Forest Medicine
The Japanese Forest Therapy trails

Qing Li
MD, PhD
President of the Japanese Society of Forest Medicine
Nippon Medical School
Tokyo, Japan
Why do people love (like) forests?

- The forest environment has been enjoyed by humans for a long time because of
  - The quiet atmosphere
  - The beautiful scenery
  - The mild climate
  - The special fragrance
  - The clean fresh air in the forest.
What is a forest bathing trip (Shinrin-yoku)?

- A forest bathing trip is a short leisurely trip visiting a forest, called "Shinrin-yoku" in Japanese, which is similar to a natural aromatherapy.
- The purpose of forest bathing trip is relaxation and recreation by breathing in volatile substances from trees, called phyttoncides, such as alpha-pinene and limonene.
Forest Medicine in Japan

• In Japan, since 2004, a serial studies have been conducted to investigate the effect of forest bathing trips on human health.

• We have established a new science called Forest Medicine.

• The Forest Medicine is a new interdisciplinary science, belonging to the categories of alternative medicine, environmental medicine and preventive medicine, which encompasses the effects of forest environments on human health.
The Japanese Society of Forest Medicine

http://forest-medicine.com

(in Japanese, English, Chinese)
Forest Medicine was published by Nova Science (NY) in Feb. 2012

Result 1
Effect of forests on immune function
Preventive effect of forest bathing on cancers
Mechanism of NK-induced apoptosis

GrA, GrB, Gr3/K, GrH, GrM

Granzymes
Perforin
Granulysin

NK

Ca^{++}↑, K^{+}↓, AIF, Cyto-C release

(Tumor cell)

Apoptosis
Female subjects enjoy the Forest Therapy
Result 1

Forest therapy increased NK activity and this effect lasted for more than 7 days in both males and females.

**N=12**

**Male**

<table>
<thead>
<tr>
<th>NK activity (%)</th>
<th>Before</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 7</th>
<th>Day 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20±5</td>
<td>25±5</td>
<td>30±5</td>
<td>35±5</td>
<td>30±5</td>
</tr>
</tbody>
</table>

**Female**

<table>
<thead>
<tr>
<th>NK activity (%)</th>
<th>Before</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 7</th>
<th>Day 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15±5</td>
<td>20±5</td>
<td>25±5</td>
<td>30±5</td>
<td>25±5</td>
</tr>
</tbody>
</table>

*: p<0.05, **: p<0.01, from before the trip

A trip to a place without forest does not enhance human NK activity in males (n=11)

Forest therapy increased NK cells and this effect lasted for more than 7 days in both males and females.

\[
\text{N=12} \\
\text{Male} \\
\text{Female}
\]

\[
\text{N=13}
\]

* : p<0.05, ** : p<0.01, from before the trip

Forest therapy increased intracellular anti-cancer proteins and this effect lasted for more than 7 days in both males and females.

N=12

Male

Female

*: p<0.05, **: p<0.01, from before the trip

Mechanism of forest therapy-induced NK activity

Forest therapy
Reduce Stress

GrA, GrB
Granzymes
Perforin
Granulysin
(Ca$^{++} \uparrow$, K$^{+} \downarrow$
AIF, Cyto-C release

(Tumor cell)

Apoptosis (cell death) → NK activity
Result 2: Forest therapy reduces blood pressure
Preventive effect of forest bathing on lifestyle-related disease

*: p<0.05, **: p<0.01, forest vs city
Mean+/−SE

Forest therapy increases serum adiponectin levels in male subjects (n=16)

Adiponectin is a hormone produced by adipose tissue.

Adiponectin has preventive effects on obesity, type 2 DM (diabetes mellitus), cardiovascular disease, and metabolic syndrome.


*: p<0.05 vs before
Result 3
Forest therapy **decreased** urinary adrenaline, whereas a city tourist trip did not affect this.

Adrenaline is a stress hormone

![Bar chart for Forest bathing trip (n=12)](chart1)

**Forest bathing trip (n=12)**

- Before: 5 ug/gCr
- Day 1: 4 ug/gCr
- Day 2: 3 ug/gCr

![Bar chart for City tourist trip (n=11)](chart2)

**City tourist trip (n=11)**

- Before: 4.5 ug/gCr
- Day 1: 4.2 ug/gCr
- Day 2: 4.1 ug/gCr

*: p<0.05 from Before

Forest therapy decreased urinary adrenaline and noradrenaline in females

Noradrenaline is also a stress hormone

**: *p*<0.01 (n=13)  


Decreases of urinary adrenaline and noradrenaline contributed to the lower blood pressure
Result 4: Preventive effect of forest bathing on depression

Forest therapy reduces the scores of anxiety, depression, anger, fatigue and confusion, whereas increase the score of vigor

POMS test  Mean+SE (n=53)

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vigour</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Fatigue</td>
<td></td>
<td></td>
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<tr>
<td>Confusion</td>
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</tr>
</tbody>
</table>

**: p<0.01 significantly different from before

Li Q. Forest Medicine, 2012
Stress and lifestyle-related disease

- It has been reported that stress may induce many lifestyle-related diseases including hypertension, cardiovascular disease (myocardial infarction, ischemic heart disease), depression, gastric ulcers, obese, etc.
- Forest bathing may reduce stress and stress hormones.
- Therefore, forest bathing may have a preventive effect on lifestyle-related diseases by reducing stress.
Conclusion

• Based on the above evidence, we may conclude that Forest Medicine as a new Preventive Medicine may have preventive effects on lifestyle-related disease and cancer.

• I propose an international project to identify the preventive effect of Forest Medicine on lifestyle-related disease and cancer.
The New York Times reported our research on July 5, 2010


References


