

CHAPTER 4

RESULTS AND DISCUSSION

Results of the study

This quasi- experimental research studied the effects of the Yoga program on stress and blood pressure reduction among persons with hypertension, conducted during the period of July to November 2003. Purposive sampling was used to recruit subjects from mobile clinic for health screening in Songkhla Province. There were initially 61 subjects for randomization at pretest. The subjects were separated into two groups, experimental and control group, by using the minimized randomization program version 2.01 of Zeller (1997) run on Microsoft access 2000 to control variables affecting stress and blood pressure. However, at the completion of the study, seven subjects (11%) of the sample were dropped for various reasons. Five subjects in the experimental group stopped practising yoga before completing the program. In the control group, two subjects were dropped from the study because of receiving antihypertensive drugs (one subject) and the other lost contact before completing the program. The experimental group received the Yoga program three times a week for eight consecutive weeks whereas the control group did not receive any yoga program during the period of the study. Finally, fifty-four subjects participated the program to fulfill the statistical design; with twenty-seven subjects in the experimental group and the control group. On completion of the study, the power of statistic and effect size were calculated through the mean of stress and blood pressure of both groups and standard deviation of the subjects to

confirm the sample size of the subject ($d = 1.49 - 1.98$) (Cohen, 1988). The power of statistic in this study was greater than .99 and effect size was .83.

The results of this study are presented in three parts: The first is the demographic data and health related factors of the subjects. The second is the distribution of stress and stress levels in control and experimental group. The last is the findings related to variables in the study.

Discussion

The aim of this quasi- experimental research was to identify the effects of a Yoga program on stress and blood pressure reduction among persons with hypertension. The results of this study showed that after practising the Yoga program for eight weeks stress and blood pressure was reduced among person with mild stress and mild to moderate hypertension. The discussion will be based on characteristics of the subjects and other variables related to stress and blood pressure: heart rate and respiratory rate. Additionally, a change of body mass index as a result of yoga was also investigated.

1. Characteristic of subjects

To ensure homogeneity between the experimental and control group they were matched for the factors; age, gender, educational level, smoking habit, alcohol use, and exercise behavior. The majority of the subjects were female; the experimental group (63%) and the control group (63.2%). Although there were more females than males in this study, it does not mean that more females than males have hypertension. Females are generally more compliant with health care than males as was supported by a study of Khantisuwan (1986) who reported that more females sought care and had more health services than males. Another study reported that females exhibit a greater predisposition to engage in preventive health behaviors than males (Pham Van Dai, 1999 cited in Ruangtip, 2000). More importantly as this study needed willing participants who were interested in practising yoga more females than males consented. The researcher approached some male participants to join the study but many of them refused and expressed their interest in other types of exercise such as running, cycling and so on. The subjects' mean ages were 56.7 and 56.2 years old in the experimental and the control group respectively, demonstrating that the subjects were

late adult, the age at which the majority of people with hypertension are diagnosed (Lewis, et. al, 1996). Similarly, Kaplan (1998) reported that most people with essential hypertension were late adult or elderly. Other personal data of the experimental and the control groups were not significant different (Table 1, Table 2). When considering stress and blood pressure both stress and blood pressure in the pretest was not significant difference between experimental and control group therefore, showing that the subjects selected were a homogeneous group and suitable for comparison of this study.

2. Effects of yoga program on stress and blood pressure reduction among persons with hypertension

2.1 Effects of the Yoga program on stress

The results showed that the subjects in the experimental group had a significantly decreased mean score of stress after practising the Yoga program from 93.62 ± 23.48 at pre-intervention to 80.87 ± 13.63 at post-intervention 8th week ($p < .01$) and had a significantly lower than that of the control group ($\bar{x} = 106.66 \pm 27.45$, $p < .01$). This finding met the hypothesis that persons with hypertension participating in the Yoga program for eight weeks would have reduced stress levels compared to those who did not participate in the Yoga program.

The reduction of stress among persons with hypertension after practising yoga is possibly due to the effect of the relaxation technique used in the Yoga program. It was obvious that every component of the yoga practice, asana, pranayama, and deep relaxation could effectively induce calmness, and peacefulness that can lead to stress reduction. This result supported the study of Wangner (1997) and Baldwin (1999), who showed that Hatha yoga practice in the elderly helped to calm the mind, engender and maintain robust psychological health resulting in stress reduction.

