

Effects of sauna on pulmonary function in mild intermittent asthma patients

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Background : *Sauna can affect the cardiopulmonary system. Previous studies in people having problem with respiratory system have shown that sauna can change pulmonary function, but there few researches on the effects of sauna on mild intermittent asthma patients.*

Objective : *The purposes of this study were to compare the change of forced vital capacity (FVC) and forced expiratory volume in one second (FEV₁) before and after sauna in mild intermittent asthma patients.*

Setting : *The Faculty of Associated Medical Science, Khon Kaen University*

Design : *Experimental Study*

Method : *The subject were 16 mild intermittent asthma patients. Their average age was 30.5 ± 11.9 years old. All subjects had their FVC and FEV₁ measured before and after a sauna experience.*

Result : *FVC were 3.3 ± 0.5 and 3.4 ± 0.6 liters and FEV₁ were 2.7 ± 0.6 and 2.8 ± 0.7 liters, respectively.*

The results showed that FVC and FEV₁ before and after sauna had no significant difference (p = 0.58, p = 0.08), respectively.

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Conclusion : *It can be concluded that sauna cannot improve FVC and FEV₁. However, more research is required to establish these findings. Also, further research is need on long-term effects of sauna to pulmonary function.*

Keywords : *Asthma, Sauna, Pulmonary function.*

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- บทนำ** : การอบไอร้อนมีผลต่อระบบหัวใจและปอด ซึ่งจากการศึกษาวิจัยที่ผ่านมาพบว่าการอบไอร้อนมีผลต่อการเปลี่ยนแปลงสมรรถภาพปอดของผู้ป่วยระบบทางเดินหายใจ แต่การศึกษาผลของการอบไอร้อนในผู้ป่วยหอบหืดระดับน้อยนั้นยังไม่มีรายงานการวิจัยใด ๆ
- วัตถุประสงค์** : งานวิจัยนี้ต้องการศึกษาเปรียบเทียบการเปลี่ยนแปลงค่าปริมาตรอากาศทั้งหมดขณะหายใจออกเร็วและแรงเต็มที่ และปริมาตรอากาศที่หายใจออกมาในช่วง 1 วินาทีแรกของการหายใจออกอย่างรวดเร็วและแรงเต็มที่ ขณะก่อนและหลังการอบไอร้อนในผู้ป่วยหอบหืดระดับน้อย
- สถานที่ที่ทำการศึกษา** : คณะเทคนิคการแพทย์ มหาวิทยาลัยขอนแก่น
- รูปแบบการวิจัย** : การวิจัยเชิงทดลอง
- วิธีการศึกษา** : เป็นการศึกษาในผู้ป่วยหอบหืดระดับน้อยจำนวน 16 คน อายุเฉลี่ย 30.5 ± 11.9 ปี โดยอาสาสมัครทั้งหมดจะได้รับการวัดปริมาตรอากาศทั้งหมดขณะหายใจออกเร็วและแรงเต็มที่ และปริมาตรอากาศที่หายใจออกมาในช่วง 1 วินาทีแรกของการหายใจออกอย่างรวดเร็ว และแรงเต็มที่ ขณะก่อนและหลังการอบไอร้อน
- ผลการศึกษา** : ขณะก่อนและหลังการอบไอร้อนปริมาตรอากาศทั้งหมดขณะหายใจออกเร็วและแรงเต็มที่ที่มีค่าเท่ากับ 3.3 ± 0.5 , 3.4 ± 0.6 ลิตร ($p = 0.58$) และปริมาตรอากาศที่หายใจออกมาในช่วง 1 วินาทีแรกของการหายใจออกอย่างรวดเร็วและแรงเต็มที่ที่มีค่าเท่ากับ 2.7 ± 0.6 , 2.8 ± 0.7 ลิตร ($p = 0.08$) ตามลำดับ พบว่าค่าทั้งสองไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ
- วิจารณ์และสรุป** : ผลของการอบไอร้อนไม่สามารถเพิ่มปริมาตรอากาศทั้งหมดขณะหายใจออกเร็วและแรงเต็มที่ และปริมาตรอากาศที่หายใจออกมาในช่วง 1 วินาทีแรกของการหายใจออกอย่างรวดเร็วและแรงเต็มที่ อย่างไรก็ตามยังคงต้องมีการศึกษาวิจัยต่อไปในอนาคตให้มากขึ้นในแง่ผลของการอบไอร้อนระยะยาวต่อสมรรถภาพปอด
- คำสำคัญ** : หอบหืด, การอบไอร้อน, สมรรถภาพปอด.

Nowadays, the role of thermotherapy has been increased for therapeutic purposes. Heat causes several physiological changes in localized areas such as an increase in skin circulation, liquid, metabolic rate, tissue flexibility, relaxation and pain reduction. Also, remote effect of heat includes an increase in blood circulation to smooth muscles, stimulation of reflex, relaxation of skeletal muscle and enhancement of the performance of cardiopulmonary system. Therapeutic heat affects the performance of the cardiopulmonary system through vasodilatation of the blood vessels leading to a better heat transfer through breathing and perspiration. Hyperemia condition occurs when the tissue temperature reaches 46 degrees Celcius and may lead to tissue damage. The appropriate range of temperature for therapeutic purposes is from 40 to 45 degrees Celcius.⁽¹⁻³⁾ Sauna is another form of thermotherapy. The sauna heat comes from burning the coals in a wooden room until the room temperature reaches 70 – 85 degrees Celcius with relative moisture of 5 - 25%. Some part of the heat, however, are lost through the reflection and convection within the room. In general, each session of sauna lasts about 8 - 12 minutes with the maximum of 20 - 30 minutes. Physiological effect of the heat reaches its peak about 30 minutes.⁽¹⁻⁴⁾ Nico JM *et al.* (1989)⁽⁴⁾ studied the effect of sauna on pulmonary function in 12 patients with the obstructive pulmonary disease. They found that FVC and FEV₁ increased after the treatment. Kiss D *et al.* (1994)⁽⁵⁾ also reported an improvement in FVC and FEV₁ after sauna in non-smoker group. Van HM, Festem J and Corstens F⁽⁶⁾ studied the effect of sauna in chronic

bronchitis. They also found that FVC and FEV₁ increased after the treatment.

