

The Effects of Forest Bathing on Anxiety in Adults: An Integrative Review

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Abstract

The aim of this study is to explore the effects of forest bathing on anxiety levels in adults. An abundance of forest bathing research evidence is present in the literature. There are documented physiological and psychological benefits from walking or spending time in forest nature. Yet, there are still many unanswered questions about the health benefits of forest bathing for humans. In this study, an integrated review of forest bathing specific to the effect on anxiety levels in adults is the focus. A thorough search of six electronic databases (CINAHL, Health and Medical Collection, OVID, Pub Med, Public Health Database, and Science Direct) for research articles published between 2015 and 2020 to evaluate the most recent evidence was completed. From the start, with 590 narrowed search results, four phases of identification, screening, eligibility, and inclusion brought the study to a final number of 11 research study articles. Additionally, the study included a scientific rigor evaluation of the latest evidence. The study found evidence of decreased anxiety levels after forest bathing. Additional research with high levels of scientific rigor is warranted to continue the evidence base about the effects of forest bathing.

Keywords: forest bathing, walking in the woods, spending time in the woods, phytoncides, anxiety

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"And into the forest, I go, to lose my mind and find my soul."

--John Muir, Father of National Parks in America



Forest bathing is a translation of the Japanese term, “Shinrin-yoku” which means spending time in forests (Hassan et al., 2018). Forest bathing is spending time in forests or wooded areas as viewing/watching the landscape, walking, or combining both. Health benefits from forest bathing include increased T lymphocyte killer cells counts, increased expression of anti-cancer proteins (Li et al., 2008), and decreased cortisol levels (Doimo et al., 2020; Kobayashi et al., 2017; Li, 2010; Lee et al., 2010). Forest bathing results in relaxation and reduced stress (Bielinis et al., 2018; Dogaru, 2020; Hansen et al., 2017) and reduced anxiety (Dogaru, 2020; Doimo et al., 2020; Hassan et al., 2018; Lee et al., 2014; Ochiai et al., 2015; Wen et al., 2019; Yu et al., 2017). Many researchers have found forest bathing effects include blood pressure reduction (Hassan et al., 2018; Ideno et al., 2017; Lee et al., 2010) and lower heart rates (Lee et al., 2014). The evidence for the health benefits from forest bathing is increasing, but more questions require examination. This study sought to focus on the forest bathing effects on anxiety levels in adults.

Background and Conceptual Framework

Anxiety is a common experience for many people and is a normal part of life (Maharaja, 2018). For example, people may be anxious about a school assignment, employment, or a special event. Such anxiety is present, but the person can function. Anxiety disorders are much more concerning, including excessive anxiety, fear, and behaviors that interfere with functioning (American Psychiatric Association, 2016). In the United States, 40 million people aged 18 years and older have anxiety disorders (Anxiety and Depression Association of America, 2020; National Alliance on Mental Illness, 2017). Forest bathing is one holistic health activity worthy of further research to examine the effect of decreasing anxiety levels.

Forest physiognomy refers to describing the forest appearance, humidity, temperature, location, pathway quality, height and spacing of trees, and the dominant trees in the forest. A clear and complete forest physiognomy is an essential component of a rigorous scientific study about the effects of forest bathing. To build a quality foundation of research evidence, the communication of forest physiognomy is a significant factor. A small, treed greenspace area in an urban setting may produce different health effects than a larger forest setting in a rural setting. Describing forest physiognomy in research articles is a vital aspect to appraise rigor and analyze data related to the environment. Detailed forest physiognomy descriptions improve the study report rigor with explicit accounts of the forest setting. Clear portrayals promote the ability to analyze differences and similarities in the forests in connection to the forest bathing results.

Phytoncides are antimicrobial organic tree and plant compounds that are volatile and permeate the air near trees and plants (Franco et al., 2017; Stanhope et al., 2020). Phytoncides function to guard plants and trees against fungi, bacteria, and harmful insects (Shin & Lee, 2018). While forest bathing in greenspaces, humans inhale the scentless and tasteless phytoncides (Franco et al., 2017). Specific to anxiety, phytoncides has had decreased effects on mice subjects (Antonelli et al., 2020). Li et al. (2006) found that phytoncides reduce stress levels in rats. Phytoncides decrease stress, promote relaxation, and sleep (Antonelli et al., 2020; Franco et al., 2017; Lee et al., 2012; Woo & Lee, 2020). Further research is necessary to examine the effects that phytoncides have on humans. Although this study did not seek to analyze the effects of phytoncides specifically, it is worthy of mention as it may have a physiological impact. A need for additional research evidence of forest bathing, phytoncide effects on humans, and effects on anxiety in adults warrants further investigations.

