

Effects of Mindfulness Meditation on Serum Cortisol of Medical Students

Wanpen Turakitwanakan MD*,
Chantana Meksepralard PhD**, Panaree Busarakumtragul PhD***

* Department of Psychiatry, Faculty of Medicine, Srinakharinwirot University, Nakhon Nayok, Thailand

** Department of Microbiology, Faculty of Medicine, Srinakharinwirot University, Bangkok, Thailand

*** Department of Physiology, Faculty of Medicine, Srinakharinwirot University, Bangkok, Thailand

Background: Mindfulness meditation is a method to relax the mind that decreases stress, which otherwise would increase serum cortisol. So, mindfulness meditation should decrease serum cortisol.

Objective: To study the effect of mindfulness meditation on mental health by using Thai GHQ28 questionnaire and study the effect of mindfulness meditation on stress by using serum cortisol.

Material and Method: Volunteer subjects were 30 second year medical students, aged 19.1 ± 0.55 year olds (range 18-20) from Srinakharinwirot University. They were screened by Thai GHQ28 and blood was drawn to measure cortisol at 8:00 am before and after a four-day mindfulness meditation programme. The comparison of Thai GHQ28 scores and serum cortisol levels before and after meditation were analysed by paired t-test.

Results: The subjects were 66.77% female and 33.33% male. The average score of Thai GHQ28 before and after the mindfulness meditation was 1.50 (SD 2.53) and 0.77 (SD 2.08) respectively. The average serum cortisol levels before mindfulness meditation was 381.93 nmol/L (SD 97.74) becoming significantly lower after mindfulness meditation 306.38 nmol/L (SD 90.95). The difference was statistically significant in cortisol level, but not statistically significant in Thai GHQ28.

Conclusion: Mindfulness meditation lowers the cortisol levels in the blood suggesting that it can lower stress and may decrease the risk of diseases that arise from stress such as psychiatric disorder, peptic ulcer and migraine. Then, mindfulness meditation should be used in combination with standard treatment.

Keywords: Mindfulness meditation, Thai GHQ28, Cortisol

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Mindfulness meditation practices have been examined for their health benefits and used as a technique to increase longevity⁽¹⁾. Some scientific attention has focused on the effects of mindfulness meditation on stress and serum cortisol level which regulate the stress pathways including hypothalamic-pituitary-adrenal axis which functions by releasing corticotrophin-releasing hormone (CRH) from the hypothalamus to stimulate the pituitary gland to release adrenocorticotrophic hormone (ACTH). Then, ACTH stimulates the adrenal cortex to release cortisol. The activation of this stress pathway from psychological stressors as well as physical stressors⁽²⁾ stimulates noradrenalin secretion⁽³⁾. Both pathways cause several physiological changes. For example, changes in cortisol, ACTH and noradrenalin in the blood stream

activate the sympathetic system resulting in an increase in pulse rate and blood pressure^(4,5) which can cause hypertension. Cortisol is the most prominent glucocorticoid synthesized from the cholesterol precursor in the adrenal cortex. Cortisol levels changes with time according to diurnal variation, having the highest level in the early morning⁽⁶⁾. Plasma cortisol levels are increased by stress from infection, fever, prolonged strenuous exercise, and acute anxiety⁽⁷⁾.

Previous research have found that persons who always practice mindfulness meditation have lower stress⁽⁸⁾. So the present study was a before-after with one comparison group study to investigate whether a four consecutive day mindfulness meditation course has any effect on mental health and serum cortisol level in trainees. Therefore, the authors report the effect of meditation on mental health by using Thai GHQ28 and on stress by using serum cortisol.

Material and Method

Study design and participants

The present study was approved by the

Correspondence to:

Turakitwanakan W, Department of Psychiatry, Faculty of Medicine, Srinakharinwirot University, 62 Moo 7, Ongkharak, Nakhon Nayok 26120, Thailand.

