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EFFECTS OF *KAEMPFERIA PARVIFLORA* ON PHYSICAL AND PSYCHOLOGICAL STRESSES IN ADULTS

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ABSTRACT: Although *Kaempferia parviflora* (*K. parviflora*) has been known as one of health-promoting herbs, a clinical trial is needed to confirm its beneficial effect on stress reduction. The aim of this study was to determine the effects of *Kaempferia parviflora* on the physiological and psychological stresses. Eighty healthy adult participants with moderate stress level were randomly allocated into two groups; either ingested with extracted *Kaempferia parviflora* at doses of 360 mg/day for 14 days (*Kaempferia parviflora* group) or placebo capsules (placebo group). The results indicated both groups had significantly decreased stress based upon Hamilton Anxiety Rating Scale (HAM-A) and Suanprung Stress Test-20 (SPST-20). Heart rate variability measures exhibited non-significant between-group comparison, except RMSSD and LF/HF of which the placebo group had significantly lower and higher respectively than the *Kaempferia parviflora* group. This study suggests that *Kaempferia parviflora* may be useful for both physiological and psychological stress reduction.

Keywords: Kaempferia parviflora, Stress, Clinical trial, Heart rate variability

1. INTRODUCTION

Currently, stress has been one of the health problems in the society and its consequences have affected daily living in a great deal, such as peptic ulcer, depressive syndrome, diabetes, and high blood pressure. The reaction of stress does affect not only physically, but also psychologically wellbeing, like having fears and trembling, obvious symptoms reacted by the autonomic nervous system; feeling a terrible headache, fatigue, nausea, vomiting, increased heart rate, and muscle tightness. [1] The long-term physical stresses can arouse the sympathetic nervous system, increase blood pressure, heart rates, salivary cortisol secretion, and decrease heart rate variability.

Kaempferia parviflora (Thai Ginseng) is an herbaceous plant in the family *Zingiberaceae*, native in Thailand (Fig. 1-2). It has been believed that it might contain a substance that increases libido when consumed. A study found that it has an inhibiting effect on the growth of microorganisms. In addition, it also be found to have beneficial effect for health such as anti-inflammatory effect [2], reduce of blood sugar levels and lipid levels in mice, increase physical fitness, and reduce oxidative stress in elderly people [3], increase blood flow to the muscles [4]-[5].

Fig. 1 The rhizomes of *Kaempferia parviflora*

Fig. 2 The leaves of the *Kaempferia parviflora*

Since persistent stress affects the body cells to produces excessive oxidants which destroy biomolecules in cells and cause tissue cell degradation [6] and because of the antioxidant mechanism of *Kaempferia parviflora*, we propose that consuming an optimum dose of extracted *Kaempferia parviflora* may reduce physical and psychological stresses in adult subjects.

2. METHODS

2.1 Design and Participants

This study was a randomized controlled trial. Ninety volunteers were recruited. However, only 80 volunteers aged 24-46 years met the criteria. They had mild to moderate degree of psychological stress were screened by a psychiatrist to rule out for anxiety. The self-assessment form for anxiety symptoms was used for volunteers who were identified having a slightly low level of anxiety. The exclusion criteria were as follows: Volunteers with a history of psychiatric illnesses, such as depression, schizophrenia, bipolar mood, or having taken any type of stress medication, have had musculoskeletal pain, postmenopausal women, functional abnormalities of liver and kidneys, lack of understandable communication, unable to follow the instructions, or having a disease that requires continuous treatment. The diagram of the flow of the volunteers through each stage of the trial was shown below (Fig. 3).

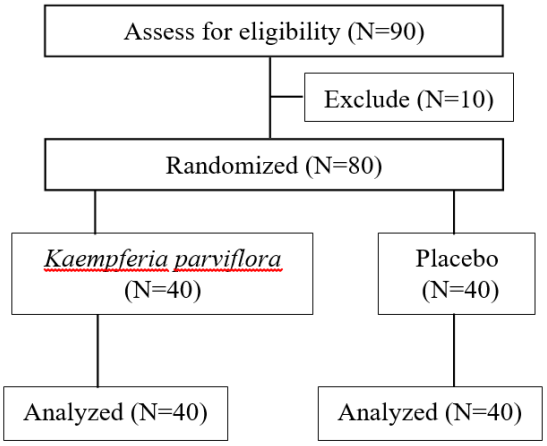

Fig. 3 Diagram showing the flow of volunteers through each stage of a randomized trial.

