

## Original Contribution

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# Psychological Characteristics after Far-infrared Hyperthermia Evaluated Using the Profile of Mood State (POMS)

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**Abstract:** Hyperthermia with far-infrared rays has recently attracted attention as a cancer treatment method with immunopotential effects. This hyperthermia has characteristics of complementary and alternative medicine, and is a new field for the treatment of pathological conditions and disorders that can not be resolved by western medicine alone. We previously suggested that far-infrared hyperthermia becomes a stressor that activates self-defense function, affecting the T-cell content ratio in immunocytes and cytokine production, and tends to recover fatigue of the body based on hematological and serum biochemical findings. In this study, the effects of far-infrared hyperthermia were evaluated in terms of psychological changes using the Profile of Mood State (POMS) in subjects with poor physical conditions such as shoulder stiffness, insomnia, and chilliness. After hyperthermia, the POMS score significantly decreased for “Depression-Dejection”, “Anger-Hostility”, and “Fatigue” and slightly decreased for “Tension-Anxiety” and “Confusion”, showing psychological improvement.

These results suggest that far-infrared hyperthermia psychologically recovers fatigue and has emotional sedative effects, supporting physiological data.

**Key words:** far-infrared hyperthermia, heat stimulation, profile of mood state (POMS)

## Introduction

Due to limitations in western medicine, medicine/nursing is advancing toward holistic medicine

which is “integrated medical care/nursing” developed by fusion between complimentary/alternative medicine (CAM) based on scientific evidence and modern western medicine. While western medicine places importance in the body and disorders, this holistic paradigm unites the “mind” with the “body”, regarding humans as an integrated whole. This idea has the same as the ideas of Nightingale’s natural healing power, Martha Rogers’ unitary human being, and Jean Watson’s theory of human care. These ideas have their roots in the Orient and, from medical aspects, are close to the essence of nursing. It is difficult to establish a generally accepted definition of CAM because of differences in history/culture/sense of values among areas. However, CAM can be considered to be a general term of medicine/medical care other than modern western medicine. Its contents include general oriental medicine (Chinese herbal medicine/acupuncture and moxibustion, and Qi-Gong), dietary health care, Ayurveda, Unani medicine, homeopathy, aroma therapy, biofeedback, hypnotic meditation, color therapy, spa therapy/hyperthermia, respiration method, tai chi, vibrational medicine, chiropractics, osteopathy, massage, dietary supplements, and energy work.

We previously reported that far-infrared thermal stimulation becomes a stressor that activates self-defense function, affecting the T cell content ratio in immunocytes and cytokine production<sup>1)</sup>, and may tend to recover fatigue based on hematological and serum biological findings<sup>2)</sup>. Far-infrared thermal stimulation is hyperthermia<sup>3)</sup> that has been attracting attention as cancer therapy with immunopotential effects and has characteristics of CAM. This hyperthermia is a new care intervention field for pathologic conditions that can not be resolved by western medicine alone and the pre-disease stage (semi-healthy/semi-sick persons). Therefore, based on such physiological evidence, we assessed psychological changes after far-infrared hyperthermia using the Profile of Mood State (POMS)<sup>4)</sup> in subjects with shoulder stiffness, insomnia, and chilliness.

## Materials and Methods

### *I. Subjects*

This study was performed in 10 female subjects with poor physical conditions such as shoulder stiffness, insomnia, and chilliness who were informed of the purpose and methods of this study and gave consent. The mean age of the subjects was  $35.1 \pm 3.4$  years. All subjects have not received medical treatment such as going to hospital regularly and administering.

### *II. Methods*

For far-infrared hyperthermia, the subjects were placed in the supine position and wore only underwear, and the entire body except the head was heated 40-42°C using a SMARTY (Fujika Co., Ltd.) for 40 minutes at a room temperature of 25°C once every other day (total, 3 times). To prevent changes in immune function due to other stimuli and make the effects of hyperthermia clearer, the subjects were asked to avoid drinking, intense exercise, staying up all night, and bathing at high temperature ( $\geq 40^\circ\text{C}$ ) or for a long time ( $\geq 30$  minutes) for 1 week from the initiation day of this study.

In addition, for the prevention of dehydration, the subjects ingested natural water (500 ml) before the initiation of hyperthermia. During hyperthermia, the absence of skin disorders in the subjects was confirmed.

