

Letter to the Editor



Current Status of Forest Medicine Research in China*

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In recent years, due to regional pollution and deteriorating environment, combined with intense social competition and heavier life pressure, an increasing number of people are affected by lifestyle-related diseases and remain in a state of being sub-healthy. Therefore, health issue has been receiving unprecedented attention.

It is well known that the forest environment has a favorable influence on the human body and mind. Studies conducted since the past decade have systematically elucidated the effects of forest therapy on human health^[1-3]. In this article, we give a brief introduction of the current status of forest therapy research in China and then propose a model of forest medicine.

According to ancient records, Chinese people have been using the smell of trees to prevent and cure diseases since more than two thousand years ago. However, it was only in 2010 that Mao G et al. conducted a clinical trial that applied modern medical knowledge to explore the effects of forest environment on human health in China^[4]. In the subsequent years, several studies on forest therapy were initiated in China.

The first study on forest bathing was conducted in September 2010^[4]. That study explored the effects of short-term forest bathing on human health using 20 healthy college students who were randomly divided into two groups, one to the Wuchaoshan National Forest Park and the other to the urban area. No significant differences were observed in the baseline values of the indicators between the two groups. However, subjects exposed to the forest environment showed reduced oxidative stress and pro-inflammatory levels, as evidenced by the decreased levels of malondialdehyde, interleukin-6, and tumor necrosis factor- α (TNF- α) compared with those in the urban group. Serum cortisol levels were also lower in the group exposed to the forest

environment than in the urban group. Particularly, the concentration of plasma endothelin-1 (ET-1) was much lower in subjects exposed to the forest environment. Evaluation of the profile of mood states (POMS) revealed that after forest bathing, the participants had lower scores in the negative subscales, whereas the score for vigor was increased.

In contrast to the above mentioned study that experimented on healthy college students in their 20s, another study evaluated 24 elderly participants with hypertension (HTN)^[5]. After a 7-day forest therapy, there was a significant reduction in blood pressure compared to that in the city group. Mechanically, exposure to the forest environment significantly inhibited the activities of the renin-angiotensin system (RAS), which is involved in blood pressure regulation, implying that forest bathing has therapeutic effects on human HTN possibly by the inhibition of the RAS activities.

Regarding the benefits of forest environment and forest bathing in terms of human health, the first aspect that we think about is their 'washing effect' on the human respiratory tract. To test this hypothesis, 20 elderly patients with chronic obstructive pulmonary disease (COPD) were recruited in August 2013 to take a 3-day forest-bathing trip^[6]. The results showed a significant reduction in the expression of perforin and granzyme B, as well as that of pro-inflammatory cytokines and stress hormones, in the forest group. Meanwhile, the scores in the negative subscales of POMS were significantly decreased after the forest-bathing trip. These results indicated the positive effects of forest bathing on the health of elderly patients with COPD by reducing the inflammation and stress levels.

The close association between air pollution and cardiovascular events and death has been well

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documented^[7]. To determine whether forest therapy could be used as an adjunctive therapy for chronic heart failure (CHF), a clinical syndrome that develops as a result of various cardiovascular diseases, a total of 36 elderly participants with CHF were randomly divided in a ratio of 2:1 into two groups, 24 in the forest and 12 in an urban control area, for a 4-day trip^[8]. The subjects exposed to the forest site showed a significant reduction in the levels of brain natriuretic peptide (BNP), a widely used biomarker of CHF in the clinic, compared to those in the city group and their own baseline levels. Moreover, the values of the pathological factors related to cardiovascular diseases, including ET-1, and the constituents of the RAS, including renin, angiotensinogen (AGT), angiotensin II (ANGII), and ANGII receptor type 1 or 2 (AT1 or AT2), in subjects exposed to the forest environment were lower than those in the urban control group. Obviously, the forest group exhibited a decreased level of inflammatory cytokines and improved antioxidant function compared to that in the city group. In addition, the POMS assessment showed that the negative emotional mood state was alleviated after forest bathing.

To further investigate the impact span and the optimal frequency of the forest-bathing trip in patients with CHF, those who experienced the first forest-bathing trip were included again after 4 weeks and were then randomly included in the urban control group (city) and the forest-bathing group (forest), respectively^[9]. After a second 4-day forest-bathing trip, the subjects showed a steady decline in BNP levels and an attenuated inflammatory response as well as oxidative stress. This exploratory study indicated the additive benefits of twice forest-bathing trips in the elderly patients with CHF, which further paves the way for its application in the treatment of cardiovascular disorders.

Taken together, the current data obtained from studies on forest therapy in China have demonstrated the benefits of forest environments in terms of physiological relaxation and improvement in immune functions, as well as the adjuvant therapeutic effects in patients with HTN, COPD, and CHF.

Then, what are forest bathing and forest medicine? As a type of nature therapy, forest bathing was first proposed in the 1980s and has emerged as a recognized relaxation and/or stress management activity in Japan^[10]. It is commonly

defined as a visit to a forest field for the purpose of relaxation and recreation by breathing in volatile substances known as phytoncides (wood essential oils), which are antimicrobial volatile organic compounds derived from plants (trees), such as alpha-pinene and limonene^[10]. Regarding the concept of nature therapy, it is defined as a set of practices aimed at achieving 'preventive medical effects' through exposure to natural stimuli that result in a state of physiological relaxation and boost the weakened immune functions to prevent diseases^[11].

As shown in Figure 1, the concept of nature therapy, proposed by Miyazaki Y et al.^[11] in 2015, was focused only on physiological relaxation and improvement in immune functions. However, scientific data accumulated since the past two decades have supported the increase in the awareness of the positive benefits of the forest environment not only on physiological relaxation and immune functions but also in terms of the therapeutic effects in several chronic diseases, including HTN, COPD, CHF, diabetes mellitus type II (DMII), depression, stroke, and insomnia^[1,2,5,6,8,9,12-14]. Consequently, this rapid advancement in forest therapy encourages us to treat it not only as a treatment method but also as a discipline, i.e., forest medicine.

Although the concept of forest medicine was first proposed as early as 2006 in Japan (Shinrin-yoku) and its English name was used in Japan 1 year later^[15], it was not until 2012 that Li Q defined forest medicine as 'a new interdisciplinary science and a focus of public attention,' and as 'the study of the effects of forest environments on human health'^[15]. In our study, based on the results of existing research, we concluded that although there are

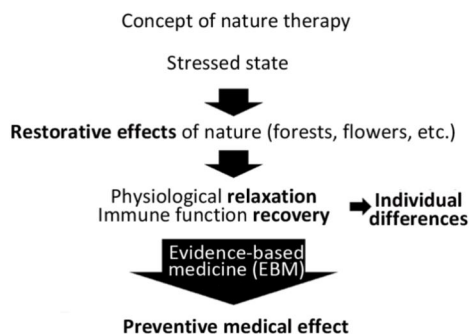


Figure 1. Concept of nature therapy^[11]. Permission to publish was obtained from Yoshifumi Miyazaki.

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