Phone: 037-395-085 ext. 80705

E-mail: wanpen2550@yahoo.com

Human Ethics Committees of the Faculty of Medicine, Srinakharinwirot University, Bangkok, Thailand. All subjects signed informed consent prior to the study. The present study group consisted of 30 male and female second-year medical students. The inclusion criteria included absence of psychiatric disease, not being afraid of taking blood sample and having no history of endocrine disorder. Subjects unable to take the complete course or to adjust to living in a temple were also excluded. Before the meditation practice, the procedure was explained to the students. Firstly, they were tested by Thai GHQ28 and blood was drawn for cortisol measurements at 8:00 am. Then, they required to practice the mindfulness meditation course at the Sunanthavanaram temple, which consists of mindfulness meditation for four hours during three periods (5:30-6:30, 11:00-12:00, 19:00-21:00) mentored by experienced monks during four days. The meditation focussed the attention on the breathing in a state of mindfulness⁽⁹⁾. The method consists in observing the breath as it enters and leaves the nostrils, and at the same time, trying to notice any sensations felt at the points of entry and exit. The sensation may be felt close to the tip of the nose or lips. After completion of the course, subjects were tested by Thai GHQ28 and blood was drawn for cortisol measurements at 8:00 am.

Thai general health questionnaire 28 (Thai GHQ-28)

All subjects were assessed in their mental health using Thai general health questionnaire 28 (Thai GHQ-28). It is a multiple-choice questionnaire to examine the mental health of Thai subjects developed by Dr. Thana Nilchaikovit⁽¹⁰⁾ from the psychiatric department, Faculty of Medicine, Ramadhibodi Hospital, Mahidol University. This questionnaire was developed from GHQ, Goldberg 1972⁽¹¹⁾. This test consists of 28 items concerning somatic symptoms, anxiety and insomnia, social dysfunction and severe depression. Each item consists of 4 choices involving the severity of symptoms (0-0-1-1). A score ≥ 6 is considered abnormal. From the research, The General Health Questionnaire is a widely used screening instrument⁽¹²⁾. We found that Thai GHQ28 can discriminate mental distress. In the Thai version, the reliability coefficient (Alpha) is 0.84, Thai GHQ28 has a sensitivity of 78.7%, a specificity of 89.7% and accuracy of 87%.

Blood cortisol determination

The volume of 4 mls of venous blood samples

were drawn from the antecubital vein of subjects. Blood was collected at 8:00 am for all subjects. Serum cortisol levels were assayed by Electro chemi luminescence immuno-assay (ECLIA) following the manufacturer's instruction.

The first incubation: 20 μ L of sample is incubated with a cortisol-specific biotinylated antibody and a ruthenium complex labeled cortisol derivative. Depending on the concentration of the analyte in the sample and the formation of the respective immune complex, the labeled antibody binding site is occupied in part with sample analyte and in part with ruthenylated hapten.

The second incubation: After addition of streptavidin-coated microparticles, the complex becomes bound to the solid phase via interaction of biotin and streptavidin.

The reaction mixture is aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed with ProCell. Application of a voltage to the electrode.

Then induce chemiluminescent emission which is measured by a photomultiplier.

Results are determined via a calibration curve which is instrument-specifically generated by 2-point calibration and a master curve provided via the reagent barcode.

The mindfulness meditation method

Mindfulness has been described as "paying attention in a particular way: on purpose, in the present moment, and non-judgementally". The mindfulness meditation method in the present study consists of observing the breath as it enters and leaves the nostrils, and at the same time, trying to notice any sensations felt at the points of entry and exit. The sensation may be felt close to the tip of the nose or lips. The goal of mindfulness meditation is to reach a state of thoughtless awareness, during which a person is passively aware of sensations at the present moment. In the present study, the subjects meditated under the mindfulness meditation courses of the Sunanthavanaram temple in Kanjanaburi, the western part of Thailand. This temple holds the famous meditation courses which are taught and mentored by well known buddhist monks or supervisors.

Statistical analysis

The descriptive statistics were presented with percentage, mean, and standard deviation. The

association between demographic background and serum cortisol level or Thai GHQ28 scores were analysed by independent t-test. The comparison of the Thai GHQ28 scores and serum cortisol level before and after mindfulness meditation course were analysed by paired t-test. Value were considered to be statistical significance when p-value < 0.05.

