are represented by a circle. The weight of the item determines the size of the circle of an item. The lighter the weight of an item, the larger the circle of the item. The cluster to which an item belongs determines the colour of the object. Lines between items represent links.

On the density visualization, each point in the item density visualisation has a colour that indicates the density of items at that point. The more items there are in a point's vicinity and the greater the weights of the neighbouring items, the closer the point's colour is to blue. The opposite is true: the smaller the

number of items in a point's neighbourhood and the lower the weight of the neighbouring items, the closer the point's colour is to white/yellow.

3. Results and discussion

The first research paper found online involved forest therapy analyses concerning motivation to exercise before and after forest therapy on patients with type 2 diabetes [9]. The published research findings highlighted the therapeutic effects of *Shin-rin Yoku's* healing components on the immune system. *Shin-rin Yoku* is also proven to decrease respiratory disease and increase psychological health [10]. Forest therapy is an important activity, and modern civilisations' engagement in it could positively impact their health, particularly regarding stress issues. Whether done in a group setting or individually by the subjects, forest therapy might be equally beneficial.

3.1. Forest therapy research from 2017-2021

Figure 3 describes the relationship between the occurrence of keywords "forest healing", "forest bathing, "*Shin-rin Yoku*", and "human health" in writings derived from Google Scholar from 2017 to 2021. In 393 works of literature, 160 terms met the minimum number of occurrences. In the VosViewer options, the relevance of these terms was further calculated. A relevance score above 60% will be shown. Based on this, the most relevant terms will be selected. Figure 3 has six main clusters (yellow, green, red, purple, dark blue, and light blue) with 78 items and 624 links.

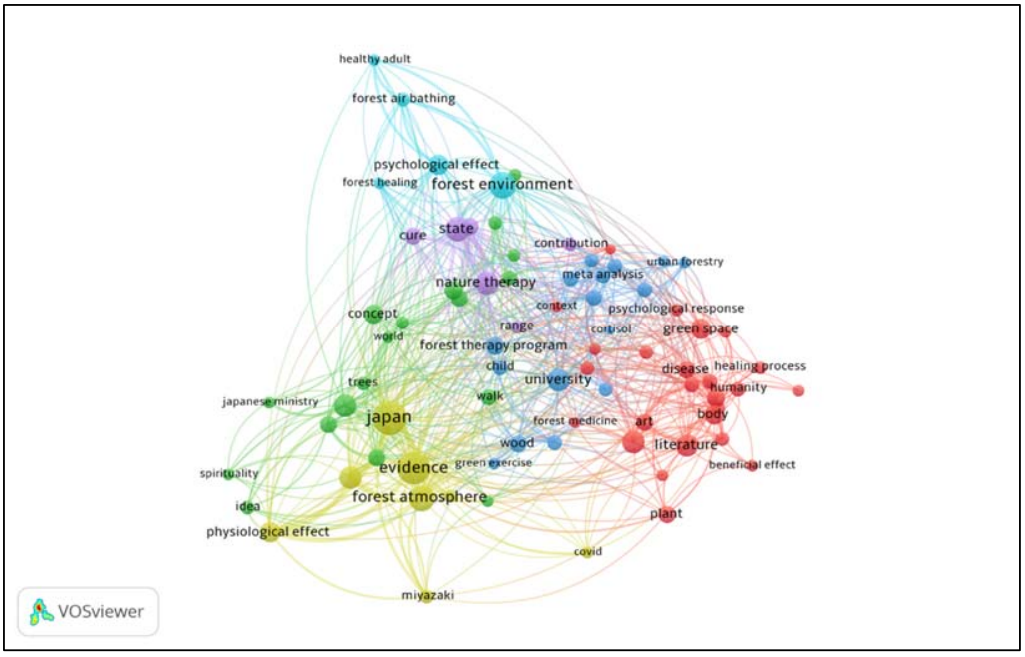

Figure 2. Network visualisation based on terms used in literature.

Clusters that are located further from each other tend to be less strongly related. In overly visual (figure 4) colour of an item is determined by the year of the terms; colours range from blue (earlier years) to green to yellow (later years). Figure 4 describes the average publication year of each term in clusters. Based on figure 4, literature with the terms "forest healing", "forest bathing, "*Shin-rin Yoku*", and "human health" in Google Scholar from 2017 to 2021 were primarily published in 2019.

