

Effectiveness of Aromatherapy to Vital Sign, Psychological and Physical Stress Relief and Sleep Quality in Pre-hypertension

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ABSTRACT

Background/Objectives: This study is a pretest-posttest design experimental research which aims to examine the effectiveness of aromatherapy to vital sign, psychological and physical stress relief and sleep quality of college students in pre-hypertension by conducting 3 weeks of aromatherapy from October 13 to November 3, 2017 targeting 27 male college students in pre-hypertension.

Methods/Statistical analysis: Recognition, life style, BMI of pre-hypertension was examined and investigated, and the study conducted insufflations of aroma oil blended with lavender, marjoram and ylang-ylang in 4:3:3 ratio which are effective in insomnia, hypertension treatment and sedation. Also, the study conducted VAS(visual analogue scale) for the vital signs, psychological and physical stress relief, sleep condition before and after insufflating aroma oil.

Findings: As the result, it was confirmed that aromatherapy pose positive physiological influence on vital signs, psychological and physical stress relief, sleep quality of male college students in pre-hypertension, which indicate aromatherapy has direct pharmacologic effectiveness to body system and that it is an effective method with positive influence.

Improvements/Applications: Aromatherapy relieves stress by stabilizing psychological and physical condition and improves sleep quality. It is expected to be utilized as a mediator by conducting non-medical method and changing life style at the same time.

Keywords: *Vital signs, Psychological physical stress, Sleep quality, Aromatherapy, Pre-hypertension*

INTRODUCTION

College students have very low quality of health due to irregular diet, stress and anxiety about studying and employment, and lack of exercise from changes of independent life style. This leads to psychological and physical stress and reduced sleep quality, rise of blood pressure up to pre-hypertension stage which let college students exposed to the higher risk of hypertension^{1,2}.

HT(Hypertension) occurs when blood flow in artery has higher pressure than normal, and when DBP is over 90mmHg and SBP is 140mmHG, the patient is diagnosed with HT³. According to global health statistics report, about one third of adults suffer from HT, and according to national health and nutrition survey, 42 million male and 28 million female over age 20 suffer from HT, and it leads to about 7 million deaths around the world every year^{4,5}. Pre-hypertension refers to the condition with higher risk of HT when DBP is between 80~90mmHg when SBP is 120~139mmHg. Prevalence rate of adult's pre-hypertension is 8 to 30% which is highly likely to proceed to complication in comparatively short time, and significantly related to increase of mortality risk due to increased risk of cardiovascular⁶. In other words, pre-hypertension is a preliminary step reaching to dangerous

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condition as it is a risk factor for coronary artery, kidney and cerebrovascular disease, so there is a need to improve public awareness for prevention and treatment of HT based on early diagnosis^{1,2,7,8}.

As psychological and physical stress stimulates heart and increases risk of HT, reducing stress could reduce risk of arterial disease. Aromatherapy which is an olfactory treatment to relieve psychological and physical stress is one of many methods. Aromatherapy is very effectiveness in circulating lymph, improving supply of oxygen and nutrition, and stress relief by relaxing muscle⁹. Lately, there are large number of people suffering from degraded sleep quality from environmental influence, sleeping habit, stress, drinking and fatigue.

To maintain health and vitalization of entire bio rhythm, certain level of sleep must be maintained, but once it isn't, degradation of sleep quality could lead to negative influence on physical health in long term such as obesity, chronic disease or early death¹⁰. Short-treatment to reduce suffering from degradation of sleep quality such as medication affects normal sleeping rhythm negatively, and consistent medication increases dependency on medicine and side effects^{10,11}. Thus, inhaling essential oil containing sedative component provides safe and effective non-medication treatment for sleeping which is considered as a solution to improve sleep quality^{10,12}.

