
Phytoneside Interaction with Natural Killer Cells-Review

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Abstract

The forest environment has been enjoyed by the humans for a long time because of the quiet atmosphere, beautiful scenery, mild climate, and also clean fresh air. As it is said that nature can heal. The healing property of plants are researched and identified as Phytoneside and because of the chemical constituents action, it boost or activates the action of Natural killer cells(Nk), thereby stimulating the immunity.

Keywords: *Natural killer cells(Nk), Phytoneside, healing property, environment, immunity*

INTRODUCTION

Few researcher previously reported that the forest environment also enhances the human natural killer (NK) cell activity, the number of NK and NKT cells, and intracellular anti-cancer proteins in the lymphocytes, and that the aggrandized NK activity lasted for more than 7days after the trips to forests both in male and female subjects. However, it is not clear what kind of the factors in the forest environment activated human NKcells. Researcher speculate that aromatic volatile substances derived from trees, including monoterpenes and the sesquiterpenes, called phytoncides, such as a-pineneand limonene (6), may play a pivotal role (Cella et al.,2014)

Phytoncides are the volatile organic compounds that are emitted by plants as a protective measure against the harmful insects or herbivores. The term phytoncide is a combination of the Greek terms “phyton”, referring to the plants, and “cide”, referring to killing, highlighting their antibacteria.

The particular phytoncide compounds differ across various tree species; however, almost all trees emit phytoncides. The Hinoki cypress (*Chamaecyparis obtusa*) and the Korean red pine (*Pinus densiflora*) produce particularly high levels of phytoncide. Phytoncides also trigger an array of biological effects in humans. Specifically, these compounds have been shown to mainly initiate anti-bacterial, anti-fungal, anti-stress, and the anti-inflammatory effects across many contexts (e.g., forest bathing, aromatherapy, and also holistic medicine. Several studies have shown that inhalation of phytoncides reduces stress and also improves the immune responses in humans (Orr et al., 2010). The beneficial effects of phytoncides are widely understood and well researched-investigated in humans, but the biopotential occurrence of these effects remains unconfirmed in dogs (Sun et al., 2011).

EXTRACTION OF PHYTONCIDE

Phytoncide was obtained by extracting the essential oil from the leaves of *C. obtusa* and *P. densiflora* growing in South Korea.

The essential oil of plants is produced by various methods such as the conventional steam distillation, the critical fluid extraction, expression, and solvent extraction, etc. Among them, steam distillation is known as the most widely availed method of essential oil extraction (Sojka et al.,2014).

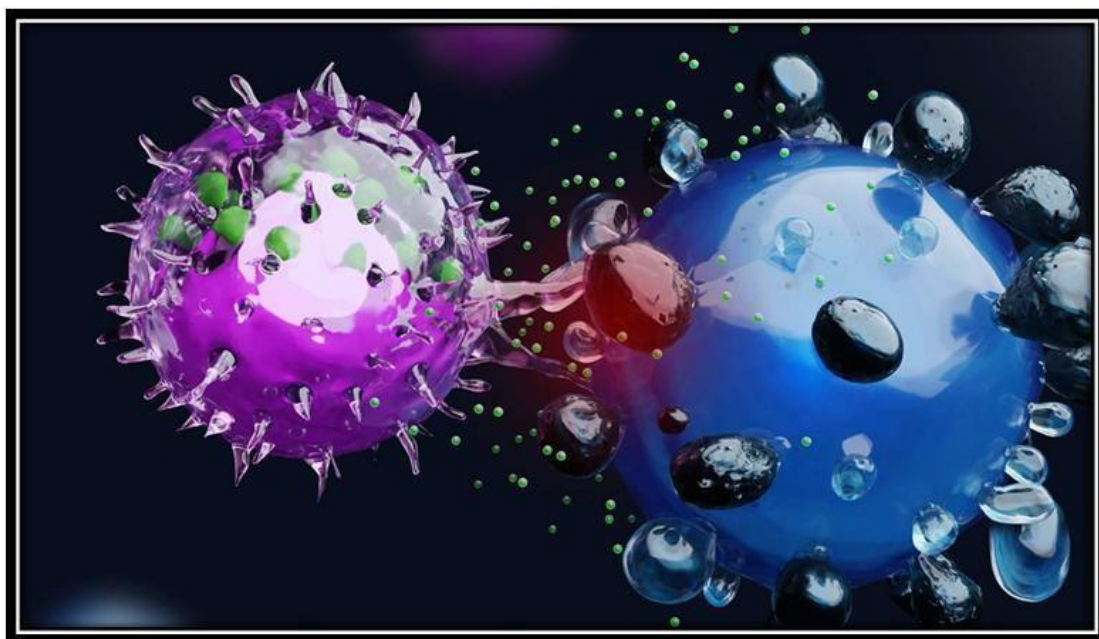


Figure no: 1

In this study, *C. Obtusa* and *P. densiflora* essential oils were extracted availing steam distillation method. Each essential oil was extracted through the following processes and series of steps are followed. After the *C. Obtusa* or *P. densiflora* needles being mixed with the distilled water and throwing in the steam distillation extraction device, it was heated at 100°C for about 2 hours and the steam distillation was enforced. Then, the extracted essential oils were dehydrated over the anhydrous sodium sulphate(O'Sullivan,2015).

Mixed phytoncide was availed by blending *C. obtusa* and *P. densifola* essential oils extracted by steam distillation at the same ratio.

