The Effectiveness of Ultra-Brief Mindfulness Intervention in Distress Reduction

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Abstract

The effectiveness of ultra-brief mindfulness intervention on distress objectively and subjectively was being examined. Forty participants included 18 males and 22 females with a mean age of 22 years old were recruited and randomly allocated to Mindful STOP or reflective listening which was the control group. The results revealed that there were no significant difference in the subjective level of distress which include SUDS ($p = 0.731$) and state-anxiety ($p = 0.080$) between intervention group and control group. Moreover, the result also showed that there was no significant difference in the objective level of distress which include heart rate ($p = 0.922$), R-R interval ($p = 0.682$), and SDNN ($p = 0.935$) between intervention group and control group. Even though the results showed no significant difference in state-mindfulness ($p = 0.123$) between intervention group and control group at post-test, state-mindfulness significantly increased among control group at post-test. In conclusion, ultra-brief mindfulness intervention which is Mindful STOP is as effective as reflective listening. The implications of this study are discussed.

Keywords: distress, ultra-brief mindfulness intervention, reflective listening

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1.0 Introduction

Background of Study

In recent years, the issues of stress have been greatly concerned by various parties and organization as there is an increasing in the number of individuals who suffer from different stressors such as academic, occupational, and financial. According to a recent Regus report, as relative to the global average of 53%, Malaysians hold a higher level of stress at 63%, mainly caused by traffic snarls, insufficient information technology infrastructure as well as prolonged meetings (as cited in "Malaysian's stress level,", 2015).

In students, according to the survey carried out in 2008 throughout the United States by Associated Press and mtvU on college student stress, four out of ten students revealed that they often feel stressed, while one out of five students revealed that most of the time they feel stressed. Moreover, one out of four revealed that they experienced daily stress (Associated Press & mtvU, 2008). First-year university students were discovered to be specifically vulnerable to stress (Towbes & Cohen, 1996; Wintre & Yaffe, 2000) and have a higher level of stress (Wintre & Yaffe, 2000). In addition, according to a systematic review, it was reported that stress among Malaysian medical students was 56% (Salam, Yousuf, Bakar, & Haque, 2013). This is because college students or university students often face a variety of stressors in their lives, such as tests and examinations, bad results, high self-expectation, heavy workload, having trouble in understanding the content or failure in providing answers to lecturer's questions (Yusoff, Rahim, & Yaacob, 2010).

Stress has been often associated with mental disorders or mental health problems (Samad, Hashim, Moin, & Abdullah, 2010). Tan Sri Lee Lam Thye, the chairperson of National Institute of Occupational Safety and Health (NIOSH) had stated that one of the major causes of mental illnesses was the heighten level of stress in distinct conditions (as cited in "More young people,", 2013). Moreover, stress is positively correlated with anxiety

which eventually lead to mental disorder among individuals who fail to cope with the stressors (Salleh, 2008). In a recent Spring 2014 National College Health Assessment by American College Health Association (2014), 33% of students were reported having depressed feelings due to the difficulties in functioning in daily tasks, 54% of them reported having excessive anxiety, and 87% were said to be over pressured by their own responsibilities.

Besides, stress triggers autonomic responses in the nervous system activity. A study conducted by Zeller, Handschin, Gyr, Martina, and Battegay (2004) reported that stress affects autonomic response by increasing heart rate (HR) in a sample of university college students. Moreover, a similar result was obtained by Loft et al. (2007) in which stress triggered the response of heart rate to be increased and this showed that stress did influence human's psychological reaction towards stressful situation. Therefore, individuals who could not cope with stressful situations will be more likely to encounter heighten heart rate when being confronted by stressors. This will then lead to the risk of having cardiovascular disease.

Furthermore, other than heart rate, heart rate variability has often been considered as an interesting variable to researchers in order to study the effect of stress objectively. Stress has usually been associated with both heighten control in sympathetic nervous system (SNS) and a lowering in parasympathetic nervous system (PNS) (Olsson, 2010). An increase in heart rate causes a decrease in heart rate variability (Terathongkum, 2006) as the distance between the R-R intervals of heart rate readings is shortened. It is found that HRV decreased during stressful situations (Bernadi et al., 2000; Hjortskov et al., 2004; Paritala, 2009).

As to be concerned, stress did influence one's mental health status and cardiovascular reactivity and steps should be taken to reduce the impact of stress in one's health and well-being. Various stress reduction programs are available such as progressive muscle relaxation

(Lolak, Connors, Sheridan, & Wise, 2008), mindfulness intervention (Chiesa & Serretti, 2009), rhythmic movement exercise (Sandlund & Norlander, 2000), deep breathing meditation (Paul, Elam, & Verhulst, 2007), and others. Mindfulness-based interventions have become popular in recent years, and being specifically emphasized as an effective tool on stress reduction by lowering one's stress level as well as regulating cardiovascular responses back to normal (Shapiro, Astin, Bishop, & Cordova, 2005). Mindful breathing, mindful yoga, and mindfulness meditation are included in the mindfulness stress reduction programs and were commonly used by researchers in laboratory studies. In a meta-analysis study, the result demonstrated that mindfulness-based stress reduction (MBSR) was able to reduce stress levels and trait anxiety as well as improve one's well-being (Chiesa & Serretti, 2009). In addition, a comprehensive meta-analysis had demonstrated that mindfulness-based intervention had a moderate effect size when compared with other active treatments, comprising other psychological treatments (Khoury et al., 2013). Moreover, mindfulness-based intervention such as mindfulness breathing has found to provide psychological advantages above and beyond other brief stress-management interventions which are progressive muscle relaxation and loving kindness meditation (Feldman, Greeson, & Senville, 2010).

Statement of Problem

Mindfulness based interventions (MBIs) have been viewed as one of the effective ways to reduce stress (Carmody & Bear, 2009; Creswell et al., 2014; Kabat-Zinn, 1982). However, most of the studies only include the subjective rating of stress (de Vibe et al., 2013; Kabat-Zinn, 1982; Song & Lindquist, 2015). Only a few studies include the objective assessment of stress (Jones, 2013; Krygier et al., 2013). The subjective rating of stress may be biased because of participants' interpretation of the questions or wish to inform their feeling in a certain way. Therefore, stress should be studied objectively at the same time.

Assessment of the activity of autonomic nervous system efforts an objective measure of the individual's psychological state as it provides a simple non-invasive measurement.

Although the effectiveness of standard MBIs or brief MBIs on stress reduction has been well established (Carmody & Bear, 2009; Chiese & Serretti, 2009; de Vibe et al., 2013), the effectiveness of ultra-brief mindfulness intervention on stress reduction is still new. In Malaysia, ultra brief mindfulness intervention has been studied in palliative care patients and caregivers (Tan et al., 2015), therefore the result cannot be generalized in the healthy population or students. Moreover, the study did not include an objective measurement on stress. Even though the oversea study of ultra-brief mindfulness intervention does include objective measurements such as cortisol and alpha amylase, the study did not assessed the activity of automonic nervous system on stress (Cruess et al., 2015).

Research Objectives

The research objectives in our study are as below:

1. To determine the effectiveness of ultra-brief mindfulness intervention in reducing the score on Subjective Units of Distress (SUDS).
2. To determine the effectiveness of ultra-brief mindfulness intervention in decreasing state anxiety.
3. To investigate the effectiveness of ultra-brief mindfulness intervention in reducing heart rate.
4. To investigate the effectiveness of ultra-brief mindfulness intervention in increasing heart rate variability.

Research Questions

Below are the research questions in our study:

1. Does ultra-brief mindfulness intervention significantly decrease the score on Subjective Units of Distress (SUDS) ?
2. Does ultra-brief mindfulness intervention significantly decrease the level of state anxiety?
3. Does ultra-brief mindfulness intervention significantly decrease heart rate?
4. Does ultra-brief mindfulness intervention significantly increase heart rate variability?

Research Hypothesis

Research question 1:

H_0 : Ultra-brief mindfulness intervention does not significantly decrease the score on SUDS.

H_1 : Ultra-brief mindfulness intervention significantly decreases the score on SUDS.

Research question 2:

H_0 : Ultra-brief mindfulness intervention does not significantly decrease the level of state anxiety.

H_1 : Ultra-brief mindfulness intervention significantly decreases the level of state anxiety.

Research question 3:

H_0 : Ultra-brief mindfulness intervention does not significantly decrease heart rate.

H_1 : Ultra-brief mindfulness intervention significantly decreases heart rate.

Research question 4:

H_0 : Ultra-brief mindfulness intervention does not significantly increase heart rate variability.

H_1 : Ultra-brief mindfulness intervention significantly increases heart rate variability.

Significance of the Study

Mindfulness based intervention lead to the results of relaxation and stress reduction, which may have therapeutic health advantages and preventive measure, enhancing the quality of care as well as reducing medical errors (Ludwig & Kabat-Zinn, 2008). Mindfulness based intervention is taught to reduce psychological stress (Carmody & Bear, 2009; Chiese & Serretti, 2009; Kabat-Zinn, 1982), increase parasympathetic nervous system (PNS) and decrease sympathetic nervous system (SNS) activity. This is then lead to a decrease in heart rate (Jones, 2013) and an increase in heart rate variability (Krygier et al., 2013). This will be an advantage to the society, helping in the preventing stress as well as reducing stress.

The study of the effectiveness of ultra-brief mindfulness intervention on stress reduction may bring advantages to individuals who are not willing to participate in mindfulness based intervention due to the reason of long time commitment that probably takes up to eight weeks. The ultra-brief mindfulness intervention is especially precious to groups such as students and caregivers due to their packed daily schedule and the class time requirements (Carmody & Bear, 2009).

In addition, the study of the effectiveness of ultra-brief mindfulness intervention is able to improve its accessibility. This is because ultra-brief mindfulness is able to be taught and learned in a short time such as 15 minutes. It is easy to approach or reach compared to standard MBIs or brief MBIs.

Moreover, investigation of ultra-brief mindfulness intervention on stress reduction objectively is able to strengthen the findings as objective assessment of stress is less bias compared to the subjective measurement and is non-invasive. Therefore, it brings a solid empirical data to the practitioners when using ultra brief mindfulness intervention on stress reduction.

Conceptual and Operational Definition of Terms

Stress. Stress is being defined as any uncomfortable emotional experience followed by foreseeable changes in term of biochemical, physiological and behavioural (Baum, 1990). It is the strain caused either physically or psychologically, generally lasting for a period of time, threatening the capability of a person to proceed in coping with a stated circumstance (Statt, 1998). It is any circumstance that inclines to interfere the equilibrium between a living creature and its environment (Ranabir & Reetu, 2011).

The operational definition of stress is the score on the subjective distress thermometer which is the Subjective Units of Distress Scale (SUDS). SUDS is a subjective self-report assessment on measuring one's distress and discomfort in current situation with scales ranged from 0 which is extremely relaxing to 100 which is extremely in stress.

Anxiety. Anxiety is being defined as an autonomous affect of discomfort, agitation, nervousness, and excessive fear and worry about an unpredictable outcome of life situations or threats (Shri, 2010). Anxiety can be divided into state and trait anxiety. In the State-Trait Anxiety Inventory (STAI), state anxiety is defined as an stimulation of autonomic response and increased emotions such as subjective feelings of stress, agitation, and distress that triggered by particular situational events with possibilities of danger, whereas trait anxiety is more to one's personality, the different in vulnerability to anxiety (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). In other words, trait anxiety is being referred to the

discrepancies between individuals in the aptness to view stressful circumstance as hazardous or threatening and to reaction to the circumstance with increase in the intensity of state anxiety (Spielberger et al., 1983).