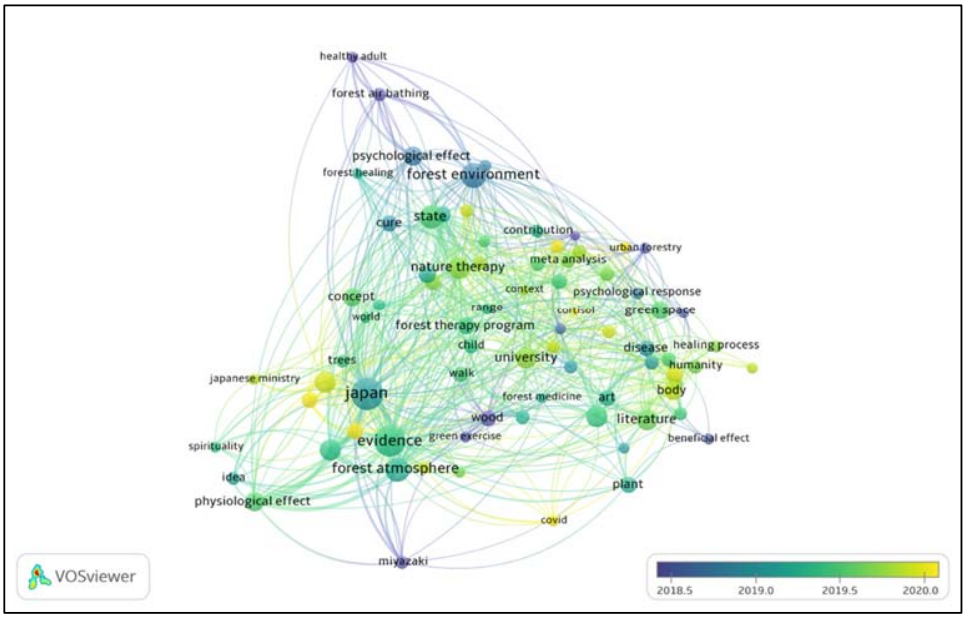

Figure 3. The overly-visualisation (average period of each term).

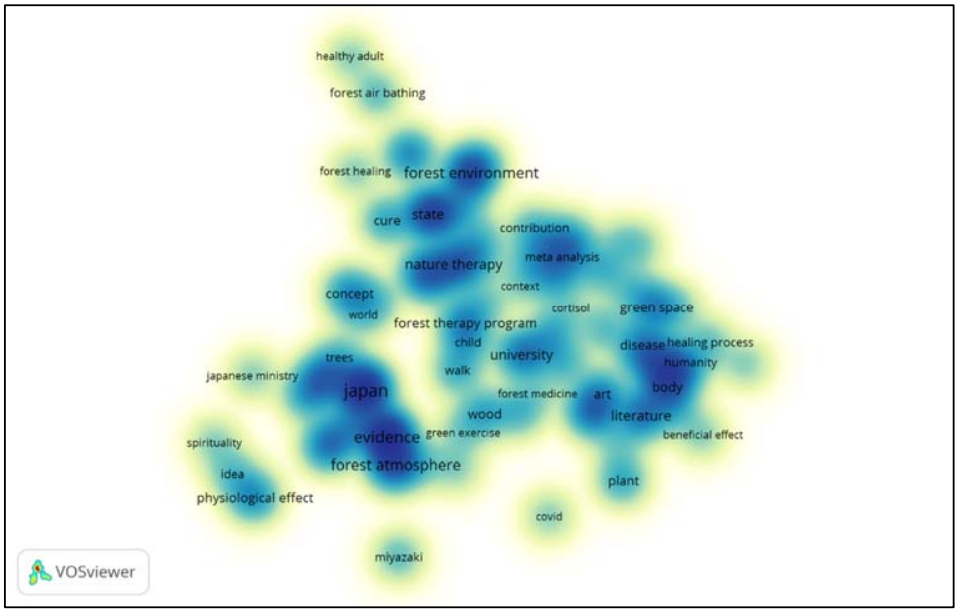

Figure 4. Density visualisation of each term.