2.2 Research setting

The data collection procedures were obtained at research room, Faculty of Associated Medical Sciences where is very quiet, no noise disturbing. Room temperature was controlled at 25 C (Fig. 4).

2.3 Intervention and Procedure

The study proposal was approved by the Khon Kaen University Ethics Committee for Human Research. All qualified volunteers were informed on research objectives and how they were expected to perform while participating in the study. Then they signed the consent form as well as answering the questionnaire relating to general information. Self- stress level was subsequently self-evaluated while the anxiety was assessed by the psychiatrist (Fig. 5). Volunteers were randomly allocated either in the experimental group to take the extracted *Kaempferia parviflora* or in the placebo group.

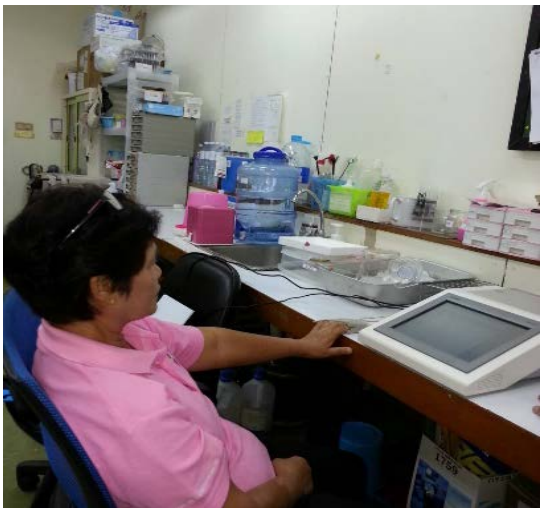

Fig. 4 The data collection on HRV in a quiet room.

Fig. 5 A participant was assessed by a psychiatrist.

The randomized volunteers took either extracted *Kaempferia parviflora* or placebo which were contained in similar capsules (Figure 6). The data collector did not know which group each volunteer belonged to until the data collection process was finished. The volunteers received either extracted *Kaempferia parviflora* (360

milligrams/day according to human-equivalent safety dose in a previous study) [7] or placebo after having blood test for Liver enzyme (alanine transaminase: ALT, aspartate transaminase: AST, alkaline phosphatase: ALP) and kidney function (Blood urea nitrogen: BUN, Creatinine: Cr) to identify the normality. After that each volunteer took 1 capsule (180 milligrams) at a time before a meal in the morning and evening meal lasted for 7 days. The blood test was repeated again after 7 and 14 days of taking the capsules to ensure that liver enzymes and kidneys function were within normal range. At the end of the study, the anxiety of all the volunteers was assessed by the Psychiatrists and self-assessment was also performed.

Fig. 6 The blinded capsules for either *Kaempferia parviflora* or placebo.

2.4 Measurement equipment

HRV data were collected in a quiet room using a standard HVR device (SA-3000P, Medicore Co., Ltd, South Korea). Variables used for stress assessment in the study were as follows. The first four variables reflected more physical than psychological stress whereas the last two reflected more psychological stress.

Stress index is a measure, sensitive to changes and reliable. It can be measured by an HRV detector. The results are as follows: 50-70 excellent, 71-90 good, 91-110 normal, 111-130 stressed (poor), 131-150 stressed (very bad)

Stress resistance refers to the adaptation of the body towards stress, used to evaluate the functioning of the autonomic nervous system. The same tools and methods of measurement were used as stress index, the results are as follows: 50-70 Bad, 71-90 Poor, 91-110 Normal, 111-130 Good, 131-150 Very good

Heart rate variability: heart rate variability includes the values of heart rate (HR), standard deviation of normal-to-normal intervals (SDNN), root of the mean squared of successive difference of normal RR intervals (RMSSD), high frequency (HF), low frequency; LF) and low frequency per high frequency ratio (LF/HF ratio).