The operational definition for anxiety is the score on STAI. STAI is a self-report questionnaire or a subjective survery in which it consists of 40 items (20 items for State-Anxiety and 20 items for Trait-Anxiety) and it is an instrument on measuring one's state and trait anxiety level during stressful situations. The scores are ranging from 20 to 80 in which 20 is considered as low anxiety and 80 is considered as high anxiety level.

Heart rate. Heart rate is being defined as the speed of the heartbeat calculated by the number of heartbeats per unit of time, expressing in beats per minute (bpm) (AL-Ziarjawey & Cankaya, 2015). The reference range of heart rate in normal adult is between 60bpm and 100bpm in which rates below 60bpm is known as bardycarida and rates above 100bpm is known as tachycardia (Mishra & Rath, 2011).

The operational definition of heart rate is the reading on the Wild Devine Iom Grapher which expressed as beats per minute (bpm). It is measured by the Wild Devine Iom Hardware in which it can be installed in computer and with the pulse oximeter connected to one's fingertips to sense pulse rate.

Heart rate variability. Heart rate variability is a physiological situation which shows the effect of autonomic nervous system on sinus node activity (Milicević, 2005). It is the beat-to-beat alteration during the length of R-R interval, which is the heart period (Billman, 2011). In another words, it is the beat-to beat variation in heart rate that made up of the activities of sympathetic and parasympathetic nerve in the heart (Sasaki & Maruyama, 2014).

The operational definition for heart rate variability is the value of R-R interval that calculated from heart rate readings as well as standard deviation of N-N intervals in which the heart rate readings is being measured by the Wild Devine Iom Hardware in which it can be installed in computer and with the pulse oximeter connected with one's fingertips. It is used to assess one's heart rate variability, heart rate, and skin conductance by Iom Grapher and constantly records the readings ("Wild Divine", n.d.). The higher the stress level, the lower the heart rate variability.

Mindfulness. In psychological terms, mindfulness has been defined as "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p.145). Furthermore, it also has been defined as "a receptive attention to and awareness of present events and experience" (Brown, Ryan, & Creswell, 2007, p. 212).

The operational definition of mindfulness is the score on Toronto Mindfulness Scale (TMS). TMS is a psychological assessment tool with 13 items of self-report questionnaire in which it needs to be assessed immediately after the mindfulness interventions. TMS helps to assess one's state mindfulness in the current moment which comprises of two factors such as curiosity and decentering (Lau et al., 2006).

Ultra-brief mindfulness intervention. Ultra-brief mindfulness intervention is being referred as one simple short session of psyhoeducation program in enhancing psychological well-being and positive affective outcomes (Erisman & Roemer, 2010) as well as in reducing uncomfortable psychological reactions (Brown & Ryan, 2003; Mohan, Sharma, & Bijlani, 2011). It is also said to be the shortest quick onset of therapeutic program in easing discomfort effects and outcomes (Tan et al., 2015).

The operational definition of ultra-brief mindfulness intervention is the delivery of mindful S.T.O.P. Mindful S.T.O.P. involves individual to constantly concentrate on their breathing and focus on their present while relaxing themselves with eyes closed or gazed down (Tan et al., 2015).

2.0 Literature Review

As stated by a recent Regus report, compared to the global average of 53%, Malaysians are having a higher level of stress at 63% in which it was mainly resulted in traffic snarls, insufficient information technology infrastructure, and prolonged meetings (as cited in "Malaysians' stress level,", 2015). This has shown that Malaysians are at risk of general health state as the study had showed that participants with higher level of stress were having a lower level of general health state (Lim, Tam, & Lee, 2013). In the present paper, the role of stress toward psychological responses such as anxiety and subjective distress are being investigated. Moreover, the effect of stress toward physiological responses such as heart rate and heart rate variability also being investigated. Furthermore, mindfulness based interventions toward stress also being discussed as well as the effect toward heart rate and heart rate variability. In addition, James-Lange theory of emotion and fight-or-flight theory also being discussed.

Stress and Psychological Responses

Stress will lead to a variety of psychological responses and one of them is state anxiety. The measurement of state anxiety was often achieved by the State Trait Anxiety Inventory (Spielberger et al., 1983). It was found that either stress without manipulation or with manipulation also caused a significant rise in state anxiety in a study done by using public speaking as a stressor in 62 male participants (Rohrmann, Hennig, & Netter, 1999). Moreover, state anxiety was higher during stress with a rousing manipulation, increasing from a mean of 37.65 to 47.65 as the participants viewed the condition as threatening (Rohrman et al., 1999).

Similarly, it was discovered that state anxiety elevated significantly in both physical athlete men group and untrained men group during a standardized psychosocial laboratory

stressor which is Trier Social Stress Test (TSST) (Rimmele et al., 2007). However, athlete men showed significantly lessen state anxiety during stress compared to untrained men as there was a protective effect of a high level of physical activity in athlete men (Rimmele et al., 2007). They tend to have a higher self-efficacy in which they believed that they can cope with the stress situation (Rimmele et al., 2007). Furthermore, it was found that the level of state anxiety also elevated significantly during stress condition when assessing TSST in a group condition of six participants rather than a single individual (von Dawans, Kirschbaum, & Heinrichs, 2011). This result illustrated that even the group version of the TSST caused a similar pattern of results in anxiety as the original version (Rimmele et al., 2007). However, all the 25 participants in the study were healthy men, making the findings hard to be generalized to women.

Moreover, when assessing real-life psychosocial stress, such as lecturing to a huge number of students, it was found that state anxiety significantly increased before the lecture compared to the control day that had no lecturing in a sample of 52 professors (Filaire, Portier, Massart, Ramat, & Teixeira, 2010). In addition, it was also found that state anxiety dropped to a level that was comparable to control day 10 minutes after the lecture (Filaire et al., 2010). This showed that stress caused an increase in state anxiety.

On the other hand, participants also confronted with subjective distress during stress condition. The process of treating cancer has been always stressful. Therefore, distress thermometer is more frequently used in cancer populations. For example, a study with an amount of 1234 cancer patients was found that all the patients and their partners had a relatively high subjective distress level on distress thermometer (Zwahlen, Hagenbuch, Jenewein, Carley, & Buchi, 2011). Besides, 33% of the patients and 41.2% of the partners reported having a high clinically significant distress on distress thermometer ratings of 4 and above (Zwahlen et al., 2011).

In addition, subjective distress has also been measured in acute stress condition. In a study done with a sample of 25 males with a mean aged of 25 years old, it was found that there was a significant increment in subjective distress ratings (Subjective Units of Distress [SUDS]) during acute stress situation, mean of 4 compared to before exposing to the stressor, mean of 2.6 (Morgan et al., 2002). Similarly, it was reported that during stress condition that induced by reality-based handgun shooting practice in a field experiment with a sample of 36 participants, anticipated distress on SUDS increased significantly in high-realism group compared to the control group (Taverniers, Smeets, Van Ruysseveldt, Syroit, & von Grumbkow, 2011).

As a conclusion, stress results in psychological response which is state anxiety (Filaire et al., 2010; Rimmele et al., 2007; Rohrmann et al., 1999; von Dawans et al., 2011). Furthermore, stress also causes an increase in subjective distress ratings (Morgan et al., 2002; Tavernier et al., 2011; Zwahlen et al., 2011).

Stress and Heart Rate

Stress can be reflected as a condition of threatened homeostasis, resulting in activating the physiological responses. When expose to stress stimuli, hypothalamus will trigger the activation of autonomic nervous system (ANS). ANS will then stimulate the target organs to elicit stress responses (Olsson, 2010). Sympathetic nervous system which is one of the two branches of the ANS stimulated the adrenal gland to release catecholamines, comprising of epinephrine, norepinephrine and dopamine (Terathongkum, 2006). This will then result in an increase of heart rate later.

Laboratory Stress Induction Protocol and Heart Rate

Trier Social Stress Test. The effect of acute psychological stress on heart rate had been investigated using Trier Social Stress Test (TSST). Kirschbaum, Pirke, and Hellhammer (1993) had investigated the effect of psychological stress through a laboratory study on heart rate. A total of 175 volunteers was recruited in the study. 'Trier Social Stress Test' (TSST), which is a protocol to induce moderate psychological stress was used in the study. The result demonstrated that heart rate was significantly heightened under the induction of stress and declined to the baseline after the stimulation. Furthermore, it also found that heart rate was non-significantly associated with any endocrine responses. The study finally concluded that TSST is a tool for exploring psychobiological stress responses through a larger varies in the concentration of ACTH, GH, prolactin, cortisol, and significant rises in heart rate.

In addition, changes of heart rate to psychological stress induced by TSST at different times of day had been investigated (Kudielka, Schommer, Hellhammer, & Kirschbaum, 2004). Five independent studies that carried out in the same laboratory had been reanalysed. A total of 180 adults, which consisted of 115 youngers and 65 olders had taken part in the study and all of the participants were faced with stress induced either in the morning or in the afternoon. The result illustrated that heart rate elevated significantly in the induction of stress, regardless of the morning or afternoon sessions. Nonetheless, there was no comparison made to late evening or night time.

Moreover, Kelly, Tyrka, Anderson, Price, and Carpenter (2008) also found a similar finding in their study that heart rate increased significantly during stress condition that induced by TSST. A total of 62 participants with 32 women and 30 men that aged from 18 to 65 years were being recruited in the study. The Polar cardiac monitor was used to obtain the

heart rate recordings. In addition, the research also wished to study whether there was a difference in heart rate and perceived stress between males and females. The results showed that as a function of sex, heart rate did not change significantly even though females revealed significantly higher level of perceived stress than males. This finding was consistent with the previous findings done by Kirschbaum et al. (1993) and Kudielka et al. (2004) that heart rate increased during stress. It was then concluded that heart rate increased significantly during stress condition without affected by the factor of sex differences.

In 2012, Hellhammer and Schubert had firmed up the protocol TSST as a tool to induce stress by concluding that measuring the physiological response within the stressor itself showed a more informative measure of stress response. Hellhammer and Schubert (2012) had explored the stress response in 260 healthy non-smoking males that aged from 16 to 60 years by assessing stress perception and heart rates before, during, and straightway after TSST. The perceived stress response was collected before TSST, between both TSST tasks and after TSST, while the heart rate data was started to collect 20 min before the TSST and terminated 20 min after TSST using the Polar watch devices. The result showed that heart rate was significantly elevated in response to TSST and reached its height during the TSST. Moreover, the result also showed that stress perception during TSST forecasted a rise in heart rate significantly. In addition, in response to the stress induction, younger males were having a higher rise in heart rate. However, the findings were limited to only males.

Mannheim Multicomponent Stress Test. Other than using TSST protocol, some of the researchers used Mannheim Multicomponent Stress Test (MSST) protocol to induce stress. In 2012, Reinhardt, Schmahl, Wust, and Bohus (2012) had investigated the heart rate and subjective stress response by using MMST with a sample of 110 healthy participants, ranging from 18 to 38 years old with two independent experiments. MMST protocol is able to induce comparatively high stress reactions without concentrating on social-evaluative parts.

