

Forest exposure and respiratory function: a literature review

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INTRODUCTION

Environmental health research has recently started to study in more depth the effects on health of well-being promoting practices based on forest exposure. Among others, potential benefits for respiratory function have gained attention.

AIM

To understand whether forest exposure can directly improve respiratory function.

METHODS

Scientific databases: PubMed, Cochrane Library, Google Scholar

Search date: April 29th, 2021

Keywords: “forest”, “shinrin yoku”, “nature therapy”, “pulmonary”, “respiratory”, “spirometry”, “inflammation”, “obstructive”

Inclusion criteria

- **Population:** healthy subjects or patients with respiratory diseases
 - **Intervention:** forest exposure
 - **Comparator:** any type, including no control
- **Outcomes:** spirometric indices or inflammatory markers in patients with chronic respiratory diseases
 - **Study design:** any type of clinical study

RESULTS

Population	Intervention (n) and forest site altitude	Comparator (n)	Outcomes*	Study design	Reference
60 elderly women	A single session of forest walking (40) - 1 h. Alt.: 150 mt a.s.l.	Walking in an urban area (20)	↑ FEV1 ↑ FEV6	RCT	Lee and Lee, 2014
65 stressed adults	A 7-day forest trip - 1 h/day spent in a forest with WF (33). Alt.: 1000 mt a.s.l.	Forest exposure (32) or no intervention (26)	↑ PEF (only significant for the forest+WF combination)	RCT	Grafetstätter et al., 2017
20 elderly patients with COPD	Forest bathing (10). Alt.: >1000 mt a.s.l.	Walking in an urban area (10)	↓ inflammatory and stress markers (no spirometry)	RCT	Jia et al., 2016
21 children with asthma	A 4-day forest trip - 2 h/day (21). Alt.: 333 mt a.s.l.	None (0)	↑ FVC = FEV1 ↓ FeNO	Pre-post study design	Seo et al., 2015
A 57-year-old male with asthma and occupational exposures to air pollutants	A 5-month program with regular light exercises in forest areas (1). Alt.: ?	None (0)	↑ FVC ↑ sleep quality ↓ symptoms	Case report	Edwards and Woods, 2018