These items were then represented by their label in the density visualisation (Figure 5), similar to the network and overlay-visualisation. Figure 5 describes the frequency of each term; deep blue colours indicate a higher amount of published works of literature. Based on Figures 3, 4, and 5, there was a higher number of published documents with the terms "nature therapy", "Japan", "evidence", "forest environment", "forest atmosphere" than "forest healing". In recent years, literature with terms "forest bathing", "forest healing", and "forest therapy" were fewer than literature that used the term "nature therapy".

3.2. Categorising methods used in Forest Therapy (FT)

We found 29 items that fit our criteria. These items were further synthesised and categorised (Figure 6). Methods used in FT practices varied. Based on the synthesis conducted, methods (programmes) used in forest therapy (FT) research were forest walks (1-2 session), forest viewing (1-2 session), forest walks (> 2 sessions), forest viewing and walking (> 2 sessions), forest therapy programme involving five human senses (> 2 sessions), doing relaxing activities in the forest, and using a traditional medicine-based form of FT. We classified one session of FT activity to 1.5 hours. Relaxing activities in the forest refer to sunbathing, laying down, light exercise, and other non-exhausting activities that do not specifically involve the five human senses.

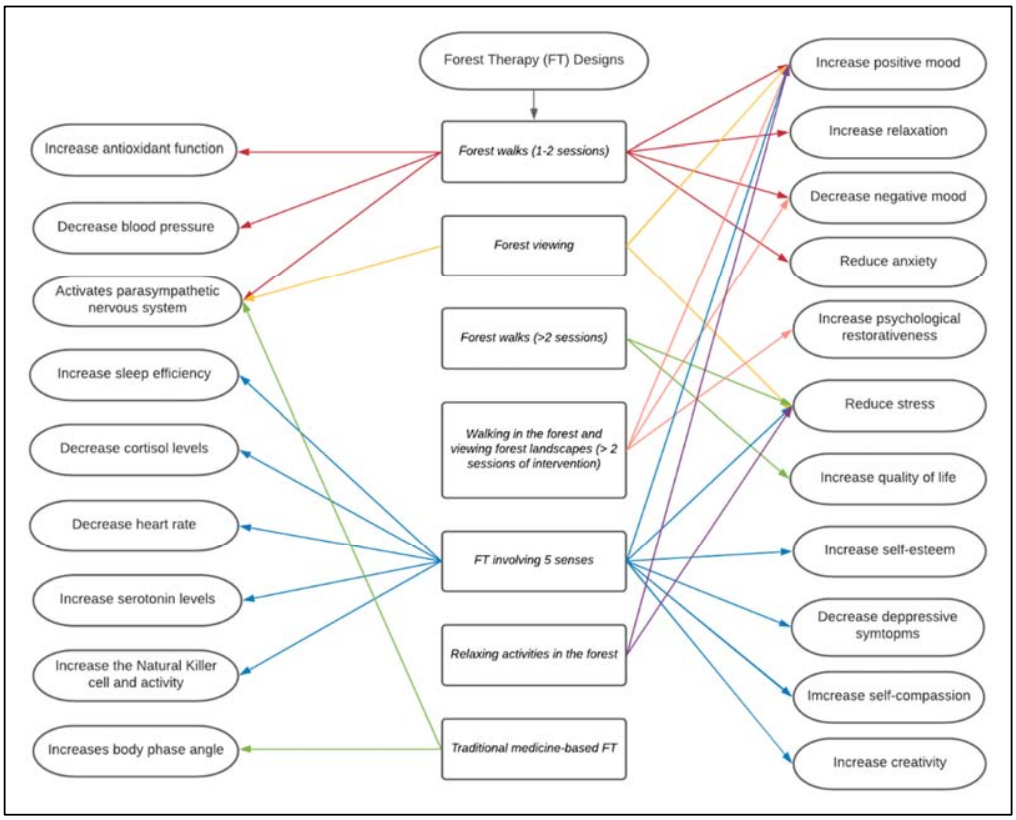

Figure 5. Methods used in forest therapy (FT) and its benefits on psychological (right) and physiological function (left).