Results

Subject characteristics

The demographic data of subjects are shown in Table 1. There are no statistical significance association between demographic background and Thai GHQ28 or serum cortisol level (data not shown).

Psychological assessment

All subjects had completed Thai GHQ28 test (100%). The average Thai GHQ 28 score of the 30 students before the meditation practice was 1.50 (SD = 2.53). After the meditation practice, the average score was 0.77 (SD = 2.08). This showed that the average Thai GHQ 28 score of the 30 students before the meditation practice was higher than the average Thai GHQ 28 score of the 30 students after the meditation practice but it was not statistical significant.

Cortisol assessment

The average serum cortisol level of the 30 students before the meditation practice was 381.93 nmol/L (SD = 97.94). After the meditation practice, the average serum cortisol level was 306.38 nmol/L (SD = 90.95) as shown in Fig. 1. This shows that the average serum cortisol level of the 30 students before the

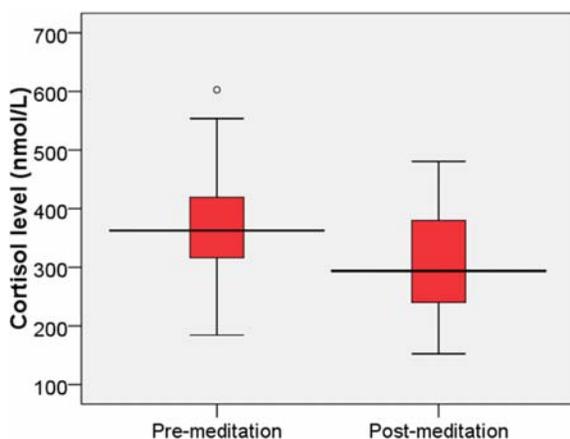


Fig. 1 Comparison of the serum cortisol before and after the meditation practice

meditation practice was higher than after the meditation practice with statistical significant (p < 0.05).

Discussion

The present study found that Thai GHQ28 score of Thai medical students decreased after the four

Table 1. Demographic data of all subjects

Factor	Number	Percent
Gender		
Male	10	33.33
Female	20	66.67
Age (year)	19.1 ± 0.55 (range 18-20)	
Parent status		
Couple	26	86.70
Divorce/widow	4	13.30
Income (bath)		
< 10,000	6	20.00
10,000-30,000	10	33.30
30,000-50,000	8	26.70
> 50,000	6	20.00
Smoking		
No	30	100.00
Yes	0	0.00
Alcohol drinking		
No	26	86.70
Yes	4	13.30
Underlying disease		
No	28	93.30
Yes	2	6.70
Stressor in previous month		
No	6	20.00
Yes	24	80.00
Hobby		
No	24	80.00
Yes	6	20.00
Relationship with parent		
Very good	18	60.00
Good	10	33.30
Moderate	2	6.70
Relationship with teacher		
Very good	6	20.00
Good	17	56.70
Moderate	7	23.30
Relationship with friend		
Very good	12	40.00
Good	16	53.30
Moderate	2	6.70
Relationship with sibling		
Very good	18	60.00
Good	10	33.30
Moderate	2	6.70

consecutive days of mindfulness meditation practice in agreement with previous studies⁽¹³⁻¹⁵⁾. The reason explaining the beneficial effect of mindfulness meditation is known and is believed to make the mind peaceful and relaxed⁽¹⁶⁾, and stop all thinking activated by external stimuli that cause nervous, anxiety, exciting, stress, and discomfort. However, the paired t-test indicated that there was no significant difference of Thai GHQ28 score between pre-and post-meditation. The post-meditation levels of serum cortisol were significantly lower as revealed by the paired t-test ($p < 0.05$) in agreement with previous studies^(17,18). A recent research⁽¹⁹⁾ concluded that there is accumulating evidence that plasma and salivary cortisol can be reduced by mindfulness meditation. Several studies have looked at immune parameters. In patients with cancer, mindfulness meditation tended to restore cytokine levels and natural killer cell activities toward normal levels^(20,21). In healthy people, meditation increased the antibody titer to influenza vaccine⁽²²⁾, lowered the stress-induced increase in interleukin-6⁽²³⁾ and decreased C-reactive protein⁽²⁴⁾. In addition, a person who practice meditation has a lower rise in cortisol levels compared to whom that does not practice^(23,25). In other words, any causes which are out of our control and not related to our intervention may be occurred in place, such as relaxation by listening the favorite song, drinking black tea⁽²⁶⁾ or coffee⁽²⁷⁾, exercise, sleep deprivation⁽²⁸⁾, and diet restriction⁽²⁹⁾. More rigorous designs should be used to establish a cause-effect relationship and a randomized controlled trial in which the control group receives some other form of mind-body training may suit the purpose. Further research with rigorous design including long-term follow-up periods are needed to address the questions about the role of the mindfulness meditation in clinical practice.