**III. Assessment using the POMS**

Before and 1 week after hyperthermia, assessment was performed using the POMS<sup>4)5)</sup> (a mood profile test using the T score that was published by McNair et al. in the U. S. A. in 1971), as a mood scale. Using the POMS, the following 6 types of moods consisting of 65 items can be simultaneously assessed : D (Depression-Dejection), V (vigor), A-H (Anger-Hostility), F (Fatigue), T-A (Tension-Anxiety), and C (Confusion). In addition, temporary feeling/mood states changing according to the conditions under which the subject is present can be assessed without being affected by subject’s emotional responses (personality tendency). The reliability and validity of the POMS have been confirmed. Yokoyama et al<sup>6)</sup>. used this scale, describing that the POMS can be repeatedly used in the same subjects for the assessment of the influences of stress and responses to treatment.

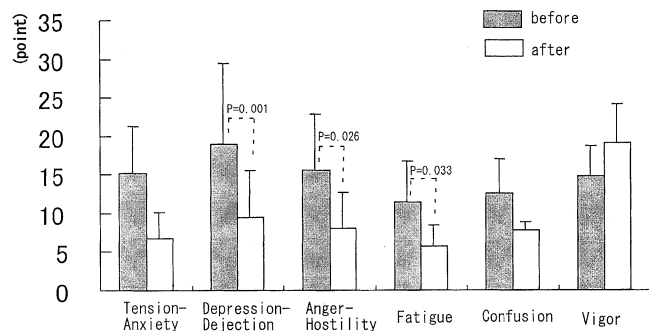
**IV. Statistical analysis**

Statistical analysis was performed using SPSS Ver. 11 and by the paired-t test. Differences with a P value less than 0.05 were considered significant.

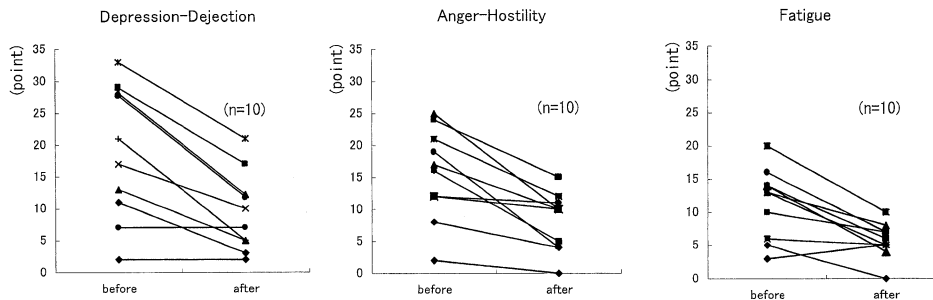
**Results**

Fig. 1 shows the mean POMS score and standard deviation and the significant level by the paired t-test before and 1 week after hyperthermia. The score for “Tension-Anxiety” was  $15.2 \pm 6.1$  before hyperthermia but slightly decreased to  $6.8 \pm 3.3$  after 1 week ( $p=0.059$ ). The score for “Depression-Dejection” was  $18.9 \pm 10.5$  before hyperthermia but significantly decreased to  $9.4 \pm 6.2$  after 1 week ( $p=0.001$ ). The score for “Anger-Hostility” was  $15.6 \pm 7.2$  before hyperthermia but significantly decreased to  $8.1 \pm 4.6$  after 1 week ( $p=0.026$ ). The score for “Fatigue” was  $11.4 \pm 5.3$  before hyperthermia but significantly decreased to  $5.7 \pm 2.7$  after 1 week ( $p=0.033$ ).

The score for “Confusion” was  $12.6 \pm 4.4$  before hyperthermia but slightly decreased to  $7.8 \pm 1.0$  after hyperthermia ( $p=0.073$ ) while that for “Vigor” was  $14.8 \pm 3.9$  before hyperthermia but slightly increased to  $19.1 \pm$



**Fig. 1.** Changes of the Profile of Mood State after far-infrared hyperthermia



**Fig. 2.** Individual changes of the Profile Mood State

5.06 after hyperthermia ( $p=0.176$ ).

Significant decreases were observed after hyperthermia in “Depression-Dejection”, “Anger-Hostility”, and “Fatigue”, slight decreases in “Tension-Anxiety” and “Confusion”, and a slight increase in “Vigor”. Fig. 2 shows the values of individual POMS score that had significant changes after hyperthermia.