Research Problem, Purpose and Research Questions

The research problem is the need to prevent and treat anxiety in humans. The lives of many humans are affected by anxiety (Anxiety and Depression Association of America, 2020; National Alliance on Mental Illness, 2017), whether non-pathological or anxiety disorders. The purpose of this comprehensive review was to identify and evaluate the effects of forest bathing (walking or viewing/watching forest landscape) on anxiety levels. The population of focus in this study was adults 18 years of age and older. The study evaluates research articles dated within the past five years to identify the current state of research literature related to forest bathing and anxiety. Additionally,

the study includes an evaluation of the scientific rigor of the studies. The researcher aims to examine the strengths and gaps in the current literature base.

For this integrated review study, the research questions were:

- 1). What is the effect of forest bathing (walking) on anxiety levels in adults aged 18 years and older?
- 2). What is the effect of forest bathing (viewing/watching) in a forest setting on anxiety levels in adults aged 18 years and older?
- 3). What is the scientific rigor of the forest bathing studies reviewed?

Methodology

This manuscript reviews research study reports investigating the effects of forest bathing on anxiety in adults using an integrative research review study approach. The integrative review design allows for diverse methodological approaches, for example nonexperimental and experimental studies in a review (Whittemore & Knafl, 2005). The study used the preferred reporting items for systemic reviews and meta-analysis (PRISMA) to direct the report delivery. According to PRISMA, the adaptation of guidelines for use with integrative reviews or other research reviews is appropriate (Page, 2021). PRISMA is a guideline to use for structuring and writing reviews. An integrative review should include the identification process for articles, inclusion/exclusion criteria, screening, eligibility, and the final included articles. Whittemore and Knafl (2005) recommend using five stages to organize the integrative review. The five stages of review are problem identification, literature search, data evaluation, data analysis, and presentation (Whittemore & Knafl, 2005). Whittemore and

Knaff's (2005) framework served to double-check and strengthen the study by using a nursing guide for integrative reviews in addition to the PRISMA guidelines. Moher et al. (2009) recommended the type of review in the article title and was in this study by including the words "integrative review." The study synthesis, limitations, conclusions, and implications for practice are PRISMA recommendations (Moher et al., 2009; Page, 2021) and included in this paper.

Literature Search

The study used a four-phase search of peer-reviewed research articles to find the final inclusion articles. The first phase of the literature search included a search for the effects of forest bathing research articles published 2015 to 2020 in six databases. Search terms were forest bathing and forest therapy. Search modifiers used were full text, peer review, research, and English. The initial search resulted in a total of 590 articles. The databases were CINAHL, Health and Medical Collection, OVID, Pub Med, Public Health Database, and Science Direct. The CINAHL search engine results located ten articles. The Health and Medical Collection database had 201 study papers. The OVID database found zero articles. Pub Med database had 284 study reports. A search using Public Health Database found 17 articles. The Science Direct database produced 78 articles.

The second phase included reviewing the 590 articles to assess for the terms forest bathing or forest therapy in the article's title or the abstract. During the second phase, duplicate reports were a sign of saturation and excluded. After assessing each title/abstract, 369 articles were remaining. During the second phase the realization that

some articles may not include all the search terms and inclusion criteria in the title or abstract was noted.

The third phase included retrieval of the full-text articles for a more in-depth review. In studies that examined multiple forest bathing effects, the term anxiety was not always present in the title and abstract, so the combination of forest bathing (or therapy) and effects of anxiety were in two steps for best search effects. After locating full text articles of forest bathing or forest therapy research, the researcher completed an assessment of each article for anxiety effects and a measure of anxiety. This procedure clarified that the study specifically had a focus and measurement of anxiety. The determination of anxiety may include the Profile of Mood States (POMS) or State-Trait Anxiety Inventory (STAI), or another anxiety measure. After this third phase review, 23 articles were remaining.