Aromatherapy using fragrant plant uses essential oil extracted from flower, fruit, tree bark and root to make diffuser or use in bathe, inhaling and massage and

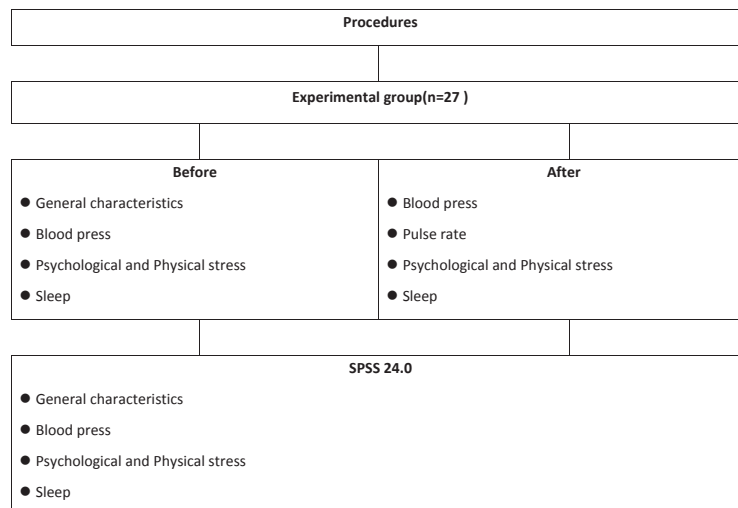
improves psychological and physical health¹³. Aroma particle helps to normalize blood pressure and heart beat, improve memory, relieve stress and improve sleep quality by reaching limbic area through olfactory sense. Despite the general belief regarding beneficial feature of aromatherapy, there are negative opinion about safety from lack of scientific evidence about aromatherapy, but regarding subjective effectiveness from recent numerous scientific experiment, patients who had CT-scan had reduced anxiety from lavender, indicating the effectiveness of aromatherapy and confirmed as a safe treatment for chronic diseases of modern people in various clinical researches^{13,14,15}.

College students are exposed to high risk of HT due to stress from employment, studying, friendship and irregular diet which are predictive factor of adult HT.

Thus, this study aims to examine the influence of 3 weeks of aromatherapy to vital signs and physiological changes (psychological and physical stress relief, improvement of sleep quality) of pre-hypertension targeting male college students with pre-hypertension and provide basic material for HT prevention and health management of college students.

MATERIALS AND METHOD

This study is a pretest-posttest design experimental research that aims to confirm the effectiveness of aromatherapy to vital signs, psychological and physical stress relief and sleeping condition of college students with pre-hypertension in **Fig 1**.



[Fig. 1. Study design]

Study subject

This study recruited 27 voluntary participants for research from October 10 to 12, 2017(3 days) targeting male students of H university in Chungcheongnam-do. The study subject selection standard is as follows. First, those who have DBP between 80~89mmHg when SBP is between 120~140 mmHg. Second, those who have no experience of rhino surgery with normal olfactory function. Third, those who have no changes in life style during research period.

Fourth, those who are not diagnosed with HT. Fifth, those who are not in medication for disease during research period. Sixth, those who voluntarily agreed to participate in research.

On October 13, 2017, targeting final study subjects, the purpose and method of the study was fully explained at College of Natural Science room 314. And in case voluntary participant of study wants to drop out of participation during anytime of the research, to delete personal information, to withdraw consent on recovery of survey, or give up participation, participants were notified with personal phone number and e-mail address of researcher for contact. Expecting certain wastage rates of research, the experiment group first started with 30 students, but later conducted research targeting 27 subjects excluding 3 subjects with insincere attitude. The subjects were given with gift cards.

Study Collection Period

This study was conducted on Oct. 13, 2017, after aromatherapy, gauze, and tissue blended in shading bottle were given from October 14 to November 3, 2017 for about 3 weeks.

Research method and data collection**Oil inhalation**

To boost synergy effect, the oils were blended, specifically blended lavender, marjoram and ylang-ylang in 4:3:3 ratio which are effective in insomnia, alleviation of HT and sedation. The subjects breathed in the blended oil in dark bottle by putting 4~5 drops of oil on gauze and put it 10cm in front of nose for 3 times a day, 3 minutes per session (10AM, 4PM, before sleep) for 21 days. To check the inhaling for 3 weeks, the subjects used checklist to check inhaling¹⁶. Main researcher and 3 assistant researchers reminded subjects to inhale 3

times a day through phone call and SNS. Inhaling aroma 3 times a day was designed considering one inhale lasts for 3 to 6hours¹⁷.

Advance education

After receiving written consent from study subjects who fit selection standard, survey to measure general characteristics, psychological and physical stress, sleep condition were conducted along with BMI and vital sign examination. On October 13, 2017, an expert who is qualified with international aromatherapy standard educated study subjects about how to inhale essential oil and precautions at College of Natural Science room 314.