In both of the studies, the findings showed that there was a significant rise in subjective stress and heart rate during the induction of stress with a large effect size. However, the emotional state such as anxiety was not being measured after the stress induction. Moreover, the study also depends on the self-reported of menstrual cycle phases with a single item.

Compared to Reinhardt et al. (2012) that only measured the variables before and after the induction of stress using MMST, Reinhardt, Kleindienst, Treede, Bohus, and Schmahl (2013) had investigated the effect of stress on heart rate before, during and after the stress induction. A total number of 80 healthy females that aged from 18 to 35 years old were being recruited. Heart rate was detected using ActiveTwo AD-Box of BioSemi system in which it constantly sampled the signals at 2048 Hz. The result reported that participants showed a relatively high subjective stress rating from 1.0 rate in the beginning to 6.0 rates at the end of the assessment, and higher ratings during stress induction. The heart rate also showed a significant increase from 76.1 bpm to 95.8 bpm. Furthermore, the mean of heart rate did not show a difference between the first stress induction and second stress induction. These findings were consistent with the previous findings done by Reinhardt et al. (2012) that stress induced by MMST caused an increase in heart rate.

Other stress induction protocol. Further than having TSST and MMST as the laboratory tools for inducing acute psychological stress, researchers also study the effect of other sources as stressors on heart rate. Researchers obtained the same findings too. Mental arithmetic test was used as a stressor in order to investigate the effect on heart rate (Carroll et al., 2000). A total of 1900 participants with an effective sample of 1657 participants were included in the study. There were a total of 898 women and 759 men, comprising of 23 years old, 43 years old, and 63 years old. Heart rate was measured with a semi-automatic sphygmomanometer. The result obatained was consistent with the studies using TSST as a stressor (Hellhammer & Schubert, 2012; Kelly et al., 2008; Kirschbaum at al., 1993;

Kudielka et al., 2004) and MMST as a stressor (Reinhardt et al., 2012; Reinhardt et al., 2013), showing that heart rate increased significantly during stressful condition that induced by mental arithmetic test. Furthermore, the result also showed that youngers (23 years old) had a higher heart rate compared to olders (63 years old) in stressful condition and this result was consistent with Hellhammer and Schubert (2012). However, even though heart rate increased due to stressful condition, it was found that heart rate reactivity were higher in men than women, indicating that men tend to have a higher heart rate during stressful condition and it was contrasted with the finding by Kelly et al. (2008). It is then concluded that heart rate increased in stressful condition with youngers and males had a higher level of heart rate.

In addition, Elwess and Vogt (2005) had used oral presentation, written examination, and laboratory foraging competition as the stressors to study the effect of acute stress on heart rate. Sixty-eight student volunteers were being assigned into the three different classroom activities and laboratory experiment. Heart rate was being collected through heart rate monitors whereby students attached the monitor and readings were then recorded when exposed to stressors. As a result, heart rate increased significantly in all the three activities. This result was consistent with study used TSST as stressor (Hellhammer & Schubert, 2012; Kelly et al., 2008; Kirschbaum at al., 1993; Kudielka et al., 2004), MMST as stressor (Reinhardt et al., 2012; Reinhardt et al., 2013) mental arithmetic test as stressor (Carroll et al., 2000). However, there were weaknesses in the methodologies. This is because the changes in heart rate may be caused by other factors such as consumption of caffeine or previous preparation for the oral presentation. Therefore, a more precise procedure should be designed in order to have a more accurate result.

Fechir et al. (2008) also used a different of stress tasks such as color-word interference test (CWT), mental arithmetic test under time pressure, singing aloud, and presenting a spontaneous talk to investigate the sympathetic responses which included heart

rate. Eleven healthy volunteers that aged from 22 to 29 years were recruited to participate in the study. Neutral affective pictures were used as a control condition. The participants participated in the stress tasks randomly and each task took about 2 minutes. The results demonstrated significantly higher subjective stress was induced by all the stress tasks compared to the neural affective pictures. Furthermore, the results also demonstrated that higher heart rate was being induced in all the stress tasks. These results were accordance with the other findings (Carroll et al., 2000; Elwess & Vogt, 2005; Hellhammer & Schubert, 2012; Kelly et al., 2008; Kirschbaum at al., 1993; Kudielka et al., 2004). It was concluded that stress caused an increase in heart rate.

In summary, the studies showed that heart rate increased during the condition of acute psychological stress. It was found that stress induced by TSST able to increase heart rate (Hellhammer & Schubert, 2012; Kelly et al., 2008; Kirschbaum et al., 1993) and it was found that heart rate increased similarly, no matter in the morning or afternoon (Kudielka et al., 2004). Moreover, by using another protocol such as MSST, results also showed that heart rate increased after the stress induction (Reinhardt et al., 2012; Reinhardt et al., 2013). Other stressors such as mental arithmetic test, oral presentation, and others also tend to increase heart rate (Carroll et al., 2000; Fechir et al., 2008; Hellhammer & Schubert, 2012). This is because subjective perception of stress is correlated with heart rate (Fechir et al., 2008; Hellhammer & Schubert, 2012). In another words, autonomous nervous system is being stimulated and caused an increase in sympathetic activity, resulting in a higher heart rate (Hellhammer & Schubert, 2012). However, precise procedures must be accounted such as avoid the consumption of food and prior knowledge of the stress tasks while carrying out the stress tasks, whether it is TSST, MMST, arithmetic test or oral presentation in order to have a more accurate result.

Stress and Heart Rate Variability

Heart rate variability (HRV) had been an interesting variable to researchers in order to study the effect of stress objectively. It is a widely used technique to evaluate cardiac autonomic control. For example, Bernadi et al. (2000) had assessed the effect of free talking and mental arithmetic, silent or aloud on HRV with a total of 12 healthy male volunteers. In free talking, the participants were required to report their daily activities for 3 minutes. For mental stress without talking, the participants are required to write the results on a blackboard. Both mental stress test, silent or aloud were done for 3 minutes. The results showed that mean R-R decreased significantly in all of the three conditions. SDNN increased non-significantly during free talking and increased significantly during mental stress aloud. In contrast, during mental stress silent, SDNN decreased non-significantly. LF (low frequency) power increased significantly during free talking and non-significantly during mental stress aloud. In contrast, LF power decreased non-significantly during mental stress silent. In addition, HF (high frequency) power decreased in all of the three conditions, but the decrease only significant in mental stress silent. Bernadi et al. (2000) also found that hurried mental arithmetic was more stressful compared to free talking as mean R-R reduced much more during hurried mental arithmetic than free talking. This had indicated distinct levels of sympathetic activation between the two situations. The researchers concluded that simple mental and verbal activity affected HRV through the variation in respiratory frequency.

In later year, Hjortskov et al. (2004) had measured the HRV by ECG and participants' stress response to a combination of cognitive and emotional stressors in 12 female students. The participants participated in three sessions of computer tasks orderly, which the sessions were introductory, stress, and control sessions. Subjective experiences of stress (SES) had been reported before the starting of task and once after each session. The results showed a significant decrease in HF power and a significant rise in LF/HF ratio during the stress

condition compared to the control condition, indicating a low parasympathetic activity and a high sympathetic activity. However, LF power showed a non-significant rise in stress condition compared to the control condition. The findings were consistent with the findings done by Bernadi et al. (2000) with mental stress aloud. Moreover, during the three work conditions, it was found that there were a significant decrease in LF power and HF power compared to the three rest periods. However, there was a significant increase in LF/HF ratio during work conditions compared to rest periods. It was concluded that the combination of cognitive and emotional stressors caused changes in HRV. Furthermore, it was found that resting led to a positive influence on HRV. Nevertheless, the sample size of this study was too small that might affect the generalizability of the findings.

Moreover, Taelman, Vandeput, Spaepan, and Huffel (2008) had induced a stressful mental situation by conducting a Mensa test. The HRV readings were recorded using ECG with signals of 450 Hz in a total of 28 participants with the mean age of 22 at rest and during the mental task. The result illustrated that pNN50 was significantly lower in the mental stress situation. In the frequency domain, the result illustrated that there is a non-significant increase in LF/HF ratio in a mental task compared to the rest situation. However, there was support in other studies that LF/HF ratio increased significantly during stress condition (Hjortskov et al., 2004; Paritala, 2009). The researchers concluded that HRV was decreased during the stressful mental situation compared to the rest situation. Even though the LF/HF ratio showed a tendency in higher sympathetic activity during a stressful mental situation, the result was insignificant. Therefore, more research should be done in order to look into this area. Furthermore, the researchers did not report other time domain parameters and frequency domain parameters in this study. Thus, it is not supported enough to make the conclusion.

A similar finding with Taelman et al. (2008) in frequency domain components were got by Paritala (2009) and the results were significant, showing a strong support to the previous study. Paritala (2009) evaluated of the effects of physical and mental stress on HRV with a total number of 24 participants that aged from 18 to 30. However, the heart rate monitor employed was the Polar RS800. The physical stress was induced by manual material handling while mental stress was induced by reading passages and answering comprehension questions under the time pressures. The results showed that HF and RMSSD components reduced significantly with the rise of physical and mental stress. The LF and the LF/HF ratio elevated significantly with the rise of physical and mental stress. However, greater variability was seen during physical stress in all components. This showed that physical activity induced a greater stress than mental task. In overall, the results implied a decrease in HRV when the demand of physical and mental task increased, indicating there was a rise in stress. However, the study was completed by the participants near the time of final exams. Therefore, it was believed that it may cause additional stress to the participants. In addition, individuals varied in levels of comprehension also tend to make some of them perceived the mental test as relatively easy.

In 2014, Deepak, Deepak, Nallulwar, and Khode had found a different result compared to the previous years studies in their control group that they used to compare with the diabetics group of their study. The control group consisted of 30 healthy participants and mental stress was induced in the group by arithmetic test under time pressure. The results demonstrated no change in RMSSD, NN50 and pNN50 in stress condition. However, there is a significant increase in SDNN during stress condition compared to the rest condition. Since there was a significant increase in SDNN, indicating the increase in sympathetic activity, it can still be concluded that HRV decreased during stress condition. The finding of no change in RMSSD was then supported by Kumar et al. (2015) later. In addition, the finding of

significant increase in SDNN during stress had supported the findings by Filaire et al. (2010) while was contradicted to the finding by Tharion, Parthasarathy, and Neelakantan (2009).

The result in a free talking study done by Bernadi et al. (2000) was supported by a study that focused on the hypothesis that psychosocial stress would be induced by the combination of cognitive and emotional stressors, such as giving a lecture to 200 students would lead to the decreased of HRV had been carried out by Filaire et al. (2010). A total of 52 professors had participated in this study. The HRV recordings were taken before and after the lecture in which it was the second lecture of the year, and thus the professors and the students were not familiar. The perceived stress level is measured by Perceived Stress Scale (PSS) and the participants revealed a high perceived stress. The HRV recordings were collected by a Bauman cardio frequency meter. The results demonstrated that RMSSD and pNN50 were significantly decreased after the lecture, but there was a non-significant rise in SDNN component. For frequency domain components, the results demonstrated that there were a significant decrease in HF and HFnu after the lecture. However, there was no change in LH and LHnu. The result demonstrated a significant rise in the LF/HF ratio. It is concluded that lecturing led to a decrease in HRV. Nevertheless, there is no correlation was found between PSS and the biological markers. The absence of this relationship might because the participants in the study had a well maintained social activities and a long year of experience in lecturing with almost more than 10 years. In addition, the result also demonstrated that there was no difference in HRV between males and females. The strength of this study was that it may be able to be extrapolated to occupational settings as it was not a laboratory experiment.