Conclusion

Mindfulness meditation lowers the cortisol levels in the blood suggesting that it can lower stress and may decrease risk of diseases that arise from stress, such as psychiatric disorder, peptic ulcer and migrainous headache. Then, meditation should be used in combination with standard treatment.

Acknowledgement

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Potential conflicts of interest

None.

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ผลของการนั่งสมาธิต่อระดับคอर्टิซอลในเลือดของนักศึกษาแพทย์

วันเพ็ญ อรุณิตต์วัฒนการ, จันทนา เมฆสีประหลาด, ภาณวี บุษราคัมตระกูล

ภูมิหลัง: การนั่งสมาธิเป็นวิธีผ่อนคลายและลดความเครียด ความเครียดทำให้ระดับคอर्टิซอลในเลือดเพิ่มขึ้น ดังนั้นการนั่งสมาธิช่วยลดความเครียด จึงช่วยลดระดับคอर्टิซอลในเลือด

วัตถุประสงค์: เพื่อศึกษาผลของการนั่งสมาธิต่อสุขภาพจิตโดยใช้ Thai GHQ28 และเพื่อศึกษาผลของการนั่งสมาธิต่อความเครียดโดยใช้ระดับคอर्टิซอลในเลือด

วัสดุและวิธีการ: กลุ่มตัวอย่างเป็นนักศึกษาแพทย์ ชั้นปีที่ 2 จำนวน 30 คน อายุ 19.1 ± 0.55 ปี (18-20 ปี) จากคณะแพทยศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ ทำแบบทดสอบสุขภาพจิต Thai GHQ28 และเจาะเลือดเพื่อดูระดับคอर्टิซอลเวลา 8.00 น. ก่อนและหลังนั่งสมาธิตามโปรแกรมของวัดครบ 4 วัน วิเคราะห์ทางสถิติด้วยวิธี paired t-test

ผลการศึกษา: กลุ่มตัวอย่างเป็นเพศหญิง 66.77% และเพศชาย 33.33% คะแนน Thai GHQ28 ก่อนนั่งสมาธิ เท่ากับ 1.50 (SD 2.53) และหลังนั่งสมาธิครบ 4 วันเท่ากับ 0.77 (SD 2.08) เมื่อนำมาวิเคราะห์ทางสถิติด้วยวิธี paired t-test พบว่าไม่มีนัยสำคัญทางสถิติ ระดับคอर्टิซอลในเลือดก่อนนั่งสมาธิเท่ากับ 381.93 nmol/L (SD 97.74) หลังนั่งสมาธิครบ 4 วัน เท่ากับ 306.38 nmol/L (SD 90.95) เมื่อนำมาวิเคราะห์ค่าทางสถิติด้วยวิธี paired t-test พบว่ามีนัยสำคัญทางสถิติ ($p < 0.05$)

สรุป: การนั่งสมาธิช่วยลดระดับคอर्टิซอลในเลือด แสดงว่าการนั่งสมาธิช่วยลดความเครียด ซึ่งเป็นสาเหตุให้เกิดโรคหลายโรค ได้แก่ โรคทางจิตเวช, โรคกระเพาะอาหาร, โรคปวดศีรษะไมเกรน จึงควรใช้การทำสมาธิ เป็นวิธีเสริมเพิ่มจากการรักษาตามมาตรฐาน