The fourth phase was a deep evaluation of the full-text articles to assess the inclusion criteria of being in a forest setting and scientific rigor. Boutron et al. (2021) state the risk of bias in research studies must be part of the article appraisal. The study procedure included assessing study strengths, limitations, and risk of bias of each research article. The study excluded any study that had a significant concern with internal validity or risk of bias. After the fourth phase was complete, 11 studies remained for final evaluation and inclusion in the study (See Figure 1 PRISMA flow chart).

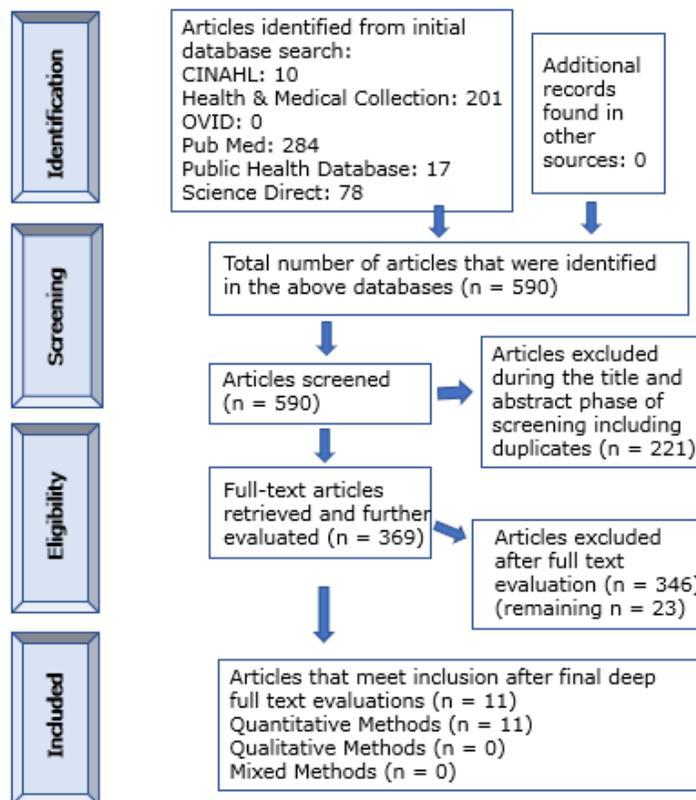
Inclusion

For inclusion of a research paper into this study, a full-text, English language research article must have a central focus on the benefit of forest bathing or forest

therapy and anxiety, including one or more anxiety measures. The study may be quantitative, qualitative, or mixed methods. An investigation may include other dependent variables as this is holistic. For example, a study may examine many effects of forest bathing and be included. However, this examination focused on the effects that forest bathing has on anxiety. Forest therapy is a term used instead of forest bathing. The term "forest therapy" (instead of forest bathing) was acceptable if a description that includes walking or viewing of forests in a forest setting (not laboratory setting) was in the article.

Figure 1.

PRISMA Flow Chart



Note: This table summarizes the literature search processes of identification, screening, eligibility, and inclusion.

Exclusion

Exclusion criteria included less than full-text articles, abbreviated conference proceedings, research briefs, and in a language other than English. Papers that did not have anxiety met exclusion. Small-sized pilot studies, duplicate articles, scoping reviews, and literature reviews met exclusion criteria. Other exclusion criteria were studies that used animal subjects or children under the age of 18. Publications with significant concerns after reviewing internal validity and risk of bias met exclusion criteria (See Table 1). The study protocol was open to quantitative, qualitative, and mixed methods, but the final 11 studies were quantitative. Some mixed-method studies met exclusion criteria for not having an anxiety focus and measure. All remaining 11 studies were quantitative.

Table 1.

Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Full-text articles written in English	Non-full-text articles
Original research	Other than English language
Systemic reviews, meta-analysis	Small pilot or case studies
Qualitative, quantitative, mixed	Not a research article
Methods	Duplicates
Human subjects	Animals
Adults aged 18 and above	Children under 18 years
2015 to 2020	Internal validity concerns
Anxiety effects examined	Risk of bias unacceptable
	Laboratory setting studies
	Watching videos of forests

Note: This table summarizes the criteria for inclusion and exclusion of research articles to the study.