Petrowski, Herold, Joraschky, Mück-Weymann, and Siepmann (2010) had conducted a study to assess the effects of psychosocial stress on HRV between 25 patients with current panic disorder and 25 healthy volunteers. Trier Social Stress Test (TSST) had been used to

induce stress and HRV was measured with the Polar watch system, S810 with a sampling frequency of 1000 Hz. In order to avoid the confounders that might affect the results, the experiments had been carried out in two consecutive days. The result indicated that there was a significant reduction in RMSSD during stress situations in both groups of participants in two consecutive days of experiment and it was similar to the result obtained by Filaire et al. (2010) and Paritala (2009). The result showed that the ratio of LF/HF only increased significantly in the patients in both of the days, whereas there was no such vary in healthy participants in both of the days. This result made a surprise as the sympathetic activation caused by acute psychosocial stress was not prominent in healthy participants. However, the small sample size in both groups of the participants will affect the generalizability of the results.

Furthermore, researchers also used examination as the stressor to assess HRV. Tharion et al. (2009) had assessed the heart rate variability parameters from a 5-minute lead II electrocardiogram (ECG) recordings in 18 healthy students with a mean age of 18.7 years during university examination and holidays. The results revealed a significant reduction in mean RR, SDNN, and pNN50 during the time of examinations compared with the holidays. However, there was no significant difference in RMSSD. For frequency domain parameters, only the power of LF showed a significant decrease during examinations compared with the holidays. However, the other frequency domain parameters had no significantly differed. The researcher concluded that there is a decrease in HRV due to the significant decrease in mean RR which showed an increase in sympathetic activity during the examination. Since the study did not quantify the level of examination stress faced by the students, it may be possible that there is no stress arouse during the examination.

Similarly, Kumar et al. (2015) also used examination as the stressor to test the effect of HRV. There was an amount of 49 medical students in which 25 boys and 24 girls

participated in the study. The researchers also wished to assess the difference in HRV response to stress between the boys and girls. The HRV analysis was carried out at three situations that were relaxed period, terminal, and professional examination. The ECG recording was then interpreted using the Biomed polygraph. The results revealed that in time domain parameters, there was no significant difference in RMSSD in both boys and girls from the relaxed state to professional examination. There was a significant fall in NN50 from the relaxed state to the professional examination in boys only. While there was a significant fall in PNN50 from the relaxed state to terminal examination in boys. In addition, in boys, the results showed in frequency domain parameters, there was a fall in all of the parameters (LF power, HF power, or LF/HF ratio) from the relaxed state to professional examination, but the results were not stastistically significant. However, in girls, the frequency domain parameters revealed a significant decrease in LF only, even other parameters also showed a decreasing trend. The short of significant findings might cause by the small sample size. Furthermore, it is possible that the participants might not have any examination stress arousal during HRV recording. The researchers concluded that there was a significant decrease in HRV in both boys and girls during the terminal examination and the girls were having a higher level of stress than the boys.

In summary, the studies focused on the effect of psychological stress on HRV. Four studies used a mental stress task (Bernadi et al., 2000; Deepak et al., 2014; Hjortskov et al., 2004; Taelman et al., 2008), one studies used physical stress and mental stress (Paritala, 2009), two studies focus on psychosocial stress (Filaire et al., 2010; Petrowski et al., 2010), and two studies used exam as the stressor (Kumar et al., 2015; Tharion et al., 2009). For time domain components, two studies showed a significant decrease in mean RR (Bernadi et al., 2000; Tharion et al., 2009). Two studies revealed a significant increase in SDNN (Bernadi et al., 2000; Deepak et al., 2014), while one study revealed a significant decrease in SDNN

(Tharion et al., 2009). A study showed no change in NN50 (Deepak et al., 2014), while a contradict result was obtained by Kumar et al. (2015), showing a decrease in NN50. The majority of the studies showed there was a decrease in pNN50 (Filaire et al., 2010; Kumar et al., 2015; Taelman et al., 2008; Tharion et al., 2009), while only one study showed no difference in pNN50 during stress condition (Deepak et al., 2014). For RMSSD, majority of the studies showed a decrease (Filaire et al., 2010; Paritala, 2009; Petrowski et al., 2010), however, there were two studies indicated no vary in RMSSD (Deepak et al., 2014; Kumar et al., 2015). On the other hands, for frequency domain components, only one study showed a significant increase in LF (Paritala, 2009) and two showed a non-significant increase in LF (Filaire et al., 2010; Hjortskov et al., 2004). All the studies showed a decrease in HF, but only three studies showed a significant result (Filaire et al., 2010; Hjortskov et al., 2004; Paritala, 2009). In contrast, Kumar et al. (2015) and Tharion et al. (2009) found a decrease in LF in their study. Moreover, majority of the studies showed a significant increase in LF/HF ratio (Filaire et al., 2010; Hjortskov et al., 2004; Paritala, 2009), while Petrowski et al. (2010) revealed that there was no change in LF/HF ratio in their study. Even though there were some contrasts in the components of HRV, the researchers concluded that stress had indeed impaired HRV. The major limitations across several studies were the small sample size that will affect the generability of the study and the significance of the study. Moreover, most of the studies did not quantify the stress level, therefore there may be the possibility that there was no stress aroused during the study.

Mindfulness-Based Interventions and Stress Reduction

Mindfulness-based intervention (MBI) has turned into a popular form of intervention. In a meta-analysis study, it was found that it is an effective therapy for a variety of psychological problems as well as reducing stress and anxiety (Khoury et al., 2013). Khoury et al. (2013) found that MBI is moderately effective in pre-post comparisons (n = 72;

Hedge's g = 0.55). Moreover, MBI showed a moderate effect size when compared with waitlist controls (*n* = 67; *Hedge's g* = 0.53) as well as when compared with other active treatments (*n* = 68; *Hedge's g* = 0.33).

Mindfulness-based stress reduction (MBSR). Mindfulness based stress reduction (MBSR) which is a psychoeducation training intends to help people in learning to live more fully in the present. MBSR is a 8-week program with 2.5 hours each, a 7-hour period that comes about between week six and seven, and 45 minutes of practice at home (de Vibe et al., 2013). The skills taught in MBSR comprises of sitting meditation, mindful yoga, and body scan meditation. It was first started by Kabat-Zinn (1982) to educate chronic pain patients in self-regulation. There was a total of 51 participants in the study. The results showed that the participants had reduced 60% of the mean of Total Mood Disturbance (TMD), illustrating that there was a great decrease in stress, confusion, depression, and fatigue. It was concluded that the participants learnt to have self-regulation. However, the study done by Kabat-Zinn (1982) did not include a matched comparison control group.

In a rondomised controlled study with a sample of 288 students, the standardized MBSR was found to be effective in decreasing mental distress in the intervention group with a moderate effect (de Vibe et al., 2013). Moreover, researchers also claimed that it had significantly decreased study stress among the students in the intervention group, but the effect was only significant in females. This result may be caused by a large number of females that participated in the study. It was reported that MBSR practice aided the males to be more aware of their distress and aided the females to handle their distress. It also claimed that the MBSR will be more effective with the increasing in exercises and attendance. The study had a low level of sample attrition and the effect of intervention was found regardless to the instructors and student classes. However, a comparable control intervention such as placebo group should be used in order to have a better understanding of the intervention.

Similarly, by using randomized controlled trials, Song and Linquist (2015) also had examined the effectiveness of standardized MBSR program in a total of 50 nursing students. It was found that MBSR helped in reducing stress as well as anxiety and depression in intervention group compared to the wait list control group. It was claimed that in order to gain a significant influence on stress, each of the programs in long version of MBIs should be at least 1.5 hours. However, the contamination which might have happened between groups was not being examined. Moreover, there was no confirmation that the participants had done the homework.

Moreover, the first meta-analysis of MBSR in healthy people had been carried out by Chiese & Serretti (2009). The results showed that there was a nonspecific influence on stress reduction relative to waiting list control group. It also found that MBSR was able to decrease trait anxiety and rumination as well as able to raise empathy and self-compassion. However, Chiese and Serretti (2009) criticized that most of the studies had a small sample size and they were a non-randomized studies. Moreover, the studies that being reviewed were using the waiting list control group rather than the active control group. Besides, the meta-analysis was done based on only 10 studies.

Due to the limitations in the meta-analysis carried out by Chiese and Serretti (2009), Khoury, Sharma, Rush, and Fournier (2015) had conducted another meta-analysis on MBSR for healthy individuals and a total of 29 studies were comprised in the analysis. The findings showed that in pre-post analyses (n = 26) and in between group analyses (n=18), MBSR had a moderate effect size. Furthermore, the findings also showed that MBSR is largely effective in reducing stress and moderately effective in reducing anxiety, depression, distress, and quality of life. However, most of the studies that included in the meta-analysis used an inactive control group, in which only one study used an active control group. Thus, it was difficult to make a comparative effect size with active control groups.

Besides that in healthy people, MBSR also found to be effective in reducing stress in the breast cancer population. It was found that MBSR also demonstrated an effect in reducing stress through the meta-analysis of nine published studies done by Zainal, Booth, and Huppert (2013). The findings demonstrated that MBSR had a strong overall effect size of 0.710 in reducing stress, d=0.368 for randomised trials while d=0.757 for non-randomised trials. Moreover, it also had a moderate effect size of 0.575 in reducing depression as well as a strong effect size of 0.733 in reducing anxiety. However, the studies had included a small sample size and non-randomised trials seem to have a selection bias in which participants that seek for help are more likely to join the intervention.

As a summary, the standard MBSR program was found to be effective in reducing stress and stress-related responses such as anxiety and depression either in clinical sample (Kabat-Zinn, 1982; Zainal et al., 2013) or non-clinical sample (Chiese & Serretti, 2009; de Vibe et al., 2013; Khoury et al., 2015; Song & Linquist, 2015). However, the standard MBSR is time-consuming as it requires a period of 8 weeks, thus require a long time of commitment from the participants which may eventually result in sample attrition or contamination between the groups. Therefore, researchers started to explore the brief MBSR due to the limitation in the standardized MBSR.

Brief MBSR. A meta-analysis of 30 published articles had been carried out by Carmody and Bear in 2009 and it had discovered that brief MBSR that comprised of reduced class time may be effective in decreasing psychological distress variables, involving stress, anxiety, and depression. It was reported that when comparing brief MBSR to a wait list control group or no intervention group (N=11 studies), the mean effect size was medium with 0.54. It also had been reported that there was a non-significant negative correlation between distributed practice and mean effect size of pretreatment and posttreatment for psychological distress. However, Carmody and Bear (2009) did not include the other characteristics of

MBSR such as time spent in class, the number of actual practices, and instructor's skills in the review.

When assessing the effectiveness of brief MBSR in non-clinical populations that were at risk of stress-related issues, it was found a brief 4-week MBSR helped in decreasing symptoms of burnout as well as enhancing relaxation, and satisfaction in life in a randomized controlled study with a sample of 30 nursing professions (Mackenzie, Poulin, & Seidman-Carlson, 2006). This study had illustrated that even a brief MBSR helped the participants in coping with stress. However, the study was not sure whether the participants had any experience in the traditional MBSR program which may diminish the effect of brief MBSR in the study.