None of the studies, however, has reported the effect of sauna on pulmonary function in mild intermittent asthma patients. Therefore, the purposes of this study were to compare the change of forced vital capacity (FVC) and forced expiratory volume in one second (FEV₁) before and after sauna in mild intermittent asthma patients.

Materials and Methods

Inclusion criteria

A total of sixteen mild intermittent asthma patients with their average age of 30.50 ± 11.95 years old were recruited in this study. None of them had history of surgery related to the cardiopulmonary system. All subjects were diagnosed with mild intermittent asthma from physician. Subjects refrained from any bronchodilator or medicine 6 months prior to participate in this study. Mild intermittent asthma were patients who have FEV₁ no less than 80% and had asthma attack less than 1 time per week. They do not have any respiratory disease such as pneumonia and emphysema, fever nor hypertension. No food or drink was allowed 1 hour prior to the test. Also, no alcohol was allowed 3 - 4 hours before the test. Materials were used in this study such as a sauna room, a spirometer (Minato 505) (Figure 1) for measuring pulmonary function. Dinamap 1846 SX (Figure 2) for measuring blood pressure and heart rate, a scale to recorded weight and height and a stop watch to record the time (Figure 3).



Figure 1. Spirometer Minato 505.



Figure 2. Dinamap (1846 SX).



Figure 3. Others equipment.

Protocol

Prior to the test, one investigator explained all the test procedure as well as any possible harm to all subjects, before asking them to sign their informed consent forms. The same investigator then measured each subject's height, weight, blood pressure (Figure 4). Another investigator was in charge of equipment preparation, demonstration and ran the tests. This investigator would read the data obtained from each test for the first investigator to record. Each

outcome measurement was recorded pulmonary function (Figure 5) before sauna and 15 minutes immediately after sauna. The sauna room temperature was set at 70 - 85 degrees Celsius. The subjects would change into proper dress and then took shower before entering the sauna room (Figure 6). This study has been approved by the Human Studies Ethics Committee of Khon Kaen University, Khon Kaen, and it conformed to the standards set by the Declaration of Helsinki.



Figure 4. Measured blood pressure and heart rate.



Figure 5. Pulmonary function test.



Figure 6. Subject in sauna room.

Data analysis

One-tail paired t-test was used. SPSS 10.0 software was used for all analyses.

Results

There were no statistically significant

differences in the baseline characteristics of the subjects in each group (Table 1). Both FVC and FEV₁ had no significant change in before and after the sauna ($p > 0.05$) (Table 2).

Table 1. Baseline characteristics of the subjects in each group (n = 16) (Mean \pm SE).

Age (years)	Weight (Kg)	Height (cm)	Blood pressure (mmHg)	Heart rate (times/minute)
30.5 \pm 11.9	69.8 \pm 9.3	164.3 \pm 9.1	112.8 \pm 7.5/71.9 \pm 9.9	79.8 \pm 9.3

Table 2. FVC and FEV₁ (n = 16) (Mean ± SE).

Data	Sauna		Statistical analyzed	
	Before	After	95% CI	P-value
FVC	3.3 ± 0.5	3.4 ± 0.6	-0.730 - 0.089	0.58
FEV ₁	2.7 ± 0.6	2.8 ± 0.7	-0.124 - 0.023	0.08

*p<0.05

Discussion

This study compared the FVC and FEV₁ before and after sauna in mild intermittent asthma patients. All the subjects were 30.5 ± 11.9 years old in average. A spirometer was used to measure the pulmonary function (FVC and FEV₁). We had calibrated the spirometer prior to the test to reduce measurement error and only same investigator ran the test. Dinamap was used in this study to measure the blood pressure of the subjects before the test. If any subject had abnormal blood pressure, we would exclude him/her from the study. To minimize the error of the FVC and FEV₁, we asked the subjects to sit down quietly 10 minute prior to the test. Our FVC and FEV₁ were similar to those in the study of Nico JM *et al.* (1989).⁽⁴⁾ The limitation of this study was that we could not control temperature outside of the sauna room which may cause an error to our measurement. We found that the FVC and FEV₁ did not significantly different. The reason could be that before and after sauna were asthmatic attack, healthy and had FEV₁ not less than 80%. No increase in FVC and FEV₁ at 15 minute after sauna could be explained by the vasodilation of alveoli sac and its capillary but it had no effect on the pulmonary function causing by the short-term effect of the sauna. This observation is

similar to the work of Priesler B *et al.* (1990). Bronchoconstriction process promotes the activity of macrophages in releasing cytokine, histamine, prostaglandin and leukotrienes. All these factors activated T-lymphocytes, eosinophils and inflammatory cells. An activated T-cell and others mediator can stimulate receptors, particularly alpha receptors that promote bronchoconstriction. However, no theory explains that the short-term effect of sauna can break down bronchoconstriction process. Therefore, this study was focused on the short-term effect of the sauna. The long-term effect of sauna on respiratory and other systems should be further examined in future studies. Also, the study should be repeated in different age groups, severity of disease and gender groups. In conclusion, this study suggests that sauna cannot increase in FVC and FEV₁ implying no affect to pulmonary function. But sauna may have good impression on mild intermittent asthma patients.

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