Salivary α-amylase levels (Salivary α-amylase levels) were measured by inserting a test strip into the mouth and left underneath the tongue for 2 minutes. Then the strip results were read by Human Cocoa Meters (Nipro Co., LTD., Japan). The readings were interpreted as follows: 0-30 KU/L Normal, 30-45 KU/L High, 46-60 KU/L High,> 60 KU/L very high.

The psychological stress level was assessed by Suanprung Stress Test with 20 questions (SPST-20), recommended by the Department of Mental Health. The Cronbach's alpha reliability coefficient was greater than 0.7.

The level of anxiety was assessed by Thai version of Hamilton Anxiety Rating Scale (HAM-A).

2.5 Statistical analyses

Descriptive statistics were used to describe the characteristics of the volunteers. The results of all the continuous variables were compared within the group by using the Sign test statistic providing that the data were not normally distributed. To compare between the groups, the Wilcoxon Rank Sum statistic was used. Statistically significant was set at $\alpha < 0.05$. All statistics were analyzed using SPSS version 19 (Armonk, NY: IBM Corp. Under licensed by Khon- Kaen University)

3. RESULTS

All the recruited participants (13 males and 67 females), aged 24-46 years, who met the inclusive criteria completed the study. The demographic data were a balance between the *Kaempferia parviflora* and the placebo groups (Table 1).

Table 1 Demographic data of the *Kaempferia parviflora* and control groups

Characteristics	*Kaempferia parviflora* (n=40)	Placebo (n=40)
Gender		
Female	33(82.50)	34(85.00)
Male	7(17.50)	6(15.00)
Age		
<36	24(60.00)	20(50.00)
36-45	15(37.50)	20(50.00)
>45	1(2.50)	0(0.00)
Mean ± SD	34.50±6.12	34.15±6.93

Note: n (%)

Results of a volunteer at baseline demonstrate that all stress variable was not significantly different between the two groups (Table 2).

Table 2 Comparison of stress variables at baseline between the two groups.

Stress variables	*Kaempferia parviflora*	Placebo	*p*-value
Stress index	95(10.5)	98(18.0)	0.065
Stress resistance	97(11.5)	93(21.5)	0.109
SDNN	39.86(22.2)	32.74(24.1)	0.175
RMSSD	30.02(21.8)	24.52(18.6)	0.194
HF	5.79(1.6)	5.29(1.4)	0.155
LF	5.44(1.6)	5.44(1.0)	0.870
LF/HF	0.81(1.5)	1.21(1.8)	0.051
Amylase	74.50(55.0)	83.00(46.5)	0.299
HAM-A	19(10.0)	18(15.0)	0.751
SPST–20	57(10.5)	60(13.5)	0.287

Note: Median(IQR)

Stress variables after 14 days of taking either extracted *Kaempferia parviflora* or placebo were compared. The results demonstrate that most of the stress variables were not significantly different between the two groups except the RMSSD and LF/HF ratio (Table 3).

Liver enzyme (alanine transaminase, aspartate transaminase, alkaline phosphatase) and kidney function (blood urea nitrogen, creatinine) were found to be normal for every volunteer even after 14 days of taking the capsules (Table 4).

Table 3 Comparison of stress variables after 14 days of taking either extracted *Kaempferia parviflora* or placebo capsules

Stress variables	*Kaempferia parviflora*	Placebo	*p*-value
Stress index	95.5(14.5)	101.5(18.5)	0.117
Stress resistance	96(13.0)	91(20.0)	0.119
SDNN	38.16(17.2)	30.25(19.6)	0.090
RMSSD	29.30(17.4)	22.90(16.0)	0.033
HF	5.43(0.9)	5.12(1.7)	0.084
LF	5.36(1.3)	5.08(1.5)	0.403
LF/HF	0.88(0.9)	1.28(1.7)	0.036
Amylase	63(47.0)	69(53.5)	0.528
HAM-A	9.40(8.0)	9.50(11.0)	0.647
SPST–20	48(16.5)	44.50(13.0)	0.158