Similary, Manotas, Segura, Eraso, Oggins, and McGovern (2014) also found that brief MBSR helped in reducing stress level in health care professions too, through a randomized control study with a sample of 83 participants with a mean aged of 39. It was reported that the perceived stress level decreased in the intervention groups compared to the control groups from a mean of 1.68 to 1.17. The finding was consistent with previous study (Mackenzie et al., 2006). It was because mindfulness helped them to pay their attention nonjudgmentally to their bodies and sensations as well as exploited the observing and nonjudging factor in order to decrease stress (Manotas et al., 2014). However, the study only included a control group and it was suggested to have a placebo group in the future study in order to have a better understanding about the effect of brief MBSR. Moreover, the study also did not keep track of participant's homework.

Moreover, brief MBSR was also found to be effective for students. In a study with a sample of 119 undergraduates, it was found that brief MBSR was effective in improving mindfulness and self-compassion (Bergen-Cico, Possemato, & Cheon, 2013). Even though

the intervention group showed a reduce in trait anxiety from a mean of 39.4 to 38.7, the analysis of covariance showed no significant decline in trait anxiety after the program (Bergen-Cico et al., 2013). This finding was in contrast with other study (Carmody & Bear, 2009). This unexpected result was explained by the confounding variable as the researchers assessed the trait anxiety in the beginning of semesters, and the follow-up assessment was carried out during midterm of the semester (Bergen-Cico et al., 2013). Thus, it showed that participants may face with other midterm stressors such as assignments and midterm test. Even though brief MBSR was found to be effective, the effectiveness of the findings was being limited as the study was not a randomized controlled trial.

In summary, brief MBSR showed an efficacy in managing stress in the majority of the studies (Carmody & Bear, 2009; Manotas et al., 2014; Mackenzie et al., 2006). However, the efficacy of brief MBSR on anxiety should be explored more (Bergen-Cico et al., 2013). The effectiveness of brief MBSR helping in managing stress had indeed showed that mindfulness intervention can be in a brief format.

Retreat format of MBSR. The retreat formats of MBSR had been explored by the researchers too, as the retreat formats are simpler and less time consuming compared to the standardized MBSR and brief MBSR. For example, 10 days of MBSR retreat which focused on mindfulness meditation was being investigated in a sample of 36 participants in a single group pre-post study (Krygier et al., 2013). The result demonstrated that depression, stress, negative affect was significantly reduced after the intervention, with effect sizes ranging from medium to large. However, the study did not include any control group. Thus, the effect of retreat formats of MBSR was not well explored.

In a randomized control trial, Zeidan, Johnson, Gordon, & Goolkasian (2010) had examined the effect of 3-day mindfulness with 7 minutes of silent retreat each day on stress

by using mindfulness meditation with a sample of 82 students. The result demonstrated that mindfulness meditation was effective in decreasing stress by decreasing tension, depression, confusion, fatigue as well as negative mood, compared to either sham mindfulness meditation or a control group. This finding was accordance with the previous study done by Krygier et al. (2013). Since the study involved an active group in the comparison, it led to a better understanding of the effect of mindfulness meditation on participants. However, there was a probability of experimenter bias as the same experimenter executed both of the mindfulness and sham mindfulness meditation groups.

In summary, retreat format of MBSR also showed effectiveness in managing stress (Krygier et al., 2013; Zeidan et al., 2010). Therefore, mindfulness interventions are effective in managing stress, even it is as simple as just consists of only one simple element.

Mindfulness-Based Cognitive Therapy (MBCT). MBCT is the combination of the features of Cognitive Behavioral Therapy (CBT) for depression with the features of the MBSR program. It is outlined to help in preventing the recur of depression, especially in Major depressive disorder (MDD) (Teasdale et al., 2000). It is an eight weekly 2-hour program in which comprises daily homework exercises (Teasdale et al., 2000). In a randomised controlled trial done by Teasdale et al. (2000), a total of 145 depressed participants, ranging from 18 to 65 years old was assigned into either a treatment group with MBCT or a control group with only treatment as usual (TAU). The study period consisted of a beginning of 8 weeks treatment period and then followed by 52weeks follow-up period. The findings demonstrated that MBCT significantly decreased the adventure of relapse in participants with more than three previous occurrences of depression which was 77% of the sample. In contrast, MBCT did not decrease the relapse in participants with only two prior occurrences of depression. It was said that MBCT decrease the dedication of modes of depressive thinking to the activities of mediating relapse.

Moreover, MBCT significantly decreased the stress-related outcomes such as anxiety and emotional reactivity in a randomized controlled trial that examined the influences of MBCT through a laboratory stress induction protocol using TSST in a sample of 52 participants with partially remitted recurrent depression (Britton, Shahar, Szepsenwol, & Jacobs, 2012). It was because MBCT aided the participants to better manage their anticipatory anxiety (Britton et al., 2012). However, the varies of stress-related anxiety was not during the stressor, it was found to be particular in pre- and post-stressor anxiety (Britton et al., 2012). The finding of the study was limited to the small sample size and the wait-list control group which may lead to sample attrition.

Even though MBCT is primarily designed in helping the depressed patients (Teasdale et al., 2000; Britton et al., 2012), it had also been employed to non-depressed participants. For example, the effect of MBCT in decreasing stress in a sample of five nursing students with a mean age of 25.6 years had been investigated in an individual counselling setting by using a basic single-subject experimental AB design (Schwarze & Gerler Jr, 2015). However, only three out of the five participants completed the full intervention periods. The findings illustrated that two out of the three participants reported reduced stress as assessed by Perceived Stress Scale (PSS-10) and all of the participants had found to have a rise in mindfulness levels after the intervention (Schwarze & Gerler Jr, 2015). However, the study was facing the threat of external validity as findings with only three cases were hard to create generalizations. Moreover, the participants were encouraged to volunteer for the study, implying that the participants have a higher stress level compared to the other nursing students.

In Malaysia, a pre-post study had been conducted in a sample of 41 female participants with a mean age of 29.19 years in order to investigate the influence of a brief version of MBCT (b-MBCT) on stress level and welfare of the critical care nurses (Hee,

Subramanian, Rahmat, and Phang, 2014). The brief version of MBCT was being modified from MBSR and MBCT by a local psychiatrist (Phang et al. as cited in Hee et al., 2014). It is then named as Mindful-Gym and is a five weekly 2-hr program (Hee et al., 2014). By using Perceived Stress Scale (PSS-10), the findings demonstrated there was a significant reduction in perceived stress levels after the intervention with a difference in median of 2. This finding was consistent with the findings in Schwarze & Gerler Jr (2015). Moreover, the findings also demonstrated that there was a significant decrease in anxiety, depression as well as mindfulness with an effect size of moderate to large after the intervention. However, the study was absence of the control group that limits the chance for comparing the effect of b-MBCT in the treatment group.

The effect of b-MBCT or Mindful-Gym in the form of DVD-delivered format on stress was being investigated by the researchers in Malaysia. It was found that b-MBCT group had lower perceived stress scores and mental distress scores compared to the control group in a randomized controlled study with a sample of 75 medical students after one week of intervention and the effect sizes were close to medium (Phang, Mukhtar, Ibrahim, Keng, & Sidik, 2015). The result was consistent with the previous study done with the nursing sample in Malaysia (Hee et al., 2014). Moreover, it was also found that there was a significant improve in mindfulness scores with a small effect size as well as self-efficacy scores with a medium effect size (Phang et al., 2015). However, the study could not offer a richer particular on the effect of mindfulness as it did not involve an active control group. Moreover, after 6 months, the effectiveness of the mindfulness intervention was not sustained besides self-efficacy.

As a summary of the above studies, even though MBCT was first designed to help depressed patients (Teasdale et al., 2000; Britton et al., 2012), it was found to be effective in non-depressed participants (Hee et al., 2014; Phang et al., 2015; Schwarze & Gerler Jr, 2015).

However, MBCT is still a time-consuming intervention for those people who are busy, decreasing the willingness to participate in the intervention.

Ultra-brief mindfulness / single session mindfulness. The effect of brief one session mindfulness intervention on subjective distress was being investigated recently in a randomized controlled trial with a sample of 120 undergraduates (Cruess et al., 2015). Beck Depression Inventory-II (BDI-II) was used as the screening tool in the study and TSST was used to induce stress among the participants. The results revealed that the enhanced mindfulness intervention group showed a lower score in acute subjective distress compared to the control group (Cruess et al., 2015). This study had provided evidence that a brief one session of mindfulness intervention did help in reducing subjective distress.

Similarly, in Malaysia, the effect of ultra-brief mindfulness had also been explored. The effect of 5-minute mindful breathing on distress was being explored through a randomised controlled trial in a sample of 20 palliative care patients and family members with a distress score that less than or equal to 4 (Tan et al., 2015). It was found that the median distress reduction for the intervention group was 2.5 while for listening control group was 1.0 (Tan et al., 2015). The findings also showed that the reduction in distress significantly differed between the two groups (Tan et al., 2015). Moreover, the decrease in distress was larger during 5-minute mindful breathing than after the intervention as during mindful breathing participants concentrated the attention on breathing and decreased the attention on distress (Tan et al., 2015). However, the sample size of the study was relatively small and the results were not able to generalize to healthy population.

In summary, ultra-brief mindfulness intervention has an effect on stress reduction (Cruess et al., 2015; Tan et al., 2015). However, more studies should be carried out in order

to provide a solid empirical support on the effectiveness of ultra-brief mindfulness intervention.

Mindfulness-Based Interventions (MBIs) and Heart Rate (HR)

Researchers have discovered enhancement in cardiovascular variables such as heart rate in mindfulness-based interventions (MBIs). The effect of a brief 3-day MBI on cardiovascular response had been examined by Zeidan et al. (2010). After assessing the heart rate before and after the intervention of mindfulness meditation which is the MBI used in the study, it was found that mindfulness meditation group illustrated a significant decrease in heart rate compared to the sham mindfulness group and the control group (Zeidan et al., 2010). This showed that MBI helped in facilitating cardiovascular improvement (Zeidan et al., 2010). However, the study done by Zeidan et al. (2010) was not an experiment that manipulated stress. Therefore, the effect of brief MBI was suggested to investigate in further in the experimental condition that manipulated stress in order to illustrate the advantages (Zeidan et al., 2010).

The limitation in the study done by Zeidan et al. (2010) had been overcome by Jones (2013) with a college sample of 58 participants in a laboratory study. In addition, this study supported the findings that mindfulness intervention such as meditation played a different character in responses to laboratory stressors. It had found that even a brief one-time intervention that required only 15 minutes was able to reduce heart rate reactivity compared to the control group that attended to a health care article (Jones, 2013). Participants in the intervention groups were able to recover immediately following a stressor, proving that even a brief one-time intervention helps in improving the capability to control attention (Jones, 2013). Thus, the participants were able to concentrate on the present-moment nonjudgmentally (Jones, 2013). The strength of this study was that the intervention was

being done prior to the stress induction, while heart rate was being measured before and after the stress induction.