Pre-test and post-test investigation on BMI, blood pressure and pulse

At College of Natural Science room 314 of H University, study subjects took rest for 20 minutes in comfortable posture and measured blood pressure from brachial artery using blood pressure gauge and got calculated the average. First measurement took place on October 13, 2017 and second measurement was on November 3, 2017. BMI was measured on October 13, 2017.

Psychological, physical stress, pre-sleep investigation

Targeting study subjects, the first survey was conducted on October 13, 2017 and second survey was conducted on November 3, 2017 at College of Natural Science room 314. Psychological, physical stress and sleep quality was measured using VAS in 10points scale from 0 point on left to 10 point on right. The higher the point is, the better psychological, physical stress and sleep quality is¹⁸.

Data analysis

The collected data was processed through SPSS 24.0 to conduct frequency analysis on general characteristics, life style, and recognition about pre-hypertension of subjects, and to examine the pre and post changes of experiment group, a paired t-test for matching sample was conducted. The significance level for statistical hypothesis testing was set to $p < .005$.

RESULTS AND DISCUSSION**General characteristics**

The average age of study subject is 22.93±2.11, average grade is 2.74±1.02, average height is 174.50±4.10, average weight is 73.84±10.52, average body fat percentage is 23.719±7.82, and average BMI is 24.130±3.7 in **Table 1**.

Table 1. Homogeneity test of experimental group (n=27)

Variables	Experimental group(n=27)
Age(yr)	22.93±2.11
Grade	2.74±1.02
High(cm)	174.50±4.10
Weight(kg)	73.84±10.52
Body fat percentage	23.719±7.82
BMI	24.130±3.75

BMI=body mass index

Recognition of pre-hypertension

As for recognition about pre-hypertension of study subjects 51.9% answered ‘Not worried because

Table 2. Recognition of pre-hypertension of experimental group (n=27)

Variables	Item	Percent(%)
Recognition about pre-hypertension	Not worried as it is not HT	51.9(%)
	It is enough to measure blood pressure often	44.4(%)
Recognition about treatment	Taking medicine	0(%)
	Low-salt diet	25.9(%)
	Quit smoking	3.7(%)
	Restrained drinking	3.7(%)
	Exercise	44.4(%)
	Weight loss	0(%)
	Stress management	11.1(%)
	Improved sleep quality	11.1(%)

Vital signs of pre-hypertension

SBD before experiment was 137.78±5.184 and after experiment was 130.89±7.202 which had statistically significant difference (t=5.507, p=.000). DBP before experiment was 84.15±7.7207 and after experiment was 9.44±6.506 which had statistically significant difference (t=2.914, p=.007) in **Table 3**. It indicated that aromatherapy (lavender, marjoram, ylang-ylang) had positive influence as supplementary treatment to

I am not diagnosed with HT’, 44.4% answered ‘It’s enough to measure the blood pressure often’, and as for the recognition about treatment of pre-hypertension, 44.4% answered ‘exercise’ followed by ‘low-salt diet(25.9%)’, ‘stress management’ and ‘improvement of sleep quality(11.1%)’, ‘quit smoking’ and ‘restrained drinking’(11.1%), and ‘medication and ‘weight loss(0%)’ in **Table 2**.

As the result, the lower recognition about pre-hypertension and treatment is presumed to be the lack of regular medical examination or education about risk of HT for college students. HT is the most dangerous factor among cardiovascular disease including major organ failure, progressive TOD in nervous system, stroke, cerebral infarction, intracranial hemorrhage, acute left ventricular failure, acute pulmonary edema, aortic dissection, renal failure and other dangerous complications^{19,20}. However, as pre-hypertension can be fully prevented, there is a need to change life style to improve health.

medication in lowering blood pressure.

Linalyl acetate or linalool, the major extract of lavender affected sympathetic and parasympathetic nerve in aggressive rat and rabbit experiment to reduce aggressive behavior, and its effectiveness on blood pressure decrease, alleviation of anxiety, improvement of sleep quality in human was observed²¹.

HT is an incurable chronic disease which requires

lifetime treatment, and medical cost related to HT is increasing ever year. In the USA, over 59 billion dollars a year is spent for HT²². Thus, aromatherapy could be applied as a countermeasure to reduce medical expense of patients and pharmacological side effects.

