The Pilot Study of the Effect of Meditation to the Serum Brain-Derived Neurotrophic Factor (BDNF) of Medical Students, Srinakharinvirot University

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Background: *Mindfulness meditation is a method to decrease stress and increase memory. So, mindfulness meditation should increase serum brain-derived neurotrophic factor (BDNF).*
Objective: *To study the effect of mindfulness meditation on the serum BDNF of medical students.*
Material and Method: *The study group consisted of 30 male and female second-year medical students that volunteered to participate in the study, aged 19.1±0.55 year olds (range 18-20) from Srinakharinwirot University. Their blood was drawn to measure BDNF before and after a four-day mindfulness meditation programme. The comparison of serum BDNF levels before and after meditation were analysed by paired t-test.*
Results: *The subjects were 66.77% female and 33.33% male. The average serum BDNF level before the meditation was 17.67 ng/ml (SD 3.58). After meditation, there was a decrease in serum BDNF to 17.34 ng/ml, which was however not statistically significant (SD 4.04, p>0.05).*
Conclusion: *The levels of blood BDNF decreases slightly after practising meditation. We plan to investigate the reason in the future.*

Keywords: *Mindfulness meditation, Brain-derived neurotrophic factor (BDNF), Medical students*

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Mindfulness meditation is a method for improving health and to increase longevity[1]. The reason is to make the mind peaceful and relaxed[2], and stop all thoughts that can cause anxiety, depression, or discomfort. BDNF is a protein[3] encoded by the brain-derived neurotrophic factor (BDNF) gene[4,5] in human. BDNF is a member of the Nerve Growth Factor (NGF) family discovered by Rita Levi Montalcini in 1956[6]. BDNF has an effect on survival and function of neurones in the central nervous system and protects the hippocampus from degeneration in Alzheimer's disease. BDNF increases the survival of cholinergic neurones in the basal forebrain, hippocampus, and cortex[7]. In addition to protect cells in a stage of low oxygen, BDNF also has a role in memory and behaviour. The hippocampus is the place of relay and storage of new information as well as learning which has been found defective in learning disorders. Hippocampus and cerebral cortex are important during the adaptation to the environment and are centres of learning and memory. Moreover, it has been found that the cause of memory loss in Alzheimer's disease is the loss of function of the hippocampus[8]. In addition, BDNF plays a role in epilepsy and depression[9], obsessive compulsive disorder, and bipolar disorders[10]. Mindfulness meditation is a method to decrease stress, decrease cortisol[11], increase memory. Mindfulness meditation decrease cortisol and this have neuroprotective effect by elevating BDNF[12,13]. So, mindfulness meditation should increase serum BDNF.

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Material and Method

Study design and participants

The study group consisted of 30 male and female second-year medical students that volunteered to participate in the study, with a mean age of 19.1±0.55

year old (range 18-20, 66.77% female and 33.33% male), from Srinakharinwirot University. All participants signed informed consent prior to the study. The inclusion criteria were: being free of psychiatric disease, not being afraid of giving a blood sample, and having no history of endocrine disorders. The exclusion criterias were: inability to take the complete course or inability to adapt to living in a temple.

This study was approved by the Human Ethics Committees of the Faculty of Medicine, Srinakharinwirot University, Bangkok, Thailand. Before the meditation practice, the procedure was explained to the students.

The blood was drawn for BDNF measurements before they practice the mindfulness meditation course at the Sunantharam Temple, which consisted of mindfulness meditation for four hours distributed in three periods (5:30-6:30, 11:00-12:00, 19:00-21:00) mentored by experienced monks for four days. The meditation consisted in focussing the attention on the breathing as air enters and leaves the nostrils, trying to notice any sensation felt at the points of entry and exit[14]. After completion of the course, blood was drawn for BDNF measurements.

Blood BDNF determination

A volume of 4 ml of venous blood samples were drawn from the antecubital vein of subjects. BDNF was determined from blood samples, as it is known that in rat hippocampus, BDNF correlates to the blood BDNF[15]. Blood was drawn to determine BDNF protein in the serum. Blood was centrifuged for 10 min at 2,000 rpm. The supernatant was used to determine brain derived neurotrophic factor protein using enzyme linked immunosorbent assay (ELISA).