Additionally, Bera, Gore and Oak (1998) studied in 27 graduate students who were induced stress by treadmill running. After completing the scheduled treadmill running, each subject took rest in one out of following three ways of relaxation: sitting on chair, lying supine, and Shavasana (yogic relaxation). The group using Shavasana could show recovery from physiological stress in a shorter time than the other groups, as measured by heart rate and blood pressure every two minutes.

In particular, the pranayama and deep relaxation that includes deep breathing and cultivation of mind concentration or awareness in their components, can lead to a deep relaxation of both body and mind (Howard VanEs, 2004). Relaxation disrupts the fight or flight stress response decreasing the output of adrenaline from the adrenal medullar resulting in stress reduction (Naunjai, n.d.). Besides, conscious awareness of the mind during yoga practice helps to break the vicious cycle of stress resulting in calmness (Nagarathna, Nagendra, &Monro, 1995). Furthermore, it was found that higher concentration was developed as a result of a yoga practice and helped effectively deal with stressful conditions.

Concentration along with controlled breathing during yoga asana results in relaxation as during the relaxation and calmness stage the body secretes endorphin, which has the same effect as morphine, resulting in a reduction of the force of muscles and stress. Some yoga asanas for instance, Bow pose and Cobra pose, have been reported to massage the adrenal glands helping to increase blood flow to the glands resulting in balanced working (Singh, 1998; Worapongpichet, 1999). As a result, body and mind become calm. Practising the Fish pose and Yoga mudra pose have a direct effect on massaging and increasing circulation to the pineal gland. This gland produces melatonin and serotonin hormone. When the pineal gland is massaged, it increases its blood circulation resulting in better working. In this way,

the production of melatonin increases and serotonin gradually decreases resulting in a direct effect of peacefulness and happiness (Anandamitra, 2000; Singh, 1998; Terasira & Chunhasawatdekul, 2000; Worapongpichet, 1999). This finding of stress reduction was supported by the study of Malathi and Damodaran (1999). They randomly assigned 50 medical students who had high stress due to examinations, to an experimental and control group. The yoga program was performed three times a week for 12 weeks. They reported that at posttest the mean anxiety score was a statistically significantly reduced in the yoga group, but there was no significant change in the anxiety score in the control group. Yoga has also reported to be used for relief of stress and anxiety in other groups of people such as epilepsy patients, post stroke patients, people with diabetes mellitus, and healthy people (Bastille & Gill-Body, 2004; Elder, 2004; Malathi, Damodaran, Shah, Patil, & Maratha, 1999).

2.2 Effects of the Yoga program on SBP, DBP, HR, and RR

The present study showed that the subjects in the experimental group had significantly decreased SBP, DBP, and HR means value at post-intervention (8th week) from 160.89 ± 10.37 mmHg to 136.04 ± 12.93 mmHg, 98.52 ± 8.33 to 81.01 ± 10.36 mmHg, and 85.59 ± 9.72 to 73.74 ± 7.76 beat / minute respectively ($p < .01$). The post intervention blood pressure was significantly lower than that of the control group, which showed no significant decrease in either SBP or DBP mean value between pretest and posttest ($p > .05$) (Table 7, 9, 11). Additionally, the finding revealed that both systolic and diastolic blood pressure had gradually decreased from the second week of yoga practice until approaching the normal level at the 8th week of intervention (Table 7, 9). Although, the mean of heart rate at pretest was normal, there was significantly decreased from the second week of yoga practice compared to the control group ($p < .01$).

Respiratory rate also significantly decreased in the experimental group from the 4th week compared to pretest and to the control group. There was no significant decrease of respiratory rate after the program in the control group (Table 11, 13). This finding revealed that respiratory rate had significantly decreased as a result of yoga practice. As decreased sympathetic activity and increased parasympathetic activity during relaxation result in decreased heart rate, respiratory rate, and blood pressure (Nath, 1992), it is suggestive that the yoga program has worked through this pathway to significantly reduce all these measures in the experimental group. This result was supported by the study of Telles, Nagarathna, and Nagendra (1994) conducted with 48 male subjects, practising 27 respiratory cycles three times daily for one month in different kinds of breathing through a particular nostril of pranayama. They reported that after practising pranayama respiratory rate and heart rate decreased.