3.2.1. Forest walks (1-2 sessions) Mao et al. conducted FT (termed forest bathing in their journal) on 36 elderly with chronic heart failure aged 65 to 80. FT method used was a 1.5-hour walk twice a day (smoking, alcohol, and caffeine were not allowed). The POMS (Profile of Mood States) questionnaire was utilised. After analysing blood samples, Mao et al. discovered that forest therapy reduced negative emotional mood states, decreased inflammatory cytokines, and enhanced antioxidant activity [12]. Similar research was conducted by Hassan et al. on 60 university students (30 male; 30 female) aged 19-24. FT method was walking in a bamboo forest for 15 minutes (control group walked in an urban area), blood samples and brain waves (using MindWave-EEG) were measured. Psychological assessment was measured using STAI (State-Trait Anxiety Inventory) and SD (Semantic Differential Method). The short session of FT resulted in a decrease in blood pressure, increased mind waves (indicating psychological relaxation), improved mood, and reduced anxiety [13].

Furuyashiki *et al.* conducted FT (termed Shin-rin Yoku in their journal) on 155 participants aged 19-59. Participants were classified into four age groups (under 30; in their 30s; in their 40s; above 50 years old), 55.5% of participants were female). The FT approach involved steadily strolling around the forest for around two hours, with one or two guides explaining the forest's surroundings. The guides demonstrated breathing methods, yoga, and hammock activities at each location, promoting conversation throughout the forest bathing experience. Furuyashiki *et al.* used POMS, K-6 (Kessler Psychological Distress), and SF-8 (health-related quality of life) to measure the psychological benefits of FT. SBP (systolic blood pressure), DBP (diastolic blood pressure), and PR (pulse rate) were the physiological components examined. The study discovered that following a forest bathing session, this strategy correlated to a drop in negative POMS items, SBP, DBP, and PR [7].

Shin and Choi also used a one session forest walk as an FT approach on ten patients who had a myocardial infarction and underwent a percutaneous coronary intervention. The participants were instructed to walk for 15 minutes in the forest and urban environments in a single session. Shin and Choi assessed the psychological benefit of FT using POMS and Semantic Differential Method and the physiological benefits using Heart Rate Variability (HRV). The study found that a single walking session in the forest setting stimulated the parasympathetic nervous system (which contributed to a sense of calm) and enhanced the positive feelings of adult myocardial infarction patients [14].

3.2.2. Forest Viewing (1-2 Session of Intervention) Shin and Choi conducted FT on ten healthy male radiologists (averagely aged 24 years old). The method of FT was viewing urban areas and forest landscape areas (15 minutes for each viewing session). Using POMS and SD (Semantic Differential Method) for psychological measurements and heart rate for measuring FT impact on the autonomic nervous system, Shin and Choi find that watching the forest ecosystem stimulated the parasympathetic nervous system more than viewing the urban area, which lowered stress and stabilised participants' psychological status. Viewing the forest landscape also enhanced positive sentiments among POMS and SD subscales [16].

3.2.3. Forest Walks (> 2 Sessions of Intervention) Han and Koo conducted FT on 56 hospital workers. The approach utilised in this study was to walk for 20 minutes on the healing forest trail at least three times each week (for three weeks period). Using POMS, The Quality of Life Questionnaire, and the Korea Occupational Stress Scale (KOSS-SF), Han and Koo discovered that walking for 20 minutes on a forest trail reduced Total Mood Disturbance, improves Quality of Life, and reduced stress, particularly from work [17].

3.2.4. Walking in The Forest and Viewing Forest Landscapes (> 2 sessions of intervention) Lyu et al. researched FT (term used in this study) on 120 students (60 males and 60 females), divided into groups, alcoholics and smokers were excluded. In the morning, the subjects sat on chairs and viewed the landscape for 15 minutes. In the afternoon, walking in the area for 15 minutes was also conducted. Using the POMS Questionnaire, this study found that a 3-day session in a bamboo forest can increase positive mood and decrease negative mood [18].

Takayama *et al.* conducted an FT on 46 male students (age 21-22). The participants were separated into four groups, each with 11-12 subjects per group. There were four sites and four urban sites chosen. The urban areas were close to the woodland areas. Each group were assigned different types of forest and urban area. Each participant viewed their assigned location for 15 minutes and walked in each location for 15 minutes. Psychological measurements were carried out using POMS, PRS, PANAS, SVS, WHO Quality of Life 26, WHOQOL26, and the SHR Questionnaire. This study discovered that the forest setting was a stimulating environment with a stronger restorative effect than the urban area. The correlation between the restorative indicators and individual trait indicators were arranged in the forest setting: stress coping, psychological health, and satisfaction with the environment were likely the vital indications related to the healing benefits of the forest ecosystem [19].