The mindfulness meditation method

The meditation consists of focussing the attention on the breathing, 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 goal of mindfulness meditation is to put the mind in a state of thoughtless awareness. In this study, the subjects meditated under the mindfulness meditation courses of the Sunanthavanaram Temple in Kanjanaburi, in the western part of Thailand. Meditation courses there are taught and mentored by well known Buddhist monks.

Statistical analysis

The association between demographic background and serum BDNF levels were analysed by independent t-test. The comparison of the serum BDNF levels before and after mindfulness meditation course was analysed by paired t-test. The descriptive statistics were presented with percentage, mean, and standard deviation. Values were considered to be statistically significant when p-value <0.05.

Results

Subject characteristics

The demographic data of subjects are shown in Table1. There was no statistical significant association between demographic background and serum BDNF levels (data not shown).

BDNF assessment

The average serum BDNF level of 30 students before the meditation practice was 17.67ng/ml (SD 3.58). After the meditation practice, the average serum BDNF level was 17.34 ng/ml (SD 4.04).

As shown in Fig. 1, the average serum BDNF level of the 30 students before the meditation practice was higher than after the meditation practice, but the difference was not statistically significant (p>0.05).

Discussion

The levels of serum BDNF decreased slightly after practising meditation, but the differences were not statistically significant (p>0.05). This finding disagrees with previous research[16] that meditation increased BDNF. Meditation, a method of mental training to focus attention[17] can control brain resource distribution, improving both self-regulation[18] and attention. The meditation practice may have the ability to strengthen neuronal circuits as selective attentional processes improve[16]. Meditation may also increase cognitive capacity[17]. Research has found that meditation significantly decreases cortisol secretion[18] and may elevate brain-derived neurotrophic factor[16], which protects neurons against stress and stimulates the production of new neurons[19]. Magnetic resonance imaging (MRI) of Buddhist insight meditation practitioners who practice mindfulness meditation were found to have an increase in cortical thickness and hippocampus volume compared to the control group[20]. Electroencephalography (EEG) and neuroimaging studies have found that practising meditation makes the brain strong[21]. Walton et al[11] studied 29 postmenopausal women. Sixteen longterm TM practioners were compaired to thirteen controls who did not practice TM. Cortisol respond was higher

Table 1. Demographic data of all subjects

Factor	Number (%) (n = 30)
Gender	
Male	10 (33.33)
Female	20 (66.67)
Age (year)	19.1±0.55 (18-20)
Parent status	
Couple	26 (86.70)
Divorce/widow	4 (13.30)
Income (baht/month)	
<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)
yes	0 (0)
Alcohol drinking	
No	26 (86.70)
Yes	4 (13.30)
Underlying diseases	
No	28 (93.30)
Yes	2 (6.70)
Stressor in previous months	
No	6 (20.00)
Yes	24 (80.00)
Hobbies	
No	24 (80.00)
Yes	6 (20.00)
Relationship with parents	
Very good	18 (60.00)
Good	10 (33.30)
Moderate	2 (6.70)
Relationship with teachers	
Very good	6 (20.00)
Good	17 (56.70)
Moderate	7 (23.30)
Relationship with friends	
Very good	12 (40.00)
Good	16 (53.30)
Moderate	2 (6.70)
Relationship with siblings	
Very good	18 (60.00)
Good	10 (33.30)
Moderate	2 (6.70)

in controls than longterm TM practioners. TM reduced the harmful effect of stress-induced hypercortisolemia on hippocampus so may increase BDNF.