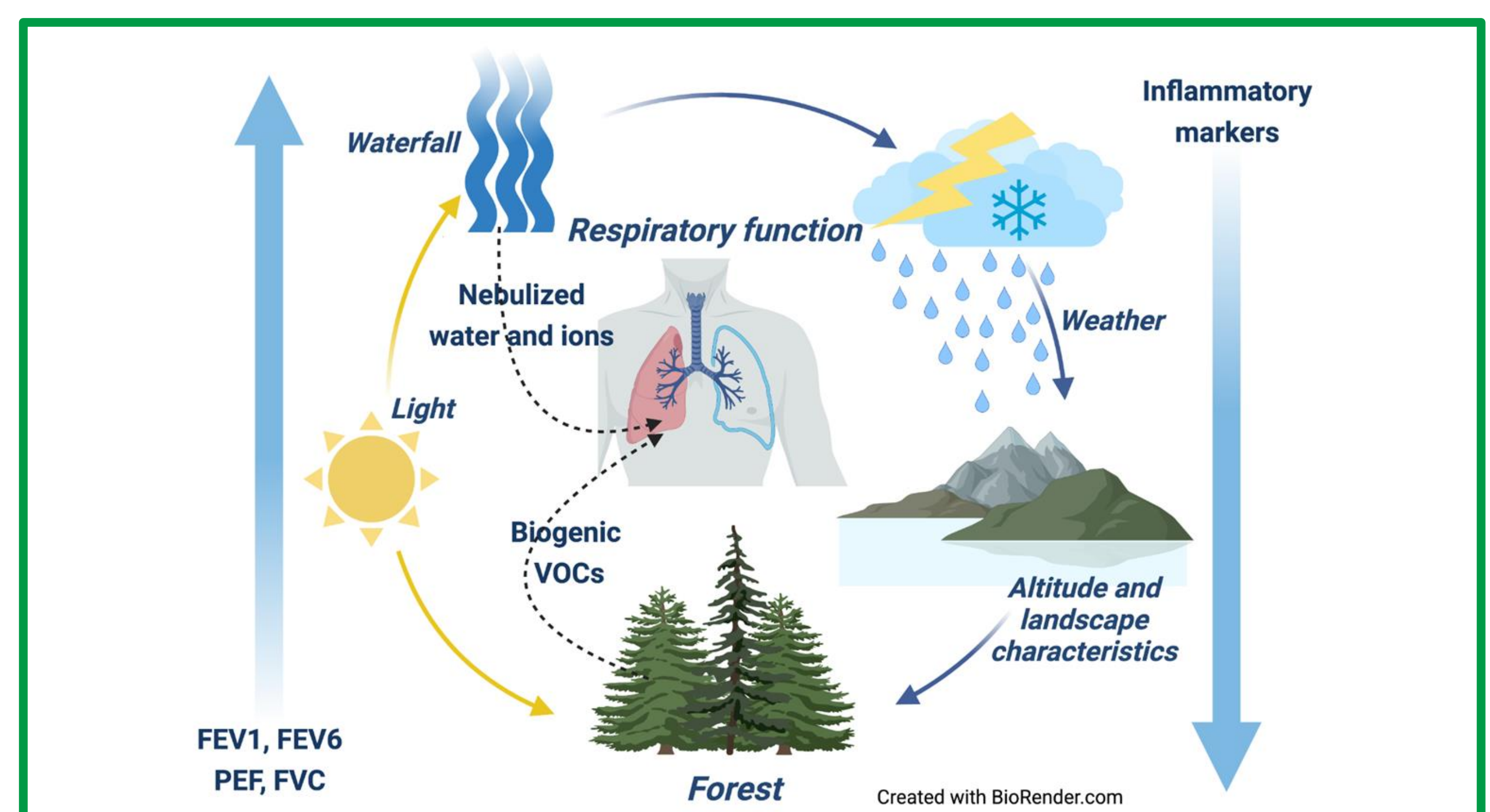
Table legends

*Significant changes in favor of intervention (p<0.05)

a.s.l.: above the sea level; COPD: Chronic Obstructive Pulmonary Disease; FeNO: Fractional exhaled Nitric Oxide; FEV1: Forced Expiratory Volume in the 1st second; FEV6: Forced Expiratory Volume in the 6th second; FVC: Forced Vital Capacity; PEF: Peak Expiratory Flow; RCT: Randomized Controlled Trial; WF: Waterfalls

KEY CONCEPTS

- Inhalation of forest volatile organic and inorganic compounds (plant-derived substances, nebulized water, ions)
- Psychophysical relaxation and autonomic responses induced by forest exposure
- Light physical activity (walking in the forest and, in case of forest bathing, even doing breathing exercises)



- Seasonal concentrations of some biogenic volatile compounds with allergic properties
- Effect size of intervention in patients with different health conditions
- Relationship between the length of forest exposure and any measurable effect
- Duration over time of respiratory function improvement

DISCUSSION

- Autonomic responses to environmental stimuli and inhalation of some volatile compounds detectable in the forest air seem to directly contribute to the overall effect (Antonelli et al., 2021).
- Current scientific evidence is limited and seasonal atmospheric levels of some plant-derived compounds, especially when reacting with air pollutants, may even worsen some respiratory conditions (Gibbs, 2019).

CONCLUSIONS

Forest exposure coupled with light physical activity may result in short-term improvements of some respiratory function parameters.

Further studies on the topic are recommended to better quantify the effect size of forest-based interventions, assess long-term benefits, ascertain potential health risks and identify any moderators of the effect.

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