Simkin *et al.* conducted a study on 66 participants aged 26–65 years old, of which 59% were women. The study was carried out in four forest locations. Every location was visited at random and on random weekdays. Each forest was coded to have the same number of first, second, third, and fourth visits to prevent the order effect. Each participant visited each forest once to maximise the study's validity. The first step of the trial involved sitting in chairs on-site for 15 minutes. A 30-minute walk followed the viewing session. This study discovered that the restorative effects of all forests on the participants increased dramatically. The primary forest was proven to be the healthiest ecosystem based on the restorative effect. The urban leisure forest has a smaller amount of restorative effect. It is critical to protect primary forests near residential areas [20].

Zeng *et al.* examined FT in a bamboo forest, 120 university students participated in this three-day field experiment (subjects who smoked or had a history of abusing alcohol were excluded from this study). The subjects sat in seats for 15 minutes while sighting the scenery, and then their physiological data was collected. They strolled about the region for 15 minutes in the afternoon, collecting physiological data and SDM Questionnaire. The topography, distance, and walking speed on the route were all adequate for moderate energy consumption. After finishing the walking and viewing, the participants could travel about the experimental sites until dinner. Except for lunch, all individuals were advised to remain at their allocated experimental sites from 9.00 am until 5.00 pm. The Semantic Differential Method (SDM) and physiological indices were used to collect psychological data. Activities such as viewing and walking in the bamboo forest environment were beneficial, as evidenced by positive changes in human physiological indicators. The FT conducted was proven to effectively reduce blood pressure, slowing the heart rate, and maintaining peripheral oxygen saturation at a high level. The FT conducted in the bamboo forest can help to reduce mental tension and emotional instability. The viewing activity had a more significant effect on slowing the subjects' heart rate than walking. The bamboo forest therapy session improved male and female subjects' systolic blood pressure, heart rate, and peripheral oxygen saturation. The bamboo forest ecosystem setting was more conducive to lowering female individuals' systolic blood pressure and heart rate while maintaining peripheral oxygen saturation at a higher level. This suggests that the bamboo forest environment can effectively reduce pressure on the human body, alleviate emotions, and boost energy [21].

FT (termed Forest Bathing in the study conducted by Bielinis *et al.* could even be done in the winter in places where snow falls on the forest landscape. This winter condition, like forest bathing during the vegetative seasons, has a favourable effect on participants' psychological relaxation. Bielinis *et al.* conducted an FT research in Poland on winter. The participants of this study were 22 undergraduate students (11 male, 12 female) aged 22 years old. They used POMS, Positive and Negative Affect Schedule (PANAS), Restorative Outcome Scale, and SVS (Subject Outcome Scale) to measure psychological indexes. Each viewing was followed by a 15-minute exposure to a forest environment or landscape with buildings (as control). The data were analysed and contrasted after participants self-reported their psychological calmness before and after the exposition. The psychological relaxation effect markers, mood, emotions, restorativeness, and subject vitality were recorded.

The negative mood indices plummeted after being exposed to the snow cover-covered environment, whereas the positive 'vigour' indices did not significantly increase or decrease. Following the exposure to the control setting, the number of negative feelings increases. Similarly, positive emotions diminished following the interaction with the control. Psychological restorativeness was significantly boosted following exposure to the experimental forest but decreased following exposure to the control buildings. In this experiment, the size of the effect in terms of psychological restorativeness was the greatest [15].

3.2.5. Forest Therapy Involving Five Human Senses (> 2 Sessions of Intervention) Bang et al. conducted FT on elementary school students aged 9-12. The programme consisted of 10 weeks, including the five human senses, forest walking and exercise, creative handcraft activities, and sports games. Each weekly programme was 30 minutes long for health education and 60 minutes long for activities conducted in the forest. Heart Rate Variability (HRV) was employed to assess autonomic nervous system activity, as well as the Rosenberg Self Esteem Scale (RSE) and the Children Depression

Inventory (CDI). Compared to the control group, the experimental group demonstrated a significant improvement in self-esteem and a significant decrease in depressive symptoms after exposure. There was, however, no evidence that this experimental design stimulated the autonomic nervous system [22]. The effect of patients with gastrointestinal tract cancer was investigated by Kim H et al. The research was carried out on nine patients (1 male; 8 female). The Pittsburgh Sleep Questionnaire Index (PSQI), STOP-BANG (to assess sleep apnea), the Insomnia Severity Index (ISI), the Epworth Sleepiness Scale (ESS), the Standford Sleepiness Scale (SSS), and the Hospital Anxiety Depression Scale (HADS) are all used to assess sleep apnea.