Data Extraction, Analysis of Data, and Synthesis

The study used a data table to compile the four-step data extraction. The data summary table included the research methods, designs, sample sizes, sampling,

measures, protocols, forest physiognomy, findings, and quality evaluation information for the final 11 articles. The table included a notes area for each study for any additional comments. The researcher read each study several times and recorded their summary table. The study used a four-step approach for article immersion. The first step was to read the entire article and complete as much of the table as possible. The second step included an in-depth evaluation of the forest physiognomy descriptions and completing the Forest Setting Physiognomy Description Score (FSPDS) (See Table 2). A critical analysis of the findings and then creating word codes and coding were during the third step. The fourth step was an appraisal of the table data for accuracy and final revision.

Table 2

Forest Setting Physiognomy Description Tool Score Legend

Score	Forest Setting Physiognomy Description Tool Score Legend
1	Minimal description that lacked more than 6 of the following elements: location by name, hilly or flat domain, types of trees, lighting (time of day), pathways, temperature/humidity weather averages, season, and lacks the time spent in forest setting
2	Good description that included some of the elements (but not all; more than 3 elements were missing) of location by name, hilly or flat domain, types of trees, lighting (time of day), pathways, temperature/humidity weather averages, season, and lacks the time spent in forest setting
3	Excellent description that is clear and included most of the elements (could be lacking 1) of location by name, hilly or flat domain, types of trees, lighting (time of day), pathways, temperature/humidity weather averages, season, and lacks the time spent in forest setting
	Description of the Forest Setting Physiognomy Description Tool (FSPDT): The FSPDT is a quantifiable score of the quality of a forest setting description intended for use when appraising forest bathing research articles.

Note: By Nancyruth Leibold, CC, BY, NC

Quality Evaluation of Studies

The study design includes three tools for evaluating the scientific rigor of the final 11 research study articles to answer the research question: What is the scientific rigor of

the forest bathing studies reviewed? First, the Levels of Evidence (7 level scale) described by Melnyk and Fineout-Overholt (2019) and Christenbery (2018) assisted in assessing each study. Second, the Critical Appraisal Guide for Quantitative Studies by Fineout-Overholt et al. (2010) also includes the seven levels of evidence and guided the critical quality appraisal. Third, the Forest Setting Physiognomy Description Score (FSPDS) tool to appraise the quality of the forest setting description is an essential factor for forest bathing research. The forest setting is a critical aspect of the review since evidence has found significant differences in the findings of different locations (urban versus forest) (Hassan et al., 2018; Ideno et al., 2017). The researcher created the FSPDS tool after extensive searches did not find one for use. The FSPDS tool (see table 3) is a quantifiable score of the quality of a forest setting description intended for use when appraising forest bathing research articles. There are three possible scores, 1-3, with three being the highest quality score. Users select the description for 1, 2, or 3 that best matches the forest physiognomy description in the research article.

Quality Assessment Results

Several aspects of quality assessment were present in the current study. One was the quality of forest physiognomy. The second was the quality of scientific rigor in the study elements. The study evaluated the quality of each included research article using the seven-scale level of evidence and Fineout-Overholt et al. (2010) framework for quantitative appraisals, including the levels of evidence.

Quality of Scientific Rigor

Fineout-Overholt et al. (2010) describe the creation of an evaluation table that includes study specifics. Fineout-Overholt et al. recommend summarizing study

specifics such as sample size, sampling, method, design, level of evidence, setting, variables, measures, and results in an evaluation table (2010). This study used a data extraction table that includes a summary of study specifics. The data was subsequently summarized in a research summary table for presentation in the results section.

Quality of Forest Physiognomy

Forest physiognomy is the forest appearance, humidity, temperature, location, pathway quality, height and spacing of trees, and the dominant tree species in the forest. The description of the forest physiognomy is a vital aspect of rigor in forest bathing research because the forest setting may impact study results. For example, the tree species may have different types of phytocides or other factors that influence the effectiveness of forest bathing. Therefore, it is necessary to include detailed descriptions of the forest settings. Researchers have documented significant differences in walking and spending time in urban areas compared to forest areas (Song et al., 2016). By describing the forest physiognomy in detail, researchers can discover any further differences between forest settings. Researchers may also study environmental factors such as climate change and deforestation for any impact. The FSPDT is a new approach to quantify the quality of forest physiognomy descriptions in research reports.

Results

The study results are in order of the research questions. The first research question, "What is the effect of forest bathing (walking) on anxiety levels in adults aged 18 years and older," findings are first (See Table 3).