Note: Median(IQR)

Table 4 Chemical blood values for liver and kidney function assessment after 14 days of taking the capsules

Chemical Blood test	*Kaempferia parviflora*	Placebo	Normal range
BUN	10.5(5.0)	11(5.0)	5.8-19.1
Cr	0.8(0.2)	0.8(0.2)	0.5-1.5
AST	22(6.5)	21(5.5)	12-32
ALT	14(5.5)	17(7.5)	4-36
ALP	47(7.0)	48.5(10.0)	37-147

Note: Note: Median(IQR)

4. DISCUSSION

The purpose of the study was to determine the clinical effects of extracted *Kaempferia parviflora* on physical and mental stress in adults. Eighty volunteers without any contra-indication underwent the randomized controlled trial although most of the stress variables were not significantly different between the two groups at the end of the trial, RMSSD was higher, and LF/HF ratio was lower in the treatment group than the control (Table 3). The results of these two variables revealed that 14 days of 360 mg/day of extracted *Kaempferia parviflora* could reduce physical and psychological stresses.

The results from Table 3, when compared to the stress index, the level of stress in the *Kaempferia parviflora* taken group was lower than the placebo group by about 6%. However, the difference between the groups was not statistically significant. As far as the value of RMSSD was concerned, the vagal tone was increased and denoted stress relief. This study also found that the stress level of the group taken the extracted the *Kaempferia parviflora* was statistically lower than the placebo. The results of changing in the Alpha-amylase and HAM-A show similarity pattern as the others. Volunteers from the *Kaempferia parviflora* taken group had a significantly lower stress and anxiety than those in the placebo group although no statistically significant differences.

The results from other variables of HRV did not detect any differences after the completion of 14 days, except RMSSD, and LF/HF only. The increased RMSSD and decreased LF/HF suggested that the *Kaempferia parviflora* taken group had a lower level of stress after the 14 days. Other variables of HRV such as stress index, stress resistance, SDNN, and HF also in line with the RMSSD and LF/HF but they did not show statistical significance. This might be due to a relatively short period of taking extracted

Kaempferia parviflora that exhibited small stress reduction effects. Further study might consider a longer period of intervention and a higher dose of taking extracted *Kaempferia parviflora* so that the differences between the groups may be obviously shown. The results of this study correspond to the past research which found that the *Kaempferia parviflora* was effective in reducing the volunteers stress in older subjects [3].

The volunteers in the current study did not drop out or quit. No serious adverse reactions were found during taking the extracted *Kaempferia parviflora*. It was reported that only one volunteer from the extracted *Kaempferia parviflora* taken group developed flatulence which was a slight symptom. In addition, blood tests on the liver enzyme, blood urea nitrogen, and creatinine were within normal limit of all the participants after 14 days of taking the capsules (Table 4). This evidence revealed that the amount of the extracted *Kaempferia parviflora* taken was safe and suitable for the volunteers' ages.

A possible mechanism of stress reduction resulting from ingestion of *Kaempferia parviflora* may be due to an indirect effect on neural tissues. Since *Kaempferia parviflora* has been found to have anti-inflammatory [8], and vasorelaxation effects [9], [10], these may increase the threshold of stress to neural tissues. Moreover, the increased RMSSD and HF resulting from having *Kaempferia parviflora* in this study suggested that it also increased the parasympathetic tone of the autonomic nervous system and produced mental relaxation.

The study design of this study is a randomized controlled trial with double-blind. Both the participants and the researchers were blinded for the group allocation because none of them knew which group received active (*Kaempferia parviflora)* capsules until the end of the data collection. This design has been suggested the as high quality of clinical trial because it reduces the potential allocation and measurement biases.

5. CONCLUSION

Although *Kaempferia parviflora* has been used as herbal medicine for health promotion and refreshment in Thai people for a long time, this randomized controlled trial is the first study to reveal that the extracted *Kaempferia parviflora* with the dose of 360 mg/day may provide some effects on reducing stress and anxiety in adults. Further study could be done in a longer period of investigation and follow up where more prominent effects may be found.

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