Nevertheless, the finding here is that there is a decrease in BDNF was not statistically significant. It

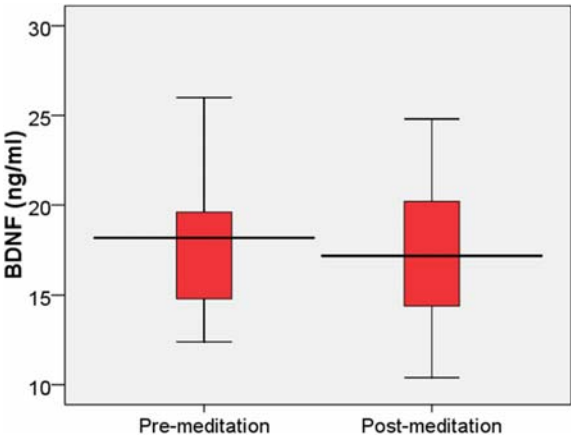

Fig. 1 Comparison of serum BDNF before and after the meditation practice.

is possible that a four day meditation period is too short to see an increase in BDNF. In other words, any causes which are out of our control and not related to our intervention may have taken place, such as exercise, sleep deprivation[22], and-diet restriction[23] that may have increased the BDNF levels. Exercise is known to increase the level of brain-derived neurotrophic factor (BDNF) resulting in benefits for learning and memory[24].

A weak point in this study is the low number of participants and the short time allowed to practice meditation. A study with more participants may give a more robust statistics. On the other hand, our study supports the notion that BDNF levels has tendency to decrease with meditation. However, data shows no significant difference a study that has never been done before in Thailand.

Conclusion

A short course meditation in Thai medical students had no significant effect on BDNF level due to unknown mechanism and no evidence support. We plan to investigate this unknown mechanism in the future.

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What is already known on this topic ?

Mindfulness meditation is a method to decrease stress and increase memory So, mindfulness meditation should increase serum brain-derived neurotrophic factor (BDNF).

What this study adds ?

Our findings suggest that a short course meditation in Thai medical students had no significant effect on BDNF.

Potential conflicts of interest

None.

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ผลของการนั่งสมาธิต่อระดับโปรตีนบีดีเอ็นเอฟในเลือดของนักศึกษาแพทย์คณะแพทยศาสตร์ มศว.

วันเพ็ญ ธุรกิตต์วัณณการ, จันทนา เมฆสีประหลาด, ภนารี บุษราคัมตระกูล

ภูมิหลัง: *การนั่งสมาธิเป็นวิธีผ่อนคลายและลดความเครียดเพิ่มความจำดังนั้นการนั่งสมาธิอาจช่วยเพิ่มระดับ BDNF ในเลือด*
วัตถุประสงค์: *เพื่อศึกษาผลของการทำสมาธิต่อระดับโปรตีนบีดีเอ็นเอฟในเลือดของนิสิตแพทย์*
วัสดุและวิธีการ: *กลุ่มตัวอย่างเป็นนักศึกษาแพทย์ ชั้นปีที่ 2 จำนวน 30 คน อายุ 19.1±0.55 ปี (18-20 ปี) จากคณะแพทยศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ เจาะเลือดเพื่อดูระดับโปรตีนบีดีเอ็นเอฟ ก่อนและหลังทำสมาธิตามโปรแกรมของวัดครบ 4 วัน เปรียบเทียบระดับโปรตีนบีดีเอ็นเอฟ ในเลือดก่อนและหลังนั่งสมาธิ วิเคราะห์ทางสถิติด้วยวิธี paired t-test*
ผลการศึกษา: *กลุ่มตัวอย่างเป็นเพศหญิงร้อยละ 66.77 และเพศชายร้อยละ 33.33 ระดับ BDNF ในเลือดก่อนทำสมาธิเท่ากับ 17.67 ng/ml (SD 3.58), หลังทำสมาธิเท่ากับ 17.34 ng/ml (SD 4.04) วิเคราะห์ค่าทางสถิติด้วยวิธี paired t-test พบว่าลดลงแบบไม่มีนัยสำคัญทางสถิติ (p>0.05)*
สรุป: *การนั่งสมาธิลดระดับโปรตีนบีดีเอ็นเอฟ ผู้นิพนธ์มีแผนจะหาสาเหตุต่อไปในอนาคต*