Besides that, yoga is also one of the elements that included in MBSR and the effect of it on heart rate had also been investigated. For example, yoga-based guided relaxation on heart rate had been examined by Vempati and Telles in 2002. Heart rate was being recorded before, during, and after the intervention and correspondingly for supine rest by using ECG that sampled the heart rate at 500 Hz. Although both intervention and supine rest decreased heart rate, yoga-based guided relaxation was more effective in lowering heart rate, with 9.7% compared to supine rest with 6.5%. However, the recording of heart rate was not done on all the participants, it was only on 15 out of 35 male participants due to the cumbersome sessions.

Similarly, in a randomized control study, it was found that with a total sample of 12 participants that aged between 20 to 40 years old, the group that received yoga intervention had a significant reduction in mean heart rate on day 30 of the training (LHR: 63.3 bpm; BHR: 70.1bpm) when compared to day 1 (LHR: 72.3 bpm; BHR: 80.7 bpm), whereas the control group showed no significant changes in heart rate readings from day 1 to day 30 (Telles et al., 2004).

In contrast, Burg, Wolf, and Michalak (2012) had found that there was no relationship between MBI which was mindful breathing exercise and heart rate with a college sample of 23 participants even though the heart rate data was collected twice with one week apart to obtain a better estimation. This finding had been further supported by Steffen and Larson (2014) when examined on the effect of brief MBI on cardiovascular reactivity in the course of a laboratory stressor paradigm in an experimental design. Even though it was found that heart rate decreased significantly as soon as following the mindfulness intervention regardless of the experimental group, heart rate showed no difference in group in the reaction

to the laboratory stressor model which was Paced Auditory Serial Addition Task (PASAT) (Steffen & Larson, 2014). Moreover, it also found that in the recovery period, heart rate showed no difference in group too (Steffen & Larson, 2014). This finding was truly in contrast to the findings obtained by Zeidan et al. (2010) and Jones (2013).

In summary, mindfulness-based interventions were found to be effective in reducing heart rate during stress in majority of the studies (Jones, 2013; Zeidan et al., 2010). However, there was study showed that mindfulness-based intervention was not effective in reducing heart rate in the laboratory stressor model (Steffen & Larson, 2014).

Mindfulness-Based Interventions (MBIs) and Heart Rate Variability (HRV)

The effect of MBIs toward heart rate variability (HRV) which is a measure of the ability of the body to regulate the physiological response of stress also being investigated recently. MBI such as mindfulness breathing was found to have a significant positive relationship with HRV components such as SDNN and RMSSD (Burg et al., 2012). It was stated that HRV increased if the capability to manage one's attention mindfully increased, showing that mindfulness practices tended to foster the regulartory ability (Burg et al., 2012). However, this result was not a causal inference.

In addition, MBIs had also been demonstrated to positively affect HRV. Krygier et al. (2013) demonstrated that a 10 day MBI retreat which was mindfulness meditation caused enhancement in HRV. It was demonstrated that there was a significant rise in high frequency (HF) of HRV during the intervention relative to resting baseline accompanied by a large effect size (Krygier et al., 2013). Moreover, it also found that MBI significantly increased HRV such as SDNN scores during a cognitive challenge compared to the interfacing with a dog group and no treatment group in a study of 74 participants (Shearer, Hunt, Chowdhury, & Nicol, 2015). These findings (Krygier et al., 2013; Shearer et al., 2015) had truly

supported the study of Burg et al. (2012) that there was a positive relationship between MBI and HRV. Since HRV illustrated the ability of the body to react to challenges in the environment such as stress, it was concluded that MBI helped individuals to manage stress as the indices of HRV increased (Shearer et al., 2015). However, it was argued that the increased in HRV indices may due to the influence of moderate physical exercise such as mindful stretching, gentle yoga, and psychoeducation in the mindfulness intervention that adapted from the MBSR protocol (Shearer et al., 2015).

The incorporation of stress induction before to randomization to an intervention group or a control group aided demonstrates the advantages of brief mindfulness intervention after the experience of stress. Azam et al. (2015) claimed that MBI such as mindfulness meditation showed effectiveness in rising HRV with a larger effect size, and thus facilitate relaxation in a total of 39 participants, further supported the findings in Shearer et al. (2015) and it was complimented with the former findings in Krygier et al. (2013). Furthermore, the study measured HRV using HF band which seems to be most resemble estimate the function of the parasympathetic. In addition, Azam et al. (2015) also argued that MBI was not having an effect on HRV in a sample of 21 maladaptive perfectionists. This was because perfectionists are having attentional difficulties (Azam et al., 2015). Nonetheless, the not validated stress induction program in the study may affect the findings. However, this study had eliminated the limitation in the study done by Shearer et al. (2015) as mindfulness meditation does not include physical exercise.

However, when Nyklíček, Mommersteeg, Van Beugen, Ramakers, and Van Boxtel (2013) conducted a laboratory study which induced stress by using mental arithmetic and speech tasks with a sample of 88 participants before and after 8 weeks of MBI which was MBSR training employing an experimental design, it was found that there was no different in the effect of MBSR on heart rate variability from pre-intervention to post-intervention when

compared to the waitlist control group. This may due to the short recovery period from stress (Nyklíček et al., 2013).

In summary, mindfulness-based interventions were found to be effective in increasing HRV (Krygier et al., 2013; Shearer et al., 2015). However, contradict result was obtained too in the study done by Nyklíček et al. (2013), showing mindfulness-based intervention was not effective in altering HRV.

Theoretical Framework

James-Lange theory of emotion. James-Lange theory of emotion is the earliest theory of emotion that proposed by James and Lange, the American psychologists. The fundamental premise of this theory is that the encounter of feeling and emotion is instigated by physiological arousal (Cannon, 1927). According to the theory, stimuli arriving at the cerebral cortex cause visceral changes, that are later being viewed as an emotion (Steimer, 2002). In other words, the alterations in the body follow straightly the awareness of the existing reality or fact, and that individual's feeling of the identical alterations as their occurring is the emotion (Strongman, as cited in Üngür & Karagözoğlu, 2013). Therefore, it can be said that physiological response to the incidents or events will lead to the occurring of emotions. Thus, in order for an individual to feel anxiety and stress, the individual must first encounter changes in the body, such as the heightened heart rate and these physiological changes will then be interpreted by the brain as the emotion. In this study, the event which is the employment of the stress induction protocol, the Trier Social Stress Test that consists of an interview session and an arithmetic test will trigger the physiological arousal such as an increase in heart rate. Thus, the brain will then interpret the increase in heart rate as an emotion. Therefore, the individual will feel distress.

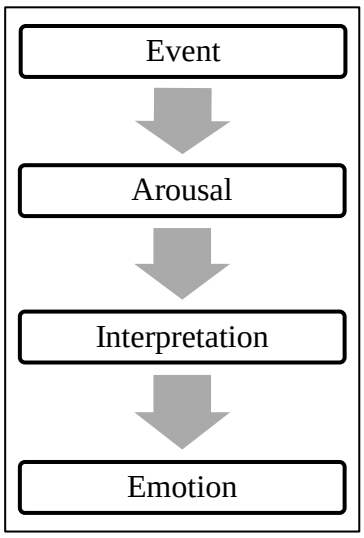

Figure 1. Theoretical framework of James-Lange theory of emotion.

Fight-or-flight theory. The fight-or-flight response is a physiological reaction which happens when there is something horrify and terrify either in a mental or physical way. In other words, when individual faces with stress and the body senses the alarm, the body will decide instantaneously whether to run away from the stress or stand and fight. The biobehavioral "fight-or-flight" theory has been first documented by Walter Cannon in 1932 and sympathetic nervous system (SNS) which is one of the branches of autonomic nervous system (ANS) is being characterised by "fight and flight" (as cited in Taylor et al., 2000).

It is mostly the ANS that transmits information from the brain to arrive at the target organs which cause the stress responses (Olsson, 2010). ANS comprises of two branches which are sympathetic nervous system (SNS) and parasympathetic nervous system (PNS). The body will prepare either a fight or flight response that produced by SNS and PNS when a person faces an acute psychological stressor (Terathongkum, 2006).

Moreover, the SNS is catabolic in the main, increasing activity, and spending recourses (Olsson, 2010). On the other hand, the PNS is characterized by "rest and digest" in which it is anabolic in the main, decreasing activity, and saving recourses (Olsson, 2010). The adrenal gland is being stimulated by the SNS to release catecholamines, involving

epinephrine, norepinephrine and dopamine, resulting in an increase in heart rate, thus lead to a decrease in heart rate variability (Terathongkum, 2006). On the other hand, PNS reduces heart rate through the mediation of acetylcholine, resulting in a decrease in heart rate (Terathongkum, 2006). Thus, it leads to an increase in heart rate variability.

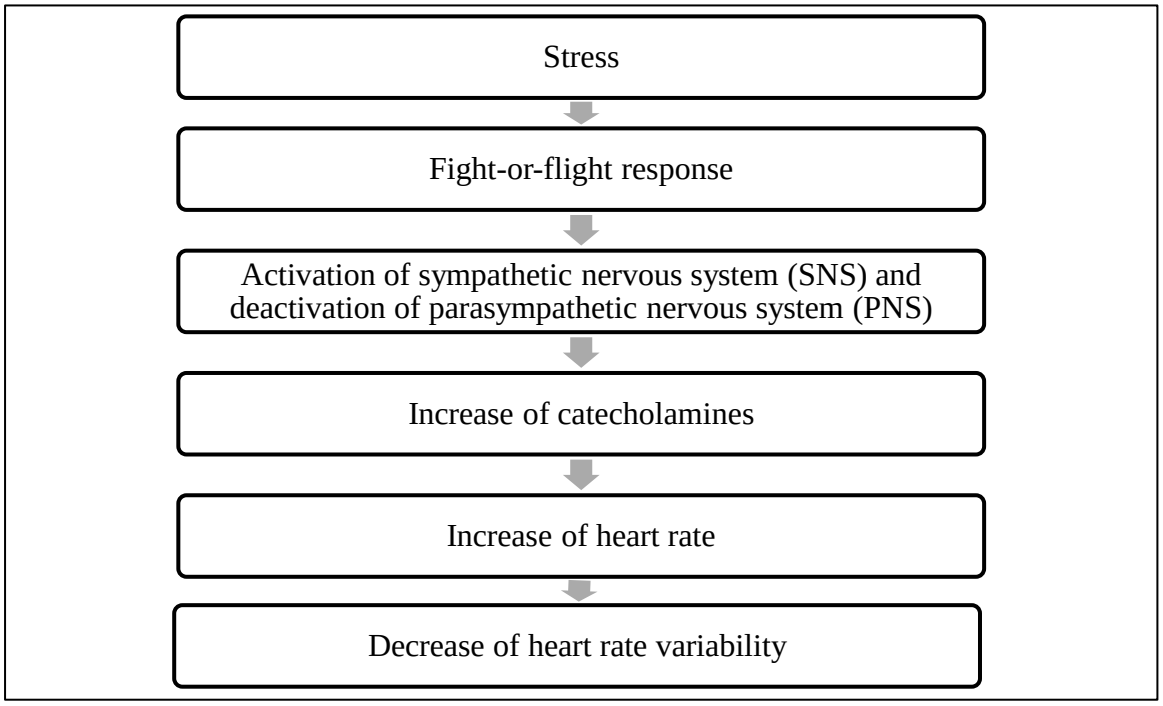

Figure 2. Theoretical framework of fight-or-flight response.