Table 3

Summary of Included Studies for Forest Bathing and Anxiety Effects

Num ber	Authors, Year	Aim	Method, Design, Sampling	Findings
1	Hassan et al. (2018)	The objective of the study by Hassan et al. (2018) was to examine the physiological and psychological effects of walking in forests.	Quantitative, true experimental design; 60 University Student Participants; control group = 30, intervention group = 30; age range of participants 19-24 years	The bamboo forest walking group had significant reductions in anxiety as compared to the city walk control group
2	Furuyashiki et al. (2019)	To examine the psychological and physiological effects of forest bathing on working age people with and without depressive tendencies.	Quantitative, quasi-experimental before and after intervention groups; N =219 but some participants were not chosen due to inclusion criteria; n = 155 people; 37% had depressive tendencies, one group with depressive tendencies and one group without depressive tendencies	All participants had significant decreases in negative Profile of Mood States (POMS) items after a forest bathing session. The group with depressive tendencies had a greater decrease of negative POMS items than those without depressive tendencies, many of which no longer differed in scores than the non-depressive tendency group.
3	Lee et al. (2017)	To assess the effect of forest bathing and evaluate the rigor of 28 research studies.	Quantitative, systemic review of 28 articles	Significant reductions in anxiety and tension after forest bathing when compared to urban walkers.
4	Song et al. (2019)	To examine the physiological and psychological effects of forest bathing on young women	Quantitative, randomized control trial with pretest posttest design; 60 participants randomly assigned to city (control) or forest (treatment) groups	Significant differences between the forest and city groups for all psychological measures; After forest bathing treatment group Had lower anxiety and higher relaxation

Table 3 (Continued)

Num ber	Authors, Year	Aim	Method, Design, Sampling	Findings
5	Takayama et al. (2019)	To examine the traits of individuals for influence on the restorative effects received from four forest settings and four urban settings	Quantitative, randomized control trial with pretest posttest design; 46 male university student participants in their twenties with no history of psychological or physical disorders were randomly assigned into smaller groups of 5 or 6	Individual traits relate to forest and urban setting walking effects; The researchers found significant correlations between vigor, distancing, fatigue, environment, confusion, meal, and emotion focused stress coping that impacted effects of forest bathing
6	Bielinis et al. (2018)	To investigate the effects of winter forest bathing on human psychological states	Quantitative; pretest and posttest design with two treatment groups; 62 Polish University students (26 females, 36 males) with random assignment into two different treatment groups; each group had 13 women and 18 men; One treatment group was an urban setting, and one treatment group was a forest setting	Participants in the forest bathing group experienced a decrease in anxiety and increased relaxation state
7	Mao et al. (2018)	To examine the effects of forest bathing on patients with congestive heart failure	Quantitative, randomized control trial with pretest posttest design; Participants were 36 patients with congestive heart failure (CHF) from the urban area in Hangzhou City, China; forest group had 23 and city group had 10 participants	Reduced tension-anxiety was significantly statistically after forest bathing

Table 3 (Continued)

Num ber	Authors, Year	Aim	Method, Design, Sampling	Findings
8	Kim, J. G. et al. (2020a)	To examine the psychological effects of a campus forest therapy program; the forest therapy program is described as 8 sessions in a forest area and included clapping, dance, rapport building, stress reduction activities, walking in forest, uses five senses in forest	Quantitative; pre-test and post-test control group design; 38 participants; random assignment of 19 participants in control group and 19 in treatment group;	Statistically significant reduction in anxiety and tension as well as anger-hostility, depression-dejection, fatigue-inertia, confusion-bewilderment; statistically significant increase in vigor in the forest bathing group
9	Ochiai et al. (2015)	To assess the physiological and psychological benefits of forest therapy in middle aged women; forest therapy was day long and had alternating walking, breathing exercises, one short lecture, resting, and lunch; all but lunch were in the forest setting	Quantitative; pretest and posttest design with treatment group only; 17 female Japanese participants with a mean age of 62.2 years;	After forest bathing, participants had statistically significant lower anxiety and tension levels and higher levels of vigor
10	Kim, H. et al. (2020b)	To analyze the impact of forest therapy in post menopausal women with insomnia	Quantitative; prospective, single arm study with pretest and posttest design	Anxiety levels decreased after forest therapy but was not statistically significant; sleep efficiency improved and was statistically significant; Note the researchers report the forest setting was not well controlled in study

Table 3 (Continued)

Num ber	Authors, Year	Aim	Method, Design, Sampling	Findings
11	Song et al. (2020)	To examine psychological effects of viewing forest landscapes	Quantitative, randomized control trial with post intervention measures only; 650 male university student participants; groups viewed in the forest setting and urban setting for comparisons	After viewing forest landscapes participants had decreased anxiety and decreased negative mood states; participants who had the highest anxiety had the largest reduction in anxiety levels after watching forest landscapes

Note: This is a summary of the research articles for presentation.