The reduction of blood pressure, heart rate, and respiratory rate as a result of practising the Yoga program in this study was congruent with several previous studies (Murugesan, Govindarajulu, & Bera, 2000; Raju, Prasad, Venkata, Murthy, & Reddy, 1994; Schell, Allolio, & Schonecke, 1994; Sevamurthy, et. al, 1998; Bowman, Clayton, Murray, Reed, Subhan, & Ford, 1997). Murugesan, Govindarajulu, and Bera (2000) who looked at the effect of selected yogic practices on the management of hypertension in thirty-three hypertensive patients. They reported that the experimental group, which underwent yoga training six days a week for 11 weeks, showed a statistically significant reduction ($p < .01$) in SBP, DBP, and HR and they were no significant difference in the control group. The study of Schell and colleagues (1994), who examined the physiological and psychological effects of Hatha yoga exercise on healthy women, demonstrated that the mean heart rate was significantly decreased during yoga practice which supported the study of Raju and colleagues (1994), who studied the

influence of the intensive yoga training on physiological changes in six adult women. They found that there was a significantly ($p < .05$) reduced respiratory quotient after the intensive yoga practice for four weeks. Several other research show evidence that yogic practice cause relaxation. The mechanism is known to reduce the sympathetic activity as evidence in pulse rate and blood pressure reduction (Bowman, Clayton, Murray, Reed, Subhan, & Ford, 1997). Both systolic and diastolic pressure had significantly decreased after the second week of the yoga practice until approaching the normal level at the 8th week of the intervention. Similarly, the heart rate had significantly decreased after the second week of the yoga practice, whereas the respiratory rate significantly decreased after 4th week ($p < .05$).

The significant gradual decline in blood pressure from the second week (or 6 days of yoga practice) is supported by the study of Selvamurthy and colleagues (1997), who studied 20 male patients with essential hypertension. The patients were divided into two groups and gradually withdrawn from drug therapy. The group-1 used a tilt table for head -up whereas group-2 did specific yogic exercises equivalent to head-up or head-down for 30 minutes daily for three weeks. Blood pressure showed a gradual significant decline from the 5th day of the yoga course ($p < .01$).

An unexpected finding was that persons with hypertension in the control group had a significant increase in their mean value of RR ($p < .05$) as well as a non-significant increase in mean value of HR and stress over 8 weeks. A possible explanation for this is that the subjects who did not practise yoga had increased stress due to their initial diagnosis of hypertension being given ways to adapt themselves in order to bring down their blood pressure. This initial stage of adaptation to a new lifestyle, such as, reduction of salty food, avoidance of smoking and drinking might cause further stress. It is not likely to have come from a crisis or day-to-day living as

stress crisis was documented during the program but none were recorded (Table 3). This event supported by the study of McEntee, & Peddicord (1987) stating that newly diagnosed hypertensive patient was likely to be worried, angry, and in denial due to cognitive appraisal of the impact of diagnosis, and may view the event as threatening. This is why the control group has increased HR and RR over 8 weeks.

The results suggested that the effects of the yoga intervention appeared to dissipate blood pressure beginning at the 2nd week of the study. The possible mechanism of blood pressure reduction is through stress reduction because of yoga practice. It was obvious in the study that every component of yoga practice: asana, pranayama, and deep relaxation could effectively induce calmness, and peacefulness that led to stress reduction. In particular, the pranayama and deep relaxation that includes deep breathing and cultivation of mind concentration or awareness in their components, lead to a deep relaxation of both body and mind (Howard-VanEs, 2004). Relaxation disrupts the fight or flight stress response resulting in stress reduction (Baldwin, 1999; Wagner, 1997). It is also evident that conscious awareness of the mind during yoga practice helps to break the vicious cycle of stress resulting in calmness while other types of relaxation failed to achieve this result (Nagarathna, Nagendra, & Monro, 1995). In this study, the effect of yoga on stress reduction was evaluated using the SAQ based on a person's experience or feeling relating to stress in a previous period of a month, so it was not appropriate to use this questionnaire to evaluate stress every two weeks as the protocol indicated. However, the stress reduction effect of yoga may have been expressed through a decrease of HR and RR because of the practice. It is believed that the calmness and awareness effect of yoga practice slow down sympathetic activity but activate parasympathetic activity resulting in a reduction of HR and RR that could be observed from the 2nd week until

the entire period of the practice. Nevertheless, the significant reduction of RR was found from the 4th week of the practice.