Table 3. Vital signs of pre-hypertension of experimental group (n=27)

Variables	Before Mean±SD	After Mean±SD	t	p
Systolic pressure	137.78±5.184	130.89±7.202	5.507	.000
Diastolic pressure	84.15±7.720	79.44±6.506	2.914	.007

SD: standard deviation

Psychological and physical stress

Psychological stress before experiment was 3.48±2.779 and after experiment was 3.11±2.293 which had statistically significant difference (t=3.338, p=.003). Physical stress before experiment was 5.22±1.987 and after experiment was 4.56±1.679 which had statistically significant difference (t=2.431, p=.022) in **Table 4**.

It is presumed to be inhaling ylang-ylang and lavender essential oil with excellent sedative effect

reduced anxiety and alleviated mood to significant reduced stress level. Excessive stress affects cardiovascular disease negatively²³.

Thus, aromatherapy is effective to not only relieving physical stress symptom but also to comfortable psychological status^{9,24}. There is a need for specific research about stress relief using various essential oils in the future.

Table 4. Psychological, physical stress of experimental group (n=27)

Variables	Before Mean±SD	After Mean±SD	t	p
Psychological stress	3.48±2.779	3.11±2.293	3.338	.003
Physical stress	5.22±1.987	4.56±1.679	2.431	.022

Sleep quality

Depth of sleep before experiment was 5.04±1.951 and after experiment was 6.44±1.761 which had statistically significant difference (t=-3.315, p=.003). Sleep quality before experiment was 3.93±2.147 and after experiment was 6.04±1.765 which had statistically significant difference (t=-4.094, p=.000) in **Table 5**.

This is presumed to be acids and esters, coumarins and monoterpenols from lavender and marjoram operating on neuron function to contend with specific

neuron receptor or influence of sedative role and sleep inducer¹⁴. Positive improvement of sleep quality affects body recovery and poses health influence to entire bio rhythm of our body¹⁶.

Thus, aromatherapy is a safe and non-medication treatment which could provide effective treatment to improvement of sleep quality, so in the future, it will be able to examine the relationship between aromatherapy and improvement of sleep quality.

Table 5. Sleep quality of experimental group**(n=27)**

Variables	Before (Mean±SD)	After (Mean±SD)	t	p
Depth of sleep	5.04±1.951	6.44±1.761	-3.315	.003
Sleep quality	3.93±2.147	6.04±1.765	-4.094	.000

CONCLUSION

This study has confirmed that aromatherapy has positive physiological changes in vital signs, psychological and physical stress, and sleep quality in pre-hypertension and proved that it is a positive and effective method that has direct pharmacologic effectiveness to body system. Thus, aromatherapy relieves stress and improves sleep quality by giving physical and psychological stability, which is expected to be applied with non-medication method and changes of life style. However, due to lack of standardization of aromatherapy researches, or limitation of this study such as targeting only male subjects and unable to control personal life of the subjects, the effectiveness of this study is quiet limited.

In follow-up studies, there is a need to conduct chemical analysis on essential oil and diversification of study subjects. Also, considering the inducing of changes of life style and health burden to normalize biologic response to delay progress of HT in pre-hypertension, there is a need to apprehend related factors between daily stress and blood pressure of college students with pre-hypertension to conduct consulting and prescription.