Walking Time in Forests and Effects on Anxiety

The first research question was, “What is the effect of forest bathing (walking) in a forest setting on anxiety levels in adults aged 18 years and older?” Nine of the 11 studies examined the effects of walking in forests. One study focused on individual traits and correlations to effects of forest bathing (Takayama et al., 2019). The study is unique and has a fascinating twist as some individuals with specific traits may reap more benefits from forest bathing (Takayama et al., 2019). Six studies examined walking in the forest and the effects on anxiety and found statistically significant decreases in participant anxiety after walking in the forest (Furuyashiki et al., 2019; Hassan et al., 2018; Lee et al., 2017; Mao et al., 2017; Ochiai et al., 2015; Song et al., 2019). Two studies, one by Kim et al. (2020a) (n = 38) and another by Kim et al. (2020b) (n = 35), found a decrease in anxiety after walking in the forest, but it was not statistically significant.

Spending Time in Forests and Effects on Anxiety

The second research question was, “What is the effect of forest bathing (watching/viewing) in a forest setting on anxiety levels in adults aged 18 years and older?” Two of the 11 studies examined spending time and viewing in forests. The participants viewed forest landscapes while in forest settings. Bielinis et al. (2018) studied the effects of adults standing in a forest setting in the winter for 15 minutes, while a control group viewed an urban environment in the winter for 15 minutes. The forest group had significant reductions in anxiety and improved states of relaxation compared to the urban group (Bielinis et al., 2018). Similarly, Song et al. (2020) used a

treatment group of adult males to view forest landscapes in forest settings and a control group of adult males to view city landscapes for 15 minutes. The participants in the forest group had an increase in positive mood states (included an increase in state of relaxation) and a decrease in negative mood states (included a decrease in anxiety) (Bielinis et al., 2018).

Levels of Evidence Analysis

The third research question, “What is the scientific rigor of the forest bathing studies reviewed” data reports are in the following three sub-sections. The levels of evidence of the 11 studies ranged from level I to level IV. One study was a level I systemic review (Lee et al., 2017). Six studies were level of evidence II randomized clinical trials (Bielinis et al., 2018; Hassan et al., 2018; Mao et al., 2017; Song et al., 2019; Song et al., 2020; Takayama et al., 2019). Two studies were level of evidence III, quasi-experimental studies (Furuyashiki et al., 2019; Kim et al., 2020a). Two studies were level of evidence IV experiments (Kim et al., 2020b; Ochiai et al., 2015). Seven of the 11 studies were of high evidence levels. Four studies were moderate levels of evidence.

Quantitative Appraisals

All 11 studies included non-probability sampling. Nine of the 11 studies had small to moderate sample sizes. Hassan et al. (2018) used a randomized control trial (RCT) and a non-probability sampling procedure using publicity posters on a university campus. Sixty participants (30 female and 30 male) were recruited for the study (Hassan et al., 2018). A systemic review study by Lee et al. (2017) included 28 articles.

The study by Lee et al. (2017) is of high scientific rigor, level of evidence I, and followed PRISMA guidelines for reporting evidence. Lee et al. (2017) used the Scottish Intercollegiate Guideline Network (SIGN) measurement tool for risk of bias assessment.

Furuyashiki et al. (2019) used an RCT design and non-probability sampling procedure that excluded severely depressed individuals but did include persons with depressive tendencies. The study included 155 participants (Furuyashiki et al., 2019). Interestingly, individuals who scored higher on the Profile of Mood States (POMS) items related to depression before forest bathing had greater improvements after forest bathing and had scores similar to those without depressive tendencies after forest bathing. More study of this phenomenon is warranted, but perhaps those with depressive tendencies (often linked with anxiety) may have even more significant benefits from forest bathing (Furuyashiki et al., 2019).