The forest therapy was carried out over six days. The programme consisted of recreation, meditation, aromatherapy, *Hinoki cypress* experiences, stretching exercises in the forest, and foot baths. The forest healing recreation was done in groups and lasted around 30 minutes. The participants then had a 40-minute meditation session on a hammock suspended between trees. The participants were treated to aromatherapy massages utilising oil collected from forest woods and wood carving experience. Patients engaged in these activities daily, with their schedules varying from day today. There was no significant difference in this research's STOP-BANG score, PSQI scores, daytime sleepiness based on the Standford and Epworth Sleepiness Scales or depression anxiety scores. However, sleep efficiency was found to have increased as a result of the PSG data [23].

In 2019, Rajoo *et al.* conducted a multi-disciplinary study to create a forest therapy programme to help students handle academic stress. The first component of the study recruited 412 students aged 19–24 years in a survey to construct a forest therapy programme based on students' expectations. The second component was field research including 29 students aged 21-23 years to investigate the long term effects of the forest treatment programme on students' blood pressure. The established strategy included forest hikes, river soaking, and sensory stimulation (viewing waterfall). A half-day therapy session helped lower students' SBP and DBP and such effect persisted for five days. The exit survey confirmed the blood pressure result, with participants believing that FT had reduced their stress [24].

Kim H *et al.* investigated the effects of FT on women who had menopausal insomnia. In a survey, up to 56% of those polled experienced sleep problems, including insomnia [25]. Measurements used in this study was the ESS, SSS (to evaluate the daytime somnolence), HADS, PSQI, STOP-BANG, and PSG Questionnaire before and after the forest therapy programme. A blood sample was also derived from participants. Programme sessions lasted one week and accommodated up to six subjects. Meditation, gymnastics, 30-minutes and 1-2 hours of walks in the morning and afternoon, respectively, were parts of the forest treatment session. Participants received relaxing treatments. The Five Senses Experience Programme maximised the use of the five human senses. Tests revealed a considerable decrease in cortisol (the primary stress horm bone), while the psychological questionnaires revealed an increase in sleep and a decrease in sleep problems. Overall, sleep time was increased [3].

Kim JG *et al.* conducted a study on university students called Campus Forest Therapy. The participants were 38 university students with an average age of 22 years. A forest therapy programme of eight sessions was carried out. Each session was one and a half hours and was led by a certified forest therapist once a week. Participants were involved in forest therapy activities for eight sessions, using the POMS and SRI-MF (Stress Response Inventory) Questionnaire. The intervention in campus forest therapy had a substantial psychological impact. More precisely, individuals' emotional states and stress reactions improved significantly. According to the findings of this research, the campus FT had a positive impact on subjects' mental health [26].

Yu and Hsieh also investigated the effects of forests on creativity. This study included 23 subjects ranging in age from 25 to 70 years. Eight of the participants were men. Various activities involving the five human senses were included in this FT design. Using the Chinese Word RAT (CWRAT) and POMS as measuring tools, this study discovered that FT boosts pleasant feelings while decreasing negative emotions. FT also increased individuals' creative abilities by 27.74 per cent, demonstrating that this FT improves high-level cognitive functioning [27].

Interest in forest activity intervention is growing daily to assist youngsters in participating in effective attendance centre order programmes. Forest activities are beneficial as a place for psychological and

physical healing. Jeon *et al.* studied 50 juvenile probationers aged 15-20. The programme included three topics, and the goal was to notice good psychological and physiological improvements through forest activities. They reflected on the past and plan for the future. The study found that the group that participated in the FT programme experienced a significant improvement in psychological well-being after the programme, using the Well-Being Manifestation Scale (to measure psychological well being) and HRV (to measure autonomic nervous system reaction). Self-esteem, psychological equilibrium, social involvement, sociability, self and event control, also happiness were all psychological components that had significantly increased. The participants in the forest treatment programme showed beneficial improvements in HRV, showing that FT participants can acquire emotional stability through autonomic nervous system balance and parasympathetic nervous system activation [28].