Additionally, the harmonious flow of prana through chakra as a result of pranayama and deep relaxation practice, lead to a balance of the five sheaths of human existence, namely physical body, vital body or life force, mind, intellect, and blissful consciousness (Nagarathna, Nagendra, & Monro, 1995; Nath, 1992). Performing asanas also helps to massage internal organs resulting in increased blood circulation leading to better function of various glands, and balancing hormone secretions. In this way, a balance of body and mind was achieved and contributing to normalize heart rate, respiratory rate, and blood pressure.

2.3 Effects of the Yoga program on body mass index (BMI)

The results showed that there was a significant reduction of BMI (Kg/M^2) within the experimental group ($p < .05$) after practising the Yoga program since the sixth week while there was no significant change of BMI in the control group ($p > .05$). However, when the mean values of BMI of between the experimental and control group at pretest and weeks 2, 4, 6, 8 were compared, there was no significant difference ($p > .05$) (Table 16). Although there was no significant difference in mean values of BMI between the experimental and the control group, the results demonstrated a trend of BMI reduction from weeks 6 and 8 in persons with hypertension practising the Yoga program. The effect of yoga on body weight has been reported by many studies (Murugesan, Govindarajulu, & Bera, 2000; Satyanarayana, Rajeswari, Rani, Krishna, & Rao, 1992; Telles, Nagarathna, & Nagendra, 1994). Murugesan, Govindarajulu, and Bera (2000) reported on their study with thirty-three hypertensive patients that the participants who underwent yoga training for 11 weeks, 6 days a week showed a statistically significant reduction

($p < .01$) in body weight whereas in the control group it was slightly increased but was not significant. Similarly, the study of Telles, Nagarathna, and Nagendra (1994), who had 48 male Indian people practice breathing through a particular nostril to see if they could alter metabolism and autonomic activities. They found that there was a significant ($p < .01$) reduction in body weight after practising either right, left or alternative nostril prannayama throughout a month. There were several explanations for the body weight reduction. Firstly, it was evident that yogic practices by breathing through a nostril either right, left, or alternate nostril showed a significant increase of baseline oxygen consumption indicating an increase in metabolism. Practising pranayama especially through the right nostril could induce more sympathetic activity than left nostril and alternative nostril pranayama. Thus, right nostril pranayama could reduce body weight more effectively than left and alternative nostril pranayama. (Telles, Nagarathna, & Nagendra, 1994). Secondly, the reduction in body weight might be a result of changing the eating style of the subjects to eating more vegetables and avoiding saturated fat after receiving routine health information related to self practice of hypertensive patients from health personnel in the hospital. In this study, it is hypothesized that the decrease of BMI is possibly a result of an increase of metabolism while practicing yoga, or may be a change of eating style as an attempt to control the hypertension after receiving health information as a part of the program. Moreover, a reduction of BMI is also depends on the types of yogic practice. The more intensive level asana pose, the more increase in the metabolism in the body. However, the effects of yoga on BMI may need to be studied for a longer period of time.

Finally, it can be concluded that practicing the Yoga program could reduce stress and blood pressure among persons with essential hypertension. The reduction of stress could have resulted primarily from relaxation and concentration because of

practising asana, pranayama, and deep relaxation. The reduction of stress further leads to blood pressure reduction through an activation of parasympathetic activity resulting in a reduction of heart rate and respiratory rate. Another possible means to explain the normalized blood pressure effects of the Yoga program includes the possibility of a direct effect of yoga practice on the harmonious flow of prana through chakra and on massaging various glands that helps balance the secretion of hormones contributing to a more congruent, harmonious state of health.