Conceptual Framework

The stress induction protocol, which is Trier Social Stress Test (TSST) will cause the fight-or-flight response. This will then activate the sympathetic nervous system (SNS) to stimulate the adrenal gland to release catecholamines, resulting in an increase heart rate, thus lead to a decrease in heart rate variability (Terathongkum, 2006). The changes in physiological response will then interpret by the brain as an emotion. Therefore, an individual will have increased feelings of distress and anxiety.

Moreover, according to Kabat-Zinn (1991), individual responds to fight-or-flight response when he perceives stress, followed by the stimulation of the adrenal glands and the

increase in heart rate. Moreover, individual tends to internalize the stress, laying the root for chronic states of anxiety and other conditions (Kabat-Zinn, 1991). Individual hides the stress from himself and tends to have maladaptive coping, leading to psychological disorder such as anxiety at the end (Kabat-Zinn, 1991).

However, mindfulness tends to decelerate the fight-or-flight response as well as induce a relaxation response (Ihnen & Flynn, 2008). Mindfulness keeps individual conscious, heading things off at fight or flight responses or stimulation of adrenal glands (Ihnen & Flynn, 2008). Thereby, it activates the PNS, resulting in a decrease in heart rate and an increase in heart rate variability. This is because mindfulness leads to attention control in which individual learns to attend to the consciousness, breaking off all the processes of elucidating experience (Shapiro, Carlson, Astin, & Freedman, 2006). Moreover, mindfulness leads a clear awareness of individual's inner and outer worlds, which consists of cognitive, emotions and behaviours (Brown et al., 2007). In addition, mindfulness helps in emotional regulation, decreasing the worriedness in individuals (Arch & Craske, 2006). The attention control, emotional regulation, and self-awareness will then leads to self-regulation, which further lead to the activation of PNS. Hence, the activation of PNS will then increase the release of acetylcholine, which results in a decrease in heart rate and an increase in heart rate variability. Therefore, the physiological changes in the body, such as a decrease in heart rate will again interpret by the brain as an emotion. The individual will then feel less distress and anxiety as well as increase feeling of relaxation.

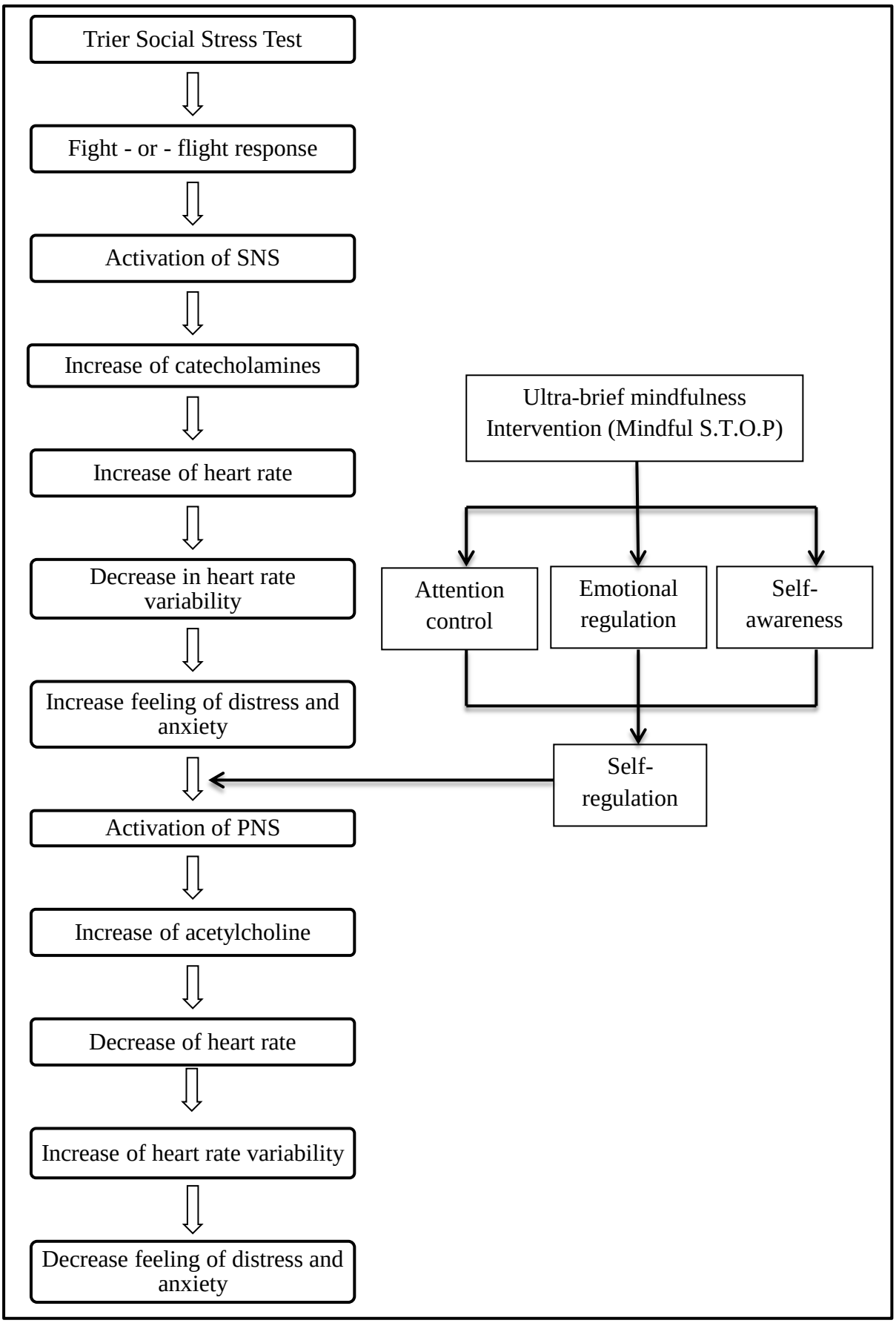

Figure 3. The conceptual framework of theories.

Overall Summary

In overall, stress causes an increase in anxiety (Filaire et al., 2010; Rimmele et al., 2007; Rohrmann et al., 1999; von Dawans et al., 2011) as well as in subjective distress ratings (Morgan et al., 2002; Tavernier et al., 2011; Zwahlen et al., 2011). Apart from psychological responses, stress also causes an increase in heart rate (Elwess & Vogt, 2005; Hellhammer & Schubert, 2012; Kelly et al., 2008; Kirschbaum et al., 1993; Reinhardt et al., 2013). Moreover, stress also impaired HRV (Filaire et al., 2010; Petrowski et al., 2010; Tealman et al., 2008; Tharion et al., 2009). However, most of the studies did not quantify the stress level while they measured the physiological responses induced by stress. Thus, there may be the possibility that there was no stress aroused during the study. Even though mindfulness based intervention was found to be helpful in reducing stress (Carmody & Bear, 2009; Kabat-Zinn, 1982; Khoury et al., 2015), heart rate (Jones, 2013; Telles et al., 2004; Zeidan et al., 2010) and heart rate variability (Azam et al., 2015; Krygier et al., 2013; Shearer et al., 2015), it is relatively time-consuming as the intervention takes a long period of time such as 8 weeks for the standard MBSR. In contrast, there are studies that showed that mindfulness-based intervention did not have an effect on heart rate (Steffen & Larson, 2014) and heart rate variability (Nyklíček et al., 2013). The effectiveness of ultra-brief mindfulness in reducing stress was being investigated recently (Cruess et al., 2015; Tan et al., 2015). However, both of the studies also did not include heart rate and heart rate variability as the physiology outcomes of stress. Thus, in this study, we tend to investigate the effect of stress on psychological and physiology responses as well as the effect of ultra-brief mindfulness on reducing stress.

3.0 Methodology

Research design

Quantitative research design was used in this research study with the aim to determine the effectiveness of ultra-brief mindfulness intervention in reducing distress, anxiety, and heart rate as well as increasing the heart rate variability. This study was carried out through the experiment. To be more specifically, randomized controlled trial (RCT) was used, where the participants being studied were randomly distributed into either the ultra-brief mindfulness intervention group or control group by listening to them under the study.

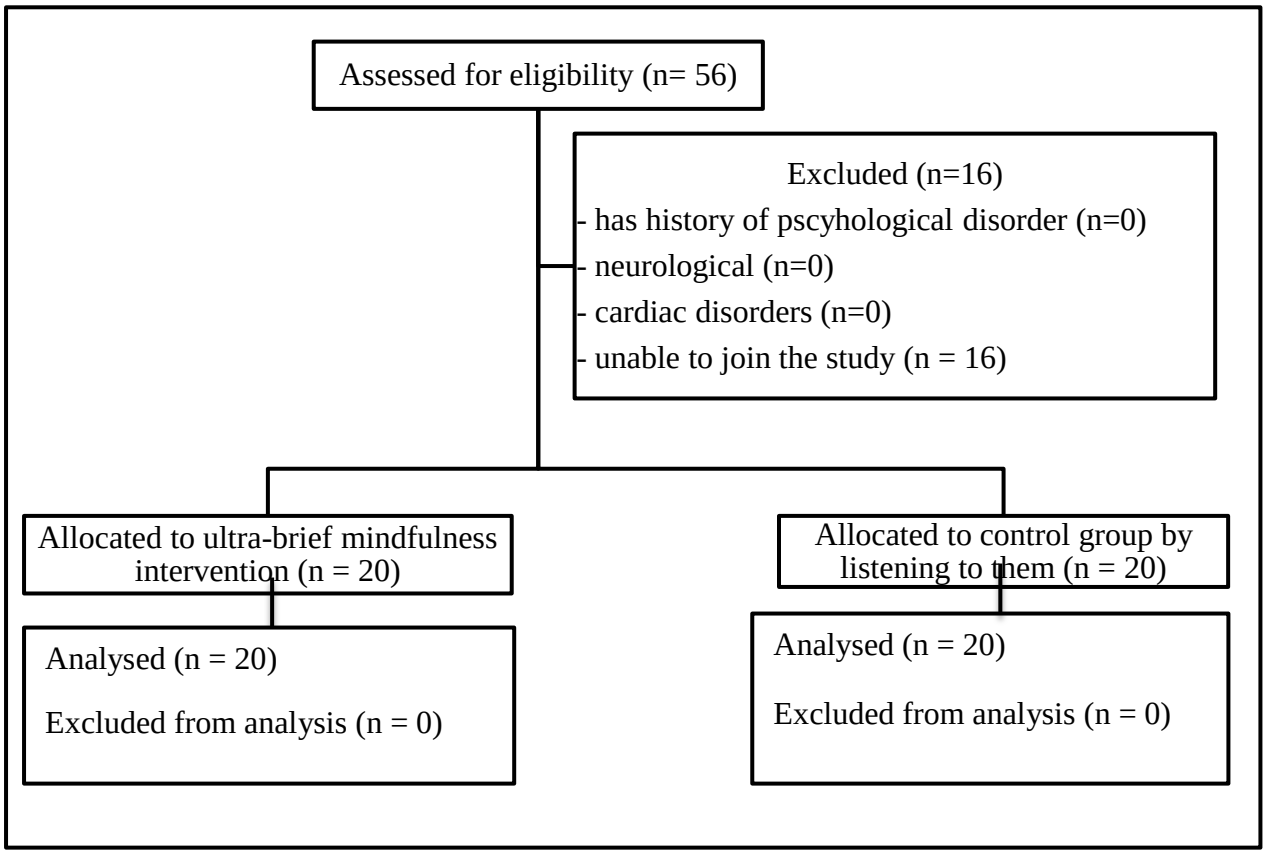

Figure 4. The chart showed the randomized controlled trial in this research study.