## Discussion

We previously reported that far-infrared hyperthermia is useful for inducing HSP70 as a stress hormone<sup>7)</sup>, increases in cellular immune function due to an increase in cytotoxic cells resulting from changes in immunocytes, becomes a stressor activating self-defense function, affecting the T cell content ratio in immunocytes and cytokine production<sup>1)</sup>, and may tend to induce recovery of fatigue based on hematological and serum biochemical findings<sup>2)</sup>. We also previously suggested that HSP70 as a stress hormone is involved in the biodefense effects and disease-preventive effects of spa therapy, and reported enhancement of natural healing power by spa therapy that induces enzymes with antioxidation effects and have biodefense effects, and the physiological influences of far-infrared hyperthermia on the body<sup>8)</sup>.

In this study, the effects of far-infrared hyperthermia were evaluated in terms of psychological changes using the POMS in subjects with shoulder stiffness, insomnia, and chilliness. The POMS score significantly decreased after hyperthermia for “Depression-Dejection”, “Anger-Hostility”, and “Confusion” and slightly decreased for “Tension-Anxiety” and “Fatigue”.

These results suggested not only psychological recovery of fatigue but also emotional sedation after far-infrared hyperthermia. These findings were supported by subjects' comments suggesting recovery of fatigue such as “refreshed” and “became brisk” and those suggesting emotional sedation such as “relieved”, “want to sleep here”, and “calmed down”. Complaints of physical conditions before hyperthermia were no longer heard.

These psychological results were consistent with the physiological findings obtained in our previous study and also with the association between recovery of fatigue and enhancement of NK activity reported by Shimizu et al<sup>9)</sup>.

Far-infrared hyperthermia promotes stimulation of the sebaceous glands and apocrine glands due to the arrival of far-infrared rays at deep areas<sup>1)</sup>. This technique has been confirmed to promote excretion of protein, lipid, cholesterol, fatty acid ester, lactic acid, excessive subcutaneous fat, glucose, ammonia and iron from the apocrine glands in the axilla and vulva, and toxic substances (mercury, cadmium, lead, and heavy metals) that enter the body from food, air, water, and the skin via the sebaceous glands, dissolve in fatty acid, and accumulate. Thus, far-infrared hyperthermia is expected to not only regulate body temperature due to its sweating effects but also promote excretion of poisonous metals such as dioxin.

Sweat induced by warming in deep areas by far-infrared rays may be similar to that induced during intense exercise such as 30-km marathons. This sweat may differ from that from the eccrine glands associated with an increase in temperature or bathing. Therefore, far-infrared hyperthermia may produce marked effects in a short time and is also expected to be useful in people without exercise habits or those in whom exercise is prohibited. In addition, the simple procedure of this hyperthermia method

suggests its wide applicability.

In this study, the score for “Vigor” only slightly increased. However, the “Vigor” score was high even before hyperthermia, and the reason for the small change may be due to the relatively active subject group.

As the proverb says, “Worry is often the cause of illness.”, immunity is considered to be associated with emotions. In recent years, their association has been studied in fields such as psychoneuroimmunology. Studies in these fields have provided biological evidence of the association between psychological factors and the autonomic, endocrine, and immune systems. Further studies are necessary in additional cases.

## Conclusion

We evaluated the effects of far-infrared hyperthermia in terms of psychological changes using the POMS in subjects with shoulder stiffness, insomnia, and chilliness. The POMS score significantly decreased after hyperthermia for “Depression-Dejection”, “Anger-Hostility”, and “Confusion” and slightly decreased for “Tension-Anxiety” and “Fatigue”.

These results not only suggested psychological recovery of fatigue but also sedative effects on emotions. After far-infrared hyperthermia, no subject complained of poor physical conditions that were present before hyperthermia.

These psychological effects support the physiological findings obtained in our previous study. Further studies are necessary in additional cases.

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## 遠赤外線温熱療法による気分プロフィール尺度 (POMS : Profile of Mood State) 検査からみた心理学的変化

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**要 旨**：遠赤外線温熱療法は、免疫賦活作用を有する癌治療法として、今改めて注目されている。その特徴は相補・代替医療の特徴を備え、西洋医学単独では解決しえない病態や未病への治療となる新たな領域である。そこで、今回、肩こり、不眠、冷え等の体調の不良を訴える人を対象に、遠赤外線温熱刺激による効果を、気分プロフィール尺度 (POMS) を用いて心理的側面の変化から検討した。結果として、温熱刺激により「抑うつ—落ち込み」、「怒り—敵意」、「混乱」において POMS 評点の有意な低下、「緊張—不安」、「疲労」の低下傾向が認められ、温熱刺激が心理的側面に影響を与えることが示唆された。