OVERVIEW

Maintaining enough NK cells is essential for the healthy aging. In general, the NK cells increased with age. Our results showed that study and assesment subjects in the forest trip group had a higher NK cell amount than the forest and urban groups, which might be due to the older age of the subjects of the forest trip group than the other two groups (60 vs. 45 years). NK cells (CD56⁺) are divided into CD56^{bright} and also CD56^{dim} major subsets that have both different receptor profiles and specific functions. Researher reported that NK (CD56^{bright}) cells proliferated rapidly but died relatively very slowly (Abel, 2018). Aging has differential effects on NK (CD56^{bright}) and NK (CD56^{dim}) cell subsets. Older individuals presented with a significantly higher percentage of NK (CD56^{dim}) cells but a significantly lower proportion of NK (CD56^{bright}) cells, thus resulting in an increased NK (CD56^{dim}) to NK (CD56^{bright}) ratio. The age-related increase in the NK cell percentage in older adults may be the result of an accumulation of long-lived NK cells (Geiger et al.,2016).

NK cells are important in the human endocrine and immune systems as first-line effectors to induce tumor or virus-infected targeted cell death. Activating NK cells have the ability to directly kill certain target cells. Many studies have demonstrated that NK cell subset distribution and the change in the expression of early activation antigen, CD3⁻/CD56⁺/CD69⁺ NK cells with respect to clinical response. Although the activating NK cells have been established to have the ability to attack the target cells, we still have to actually carry out the activity assay of killing target cells for understanding NK cell activity. In general, NK cell activity was assayed according to the standard microtiter ⁵¹Cr-release assay . Consistent evidence from both epidemiological and experimental studies have

demonstrated that alcohol consumption , physical exercise , circadian variation , menstruation cancer , age , smoking habits , and environment can affect NK cell activity in human. Furthermore, many studies have demonstrated that a forest environment can enhance the immune response as measured by NK cell activity, and the percentage and absolute numbers of NK cells (Yu et al., 2013).

NK cells in humans are dependent on environmental factors, alcohol consumption, physical exercise, circadian variation, and food. Previous studies also suggest that exposure to phytoncides and decreased stress hormone levels may have partially contributed to the increases in human NK cells after the forest trip. In particular, both the environmental factors related to the forest and cardiovascular characteristics were the major factors that affected human NK cells. The specific features of the Xitou forest comprise the biogenic volatile organic compounds emitted by the leaves of *Cryptomeria japonica* trees, including phytoncides such as α -pinene, limonene, and cedrol. A previous study in Japan showed that subjects with healthy lifestyles, such as nonsmokers and those who exercised regularly, had significantly higher NK cells and more perforin, granulysin, and granzyme A/B-expressing cells than subjects with poor lifestyles. Effects of phytoncides from wood essential oils significantly increased NK cell, and perforin, granulysin, and granzyme A/B-expressing cells, whereas they significantly decreased the percentage of T cells, thereby indicating that phytoncide exposure may affect human immune function (Lee et al.,2009).

We also measured the phytoncides and negative ions during outdoor monitoring of forest and urban environments and indoor monitoring of a wooden house made of Western red cedar (*Thuja plicata*) during the forest trip . We detected several phytoncides such as α -pinene, limonene, and (1R)-(-)-Myrtenol in the outdoor forest fields and α -pinene, limonene, (1R)-(-)-Myrtenol, camphor, and β -caryophyllene in the indoor wood house. Studies suggested that phytoncides may partially contribute to the enhanced activating NK cells during the forest trip Our study also demonstrated that most cardiovascular characteristics (age, male gender, SBP, and triglyceride, hs-CRP, fasting glucose levels, and smoking and tea drinking habits) affected NK cell percentage, thereby indicating the potentially confounding factors of NK cell measurements(Lee et al.,2011).

There are many complicated disorders affecting the human system(Dr.S.Sreeremya,2019), by which stress a psychological condition is manifested. Conditions like autoimmune disease with less presymptomatic disease causes stress with panic attack(Dr.S.Sreeremya,2024).So to remove the stress techniques like Shinrin-Yoku(Dr.S.Sreeremya,2020) and immunomodulators(Sreeremya S,2016) are implemented, to have a peaceful mind and to align the energies.

Furthermore, we detected significantly lower concentrations of gaseous air pollutants, such as NO, NO₂, NO_x, SO₂, and CO, in the forest environment compared with the urban environment during the study period. Thus, the beneficial effects on immune function suggest a potential link between the better air quality in the forest environment and human health. Ambient air pollution can affect child and perinatal health on immune function by low-dose insults as compared with adult health. Exposure to air pollutant toxicity may cause immunosuppression and result in increased expression of aberrant immune responses (Morita et al.,2007) .

NK CELLS

Natural killer (NK) cells are effector lymphocytes of the innate immune system that are able to mount a multifaceted antiviral response within hours following infection. This is achieved through an array of cell surface receptors surveilling host cells for alterations in human leukocyte antigen class I (HLA-I) expression and other ligands as signs of viral infection, malignant transformation, and cellular stress. This interaction between HLA-I ligands and NK-cell receptor is not only important for recognition of diseased cells but also mediates tuning of NK-cell-effect or functions (Park et al., 2007).

CONCLUSION

The action of Natural Killer cell is to target the Antigens and lyse it. Natural killer cell is effective in killing the cancerous cells, virus and pathogens. The action of Nk cells is simulated by the Phytoneside.

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