Kotera and Fido examined the psychological well-being using WEMWBS-J and SCS-J questionnaires in 25 students (15 males and ten females, ages 18–28 years old). The *Shin-rin Yoku* retreat included a stroll about the area on day one, water and earth activities on day three. Each day, participants practised meditation and yoga in a group setting to bring their five senses to consciousness. The intervention took 13 hours to complete. The FT programme increased self-compassion, shared humanity, and mindfulness compared to before the FT programme. However, the mean mental well being and loneliness scores did not alter statistically substantially [29].

3.2.6. Relaxing Activities In The Forest As A Form of Forest Therapy Besides involving the five senses, walking and viewing forest ecosystems, there were also studies using unguided relaxing activities as FT methods. Vujcic and Tomicevic-Dubljevic studied depression and anxiety on 47 participants aged 22-32 (76% women) using the Depression Anxiety Stress Scale (DASS-21). The forest therapy group engaged in two hours of relaxing activities in an arboretum forest (laying down, walking, sunbathing) every day for five weeks. At the same time, the control group was located indoors. Vujcic et al. found that participants who engaged in relaxing activities in the forest had a higher tendency to have a lower stress level [30].

Many people around the world suffer from mental health issues. Because this problem is both costly and destructive to societies, initiatives are desperately needed. As a result, the finding of a new treatment is critical. Bielinis *et al.* studied 18 women with affective disorders, nine women with psychotic disorders, nine men with affective disorders, and 14 men with a psychotic disorder. Patients participated in the forest strolling with extra exercises in the forest ecosystem under the supervision of a skilled therapist using the POMS Questionnaire and the State-Trait Anxiety Disorder (STAI). This research discovered that forest treatment had a favourable benefit on all POMS subscales of affective disorder, except for anger-hostility, bewilderment, and depression-dejection, which were significantly decreased, as was the degree of anxiety measured using the STAI-S scale. The bewilderment and vigour subscales and the STAI-S scale exhibited the highest shift in psychotic illnesses. There were no significant changes in the fatigue subscale in patients with psychotic illnesses [31].

Kim JG *et al.* studied relaxing forest activities as an FT design. For the experiment, 38 university students were recruited. The participants were divided into 14 males and 14 females. The interventions were carried out once a week during the day, according to the participants' preferences. During each of the intervention's eight sessions, the participants were requested to walk along the planned route in the campus forest and visit specific sites where explanatory panels on forest activities were placed. The POMS Questionnaire, SRI-MF (as a stress response inventory), and Concise Measurement of Subjective Well-Being were utilised as measurement instruments. This study discovered that individuals in the forest activities intervention group had significantly higher scores in positive mood indicators, stress response than those in the control group who did not participate in any forest activities [32].

3.2.7. Traditional Medicine-Based Forest Therapy Yi et al. developed two FT programmes involving Korean-based medicine called "Walking Programme" and Breathing Programme. They used particular traditional therapy techniques (TKM). The first programme is known as the Walking Programme (WP), and its main design point is strolling in a forest ecosystem to increase sweating. The second program is

known as the Breathing Programme (BP), which is beneficial for physiological health. Both programmes were created to improve the health of older adults. This study included 90 patients aged 72-79 years, with 29 assigned to BP, 31 assigned to WP, and 30 assigned to the control group. The intervention lasted two hours per daily session for 11 sessions with one session per week. Compared to the control, the BP and WP improved neural and parasympathetic nervous function, respectively, and both FTs improved bioimpedance. The BP increased the phase angle in the upper limbs while the WP increased the phase angle of the lower limbs [33].