Song et al. (2019) used a RCT design, and non-probability sampling of university students. The participant size was 72 females (Song et al., 2019). Takayama et al. (2019) used a RCT design and non-probability sampling procedure that produced 46 male undergraduate and graduate university students. Bielinis et al. (2018) used a RCT design and non-probability sampling procedure. The study has 62 Polish university students (26 females and 36 males) (Bielinis et al., 2018). Mao et al. (2017) used a RCT design and non-probability sampling of 36 patients with congestive heart failure. Kim et al. (2020a) used a quasi-experimental design, non-probability sampling, and had 38 participants in the study. Ochiai et al. (2015) used a comparison study design with 17 participants. Kim et al. (2020b) used a non-probability sampling technique, pre and post one-group design with 35 female participants. Song et al. (2020) used a CRT design

with non-probability sampling and had 650 male university student participants in the study.

Forest Setting Physiognomy Descriptions

The study included appraisals of each study with FSPDT score appraisals. One study (Lee et al., 2017) was a systemic review, and therefore the FSPDT score is not applicable. Four of the FSPDT scores were 3, meaning the forest physiognomy description was excellent. Some reports included images in addition to the text descriptions. The photos were helpful by providing a visual representation along with the narrative of the setting. Five of the studies had FSPDT scores of 2. A score of 2 is a good description that includes some forest physiognomy descriptions, but three or more elements were missing. One study had a minimal description of the forest physiognomy that lacked more than six major elements of the forest setting.

Discussion

The study sought to investigate current research dated 2015-2020 about forest bathing effects on anxiety. Researchers reported walking or viewing in the forest decreased anxiety in eight of the 11 studies with statistical significance. Two other studies, both with smaller numbers of participants, found decreased anxiety levels after forest bathing, but the findings were not statistically significant. Perhaps larger numbers of participants would impact the results with statistical significance. Another study reported individual traits that correlate with effects, but the study is a new, innovative idea that needs further investigation.

Seven of the 11 studies were level of evidence I or II in this study (Bielinis et al., 2018; Hassan et al., 2018; Lee et al., 2017; Mao et al., 2017; Song et al., 2019; Song et al., 2020; Takayama et al., 2019). Four of the 11 studies were level of evidence III or IV in this study (Furuyashiki et al., 2019; Kim et al., 2020a, Ochiai et al., 2020, Kim et al., 2020b). Higher levels of evidence may improve confidence in the results of the studies. Using a longer year span, such as 2010-2020 for the search process of this study could make a future study of all evidence I and II studies, thus increasing rigor to a systemic review. Cause and effect have a link to high rigor because the RCT design is the gold standard for examining cause and effect (Melnyk & Fineout-Overholt, 2019). Additionally, the studies used non-probability sampling, which may have sampling bias (Elfil & Negida, 2017). A limitation of this project was the English language and, therefore, may not include some rigorous studies in other languages.

Four of the 11 studies received an FSPDT score of 3, meaning the forest setting description was excellent (Furuyashiki et al., 2019; Hassan et al., 2018; Mao et al., 2017; Takayama et al., 2019). Five of the 11 studies received an FSPDT score of 2, and 1 study had an FSPDT score of 1. Improved reporting of forest physiognomy would increase study rigor, as this is part of reporting settings. A limitation of the study analysis of forest physiognomy is the lack of reliability and validity studies with the new FSPDS. However, the tool does pay detailed attention to the significance of forest physiognomy in forest bathing research. Pointing out this vital aspect is a strength of the study. Future work to improve reporting of forest descriptions, developing the FSPDS tool, and testing reliability and validity are warranted.

A possible limitation was the study had one researcher. Since one researcher did the study alone, the investigator repeated the appraisal process six months later. The findings were the same on the first and repeated analysis and appraisal. Having a second or third co-investigator adds an additional check for accuracy to the project.

Conclusions

Overall, the study found decreased anxiety in adults after viewing or walking in forests. Although both forest bathing and urban walking have benefits, forest bathing had significantly reduced anxiety scores as compared to urban settings. The population in this study was adults. More research variety in populations to study the effects of forest bathing is needed. The findings are encouraging for the effects of reducing anxiety after forest bathing. Future research of high rigor is necessary to continue the evidence base development.

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Note: The image of the forest in front of the mountains is a free image for use from Canva.com account users