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Conflict of Interest: Nil

REFERENCES

- Barry J. Materson MBA, Manuel GE, Stephane BD, Richard A. Preston, MBA, MSPH. Prehypertension is real and can be associated with target organ damage. *J Am Soc Hypertens.* 2017 Nov ; 11(11): 704-8.
- Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet.* 2005 Jan 15; 365(9455): 217–23.
- Wolff M, Brorsson A, Midlöv P, Sundquist K, Strandberg EL. Yoga—a laborious way to well-being: patients’ experiences of yoga as a treatment for hypertension in primary care. *Scand J Prim Health Care.* 2017 Dec; 35(4): 360-8.
- Ornstein SM, Nietert PJ, Dickerson LM. Hypertension management and control in primary care: a study of 20 practices in 14 states. *Pub Med.* 2004 Apr; 24(4): 500-7.
- Megan L C, BSN, MPH, Kathleen B. Fedan BS, Nicole Edwards MS, David J. Blackley, Cara N. Halldin, Anita L. Wolfe BA, Anthony S L. Evaluation of high blood pressure and obesity among US coal miners participating in the enhanced coal workers’ health surveillance program. *Am J Hypertens.* 2017 Jun 20;11(8):541-5.
- Davis JT, Rao F, Naqshbandi D, Fung MM, Zhang K, Schork AJ, et al. Autonomic and hemodynamic origins of pre-hypertension: central role of heredity. *J Am Coll Cardiol.* 2012 Jun 12; 59(24): 2206-16.
- Kropa J, Close J, Shipon D, Hufnagel E, Terry C, Oliver J, et al. High prevalence of obesity and high blood pressure in urban student-athletes. *J Pediatr.* 2016 Nov; 178: 194-9.
- Lurbe E, Cifkova, Cruickshank JK, Dillon MJ, Ferreira I, Invitti C, et al. A. Management of high blood pressure in children and adolescents: recommendations of the European Society of Hypertension. *J Hypertens.* 2009 Sep; 27(9):1719-42.
- Eguchi E, Funakubo N, Tomooka K, Ohira T, Ogino K, Tanigawa T. The effects of aroma foot massage on blood pressure and anxiety in Japanese community-cwelling men and women: a crossover randomized controlled trial. *PLOS ONE.* 2016 March 24; 11(3):1-13.
- Lillehei AS, Halcon L L. A Systematic Review of the Effect of Inhaled Essential Oils on Sleep. *J Altern Complement Med.* 2014 Jun; 20(6): 441-51.

- 11 Hwang E, Shin S. The effects of aromatherapy on sleep improvement: A systematic literature review and meta-analysis. *J Altern Complement Med.* 2015 Feb; 21(2): 61-8.
- 12 Yamagishi R, Yokomaku A, Omoto F, Misao K, Takada K, Yoshimatsu S, et al. Sleep-improving effects of the aromatic compound heliotropin. *Sleep Biol Rhythms.* 2010 Oct; 8(4): 254-60.
- 13 Posadzki P, Alotaibi A, Emst E. The effects of aromatherapy: A systematic review of case reports and case series. *Int J Risk Saf Med.* 2012 Jan 13; 24(3):147-61.
- 14 Hur MH, Lee MS, Kim C, Emst E. Aromatherapy for treatment of hypertension: a systematic review. *J Eval Clin Pract.* 2012 Feb; 18(1): 37-41.
- 15 Martin GN. Olfactory remediation: Current evidence and possible applications. *Soc Sci Med.* 1996 July; 43(1): 63–70.
- 16 Lehrner J, Marwinski G, Lehr S, Jöhren P, Deecke L. Ambient odours of orange and lavender reduce anxiety and improve mood in a dental office. *Am J Physiol Heart Circ Physiol.* 2005 Sep 15; 86(1-2): 92–5.
- 17 Heras MO, González M L, San J, Beltrán S. Aroma composition of wine studied by different extraction methods. *Anal Chim Acta.* 2002 April 29; 458(1):85-93.
- 18 Reid R, Steel A, Wardle J, Trubody A, Adams J. Complementary medicine use by the Australian population: A critical mixed studies systematic review of utilisation, perceptions and factors associated with use. *BMC Complement Altern Med.* 2016 Jun 11; 16(1):176.
- 19 Irina F, Barry O. Effects of stress-reducing aromatherapy on go-nogotask following acute stress: An evoked related potentials study. *J Altern Complement Med.* 2014 May 7; 20(5):65-6.
- 20 Christofaro DGD, Farah BQ, Vanderlei LCM, Delfino LD, Tebar WR, Barros MVG, Ritti-Dias RM. Analysis of different anthropometric indicators in the detection of high blood pressure in school adolescents: a cross-sectional study with 8295 adolescents. *Braz J Phys Ther.* 2018 Jan; 22(1): 49-54.
- 21 Bell RA, Suerken CK, Grzywacz JG, Lang W, Quandt SA, Thomas AJ. CAM use among older adults age 65 or older with hypertension in the United States: general use and disease treatment. *Altern Complement Med.* 2006 Nov 16;12(9): 903-9.
- 22 Igarashi T. Physical and psychologic effects of aromatherapy inhalation on pregnant women: A randomized controlled trial. *J Altern Complement Med.* 2013 Oct; 19(10):805-10.
- 23 Messerli FH. Cardiovascular effects of obesity and hypertension. *Lancet.* 1982 May;319(8282):1165-8.
- 24 Hye GJ. Therapeutic application of meditation to the stress-related disorders. *Korean psychology.* 2004; 9(2): 471-92.