In 2021, Yi *et al.* further analysed the effect of the FT programme using the Qigong exercise. *Taoin* massage which combined meridian relaxation, body scanning, body balancing, and sensory attention, motion coherent breathing techniques were also applied. Such a technique was found to increase the body's sensory awareness, activate therapeutic Qi and blood circulation via the meridian system and peripheral arteries, and stabilise the *Qi* (a cool-down procedure). The WP, on the other hand, was the other FT approach used; the primary component of WP was vigorous. While walking, Yongquan (K11) acupoints were stimulated. This form of therapy is known to have beneficial effects on cognition, hypertension and blood circulation, and sleep disorders. The Korean version of the Montreal Cognitive Assessment (MoCA), The Korean version of the Geriatric Depression Scale (GDS), and EQ-5D are used to assess neuropsychological (cognition, depression, and quality of life). Electroencephalogram (EEG), Bioimpedance, and Photoplethysmography were used to measure psychological parameters (PPG). The WP group outperformed the control group in neurocognition (increases in the MoCA score, alpha and beta band power values in EEG), sympathetic nerve activity, and lower body impedance. On the other hand, the QP group demonstrated reduced depression and increased bioimpedance phase angle in the upper body. In conclusion, both activities in the forest were demonstrated to have significant cognitive and electrophysiological benefits, and both were useful in preventing dementia and treating related health problems in senior members[34].

3.3. Other Findings

Park *et al.* used a modified version of the Mindfulness-Based Stress Reduction (MSBR) therapy. The programme consists of lying-down meditation, Seon yoga, serotonin walking, healing touch, stress reduction meditation, and natural meditation. A professional instructor guided the three-day programmes. Serotonin levels were tested in 53 middle-aged women between the age of 40 and 64 in this research. Subjects were divided into two groups; one group engaged in a three-day forest programme followed by a three-day city programme. In comparison, the other group did the opposite. It was established that forest therapy helped enhance health due to serotonin's impact. This study's meditation-oriented forest treatment programme can promote sickness prevention and quality of life by increasing serotonin levels. The effects of the FT programme described in this research can be viewed as a mix of the impacts of the forest environment and the effects of the FT programme [35].

Another interesting research conducted by Machakova *et al.* analysed the effect of forest therapies on aggressive behaviour based on monitoring the social behaviour of forest animals with concurrent therapeutic activity of *Shin-rin Yoku* and Outdoor Behavioural Therapy (OBH). This research involved 68 teenagers from institutions with substitute social care with diagnoses affective disorders and family-related behavioural disorders, aged 12–16 years. The therapeutic effect of *Shin-rin Yoku* therapy was used in this forest programme design, which was reinforced with forest pedagogy, and observational learning focused on the concept of partnership, adaptation, and cooperation in forest animals. Forest treatments were conducted twice a week for two months (two hours of therapy). Adolescents were constantly monitored by a skilled mental health expert, who could intervene if an outburst occurred. For aggressive symptoms, projective tests were utilised as a diagnostic tool. The experimental intervention had a statistically significant influence on lower final values for psychopathology, irritability, restlessness, emotional instability, egocentrism, relativity, and negativism [36].

Kim and Shin analysed the difference between a guided FT and a self-guided FT. This study included 37 undergraduates (23 men and 14 females). The subjects were separated into 19 for self-directed forest treatment and 18 for guided forest therapy. In the guided FT, a trained forest therapist guided sessions.

During the programme's eight sessions, participants participated in each of the eight sessions together. They engaged in various activities, including familiarising themselves with the forest, clapping exercises, forest orienteering, forest strolling, and talking to nature. In the self-guided therapy programme, five forest activities were selected to apply as the self-guided forest therapy activities: stretching, respiration, walking, meditation, and exercise. Kim and Shin further used self-reported essays written by the subjects. Based on the research conducted it is concluded that self-guided FT allows for self-reflection through focusing on and thinking about one's inner self. On the other hand, Guided FT produces good emotional improvements while also fostering social relationships through interaction with others. As a result, because the effect obtained vary based on the sort of FT [37].

4. Conclusion

Based on the systematic literature review, there is still a low amount of literature research on forest therapy and forest bathing. Synthesis of these works of literature resulted in the categorisation of methods used for FT intervention. FT methods used by researchers are forest walks, forest viewing, the combination of forest walks and viewing forest landscapes, therapy programmes involving five human senses, doing relaxing activities in the forest and traditional medicine-based therapy. On the other hand, there were also combined methods used. All of these methods were demonstrated to be benefited human health. The limitation of this finding is the broad types of forest used for forest therapy. Further research on types of forests that are used for forest therapy is suggested regarding this matter.

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