Participants

The population for this research study was all the students in University Tunku Abdul Rahman (UTAR) Perak campus. Non-probability sampling method which was purposive sampling was used to select the sample. Healthy volunteers were being selected only. Those students with existing psychological disorders, neurological disorders and cardiac disorders were being excluded from the study. In this study, the total sample size was 40 UTAR students and we had randomly assigned the participants into either intervention group or control group by allowing the participants to draw lots. Therefore, 20 participants were assigned in the intervention group and 20 participants in the control group. Both of the groups had an equal amount of males and females, which is nine for males and 11 for females. Moreover, the average age of both of the groups was the same, which was 22 years old. Table 1 shows the demographic data in detail, which included the years of study, faculties that involved in, and the courses the participants studied.

Table 1

The Demographic Data of Participants in Intervention Group and Control Group.

Demographic Variable	Intervention Group	Control Group
Mean age (SD)	22 (1.24)	22 (1.63)
Gender		
Male	9	9
Female	11	11
Year of Study		
Year 1	2	2
Year 2	3	3
Year 3	13	13
Year 4	1	2
Unknown	1	0
Faculty		
FSC	2	1
ICS	1	2
FBF	0	5
FAS	16	12
FICT	1	0
Course		
Biochemistry	0	1
Biotechnology	1	0
Statistical Computing and Operations Research	1	0
Chinese Studies	1	2
Business Administration	0	1
Banking and Finance	0	1
Accounting	0	1
Psychology	11	9
Public Relation	1	2
Marketing	0	1
Finance	0	1
English Education	1	1
English Language	1	0
Computer Science	1	0
Advertising	1	0
Journalism	1	0

Instruments

Demographic Questionnaire. A demographic questionnaire was employed to collect data on age, gender, year of study, type of faculty, and type of course studied.

Subjective Unit of Distress Scale (SUDS). The SUDS (Wolpe as cited in Kim, Bae, & Park, 2008) was used to assess the subjective severity of distress that contemporary encountered by the participants. The SUDS consists of only one item with a 11-point Likert scale, ranging from 0 (a state of absolute calmness) to 10 (the worst anxiety). The participants were required to self-evaluate where they are on the scale.

State-Trait Anxiety Inventory (STAI). The STAI (Spielberger et al., 1983) was used to examine trait anxiety and state anxiety of the participants. The STAI is a self-report questionnaire. It comprises of two subscales, which are the State Anxiety Scale (S-anxiety) and the Trait Anxiety Scale (T-anxiety) with 20 items each. The S-anxiety evaluates how the participants perceive their feeling "right now, at this moment". Examples of the items are "I feel calm" and "I feel steady". In addition, the T-anxiety evaluates how the participants "generally feel". Examples of the items are "I feel rested" and "I feel inadequate". Moreover, both of the subscales have two factors, which are anxiety-present and anxiety absent (Spielberger et al., 1983). The responses are assessed on a 4-point Likert scale, ranging from 1 (Not at all) to 4 (Very much so) for the S-anxiety and from 1 (Almost never) to 4 (Almost always) for the T-anxiety. The scores of the items are summed to acquire subtest total scores. Scoring should be reversed for anxiety-absent items. Examples of anxiety absent items are item 1, 2, 5, 8, 10, 11, 15, 16, 19, and 20 for S-Anxiety (Spielberger et al., 1983). Whereas, for T-Anxiety, examples of anxiety absent items are item 21, 23, 26, 27, 30, 33, 34, 36, and 39 (Spielberger et al., 1983). Therefore, the total score for each subscale can be ranged from 20 to 80. Higher scores reveal higher anxiety level. It needs about six minutes to finish

either the scale of S-Anxiety or the scale of T-Anxiety, and about ten minutes to finish both (Spielberger et al., 1983).

The scale of T-anxiety had a high test-retest correlation with an alpha coefficient from 0.65 to 0.75 (Spielberger et al., 1983). During the circumstances of psychological stress, S-Anxiety scale has a high reliability, ranging from 0.89 to 0.92 (Spielberger et al., 1983). T-anxiety scale was found to have construct validity with psychiatric patients had a higher score than the normal (Spielberger et al., 1983). Moreover, S-anxiety scale also was found to have construct validity with college students scored higher in the examination circumstances than in a normal class (Spielberger et al., 1983).

Moreover, the reliability of S-Anxiety in this study had been performed. S-Anxiety showed an internal consistency of 0.931 before the TSST and 0.933 during the TSST. After the intervention, S-Anxiety had an internal consistency of 0.806 for the intervention group and 0.953 for the control group.

Toronto Mindfulness Scale (TMS). The TMS (Lau et al., 2006) was used to evaluate the participants' state mindfulness before and after the intervention. The TMS is a self-report questionnaire designed to examine the capability to raise a state of mindfulness at a specific point in time. It consists of 13 items. The scale embodies two factors, which are curiosity and decentering. The curiosity scale evaluates a desire to gain more knowledge about one's experience (Zanetich, 2012). The curiosity scale encompasses six items, which are item 3, 5, 6, 10, 12, and 13. Examples of these items involve "I remained curious about the nature of each experience as it arose" and "I was curious about my reactions to things". The decentering scale refers the capability to disidentify with an individual's thought and affections and grasp an expanded realm of consciousness (Zanetich, 2012). The decentering scale encompasses seven items, which are item 1, 2, 4, 7, 8, 9, and 11. Examples of these

items involve “I experienced myself as separate from my changing thoughts and feelings” and “I was aware of my thoughts and feelings without overidentifying with them”. The responses are assessed on a 5-point Likert scale, ranging from 0 (Not at all) to 4 (Very much). The scoring is done by summing up the score of each item. Therefore, the score will range from 0 to 52. Higher scores reveal higher level of state mindfulness at the moment. The scale was being developed using a sample of experienced (N=232) and inexperienced (N=158) meditators (Lau et al., 2006).

Through a systematic analysis, curiosity and decentering was found to have a high internal consistency with alpha coefficients of 0.84 and 0.88 respectively (Russell, 2011). For construct validity, both of the subscales were found to have a positive correlation with absorption, internal state awareness, and reflective self-awareness (Lau et al., 2006; Russell, 2011). Moreover, both of the subscales did not correspond with dissociation (Lau et al., 2006; Russell, 2011).

Moreover, the reliability of TMS in this study had been performed. TMS showed a reliability of 0.811 before the TSST with curiosity had a reliability of 0.843 and decentering had a reliability of 0.532. After the intervention, TMS showed a reliability of 0.849 for the intervention group and 0.836 for the control group. In the intervention group, curiosity had a reliability of 0.861, while decentering had a reliability of 0.802. In the control group, curiosity had a reliability of 0.927, while decentering had a reliability of 0.255.

The low reliability of decentering factor may due to the influence of the environmental factors and test-taker factors (Cohen, Swerdlik, & Sturman, 2012). Examples of the errors that might be included in our study are the uncomfortable room temperature and the feeling of fatigue in test-takers. Participants in the control group tended to use more

mental effort during the reflective listening compared to the intervention group, making them to be more difficult to answer with their best efforts while doing the post-test.

Wild Devine Iom Hardware. The Wild Devine Iom hardware was installed in the computer. It is joined with the pulse oximeter which connected to the participants' fingertips to sense the pulse rate. Then, the heart rate is being displaced in the Wild Devine Iom Grapher which expressed as beats per minute (bpm). Whereas, the heart rate variability, R-R interval is calculated from the heart rate readings with the formula provided in figure 5 (Blumenthal et al., 2012). Moreover, standard deviation of all N-N intervals or R-R intervals (SDNN) also been calculated.

$$\mathrm{R-R\ interval} = \frac{60,000}{\mathrm{Heart\ rate\ (bpm)}}$$

Figure 5. The figure showed the formula of calculating R-R interval from heart rate.

Research Procedures

Pre-stress measurements. As participants arrived the laboratory, written informed consent was gained from the participants. A cover story was made to deceive the participants in order to get a more accurate result. After the informed consent, the participants rested for 10 min at room A. After 10 min the participants were brought to room B. Participants were required to fill in the questionnaire, in which the questionnaire consists of demographic data, SUDS, STAI (S-anxiety and T-anxiety), and TMS. Heart rate and heart rate variability were being recorded for 5 min.

Trier Social Stress Test (TSST) Protocol. TSST protocol (Kirschbaum et al., 1993) was used to induce stress on the participants. After the pre-stress measurement, at time 0 min,

3 interviewers entered room B. A video camera was installed. The participants were required to assume themselves as a job applicant who was asked for a personal interview with the managers of the corporation. They were informed that after a time of preparation, they ought to present themselves in a free speech of 5 min to the managers and persuade the managers that he or she was the ideal applicant for the available position. Moreover, they were being informed that their speech will be videotaped and analysed by a panel of judge. The interviewers were always consisted of males and females. To avoid inconsistency, the following speech (Birkett, 2011) was being read to the participants:

> *"This is the speech preparation portion of the task. You are to mentally prepare a five-minute speech describing why you would be a good candidate for your ideal job. Your speech will be videotaped and reviewed by a panel of judges trained in public speaking. You have ten minutes to prepare and your time begins now."*

The participants were given with paper and pencils for outlining their speech. Nonetheless, they were not permitted to have the written concept for their speech. A digital timer for 10 min was set.

At time +10 min, the interviewers returned to room B and the participants were asked to give their speech in the following 5 min. To avoid inconsistency, the following speech (Birkett, 2011) was being read to the participants:

> *"This is the speech portion of the task. You are to deliver a speech describing why you would be a good candidate for your ideal job. You should speak for the entire five-minute time period. Your time begins now"*

Whenever the participants ended their words in less than 5 min, the interviewers reacted in a standardized method. The interviewers allowed the participants to stay quiet for 20 seconds. Then, the interviewers told the participants "You still have some time left. Please continue!". Heart rate and heart rate variability were being recorded during the 5 min free speech.

At time +15 min, the participants were inquired to sequentially minus the number 13 from 1022 as quickly and as accurately as possible. To avoid inconsistency, the following speech (Birkett, 2011) was being read to the participants:

> "*During the final five-minute math portion of this task, you will be asked to sequentially subtract the number 13 from 1,022. You will verbally report your answers aloud, and be asked to start over from 1,022 if a mistake is made. Your time begins now.*"

The participants had to start over again at 1022 if they made a mistake. The interviewer interfered with "Stop, 1022". Heart rate and heart rate variability were being recorded during the 5 min arithmetic task.

At time +20 min, the arithmetic task was ended. The subjective stress levels were being measured again using a questionnaire, in which the questionnaire consists of only SUDS and S-anxiety. After that, the participants were assigned randomly in either intervention group or control group.

Ultra-brief mindfulness intervention. Participants in the intervention group received 5-minute Mindful S.T.O.P. (Phang, Keng, & Chiang, 2014) session guided through voice recording. Mindful S.T.O.P. is an acronym for a four-step way that employed to foster mindfulness in anytime and everywhere (Phang et al., 2014). It is started by ringing the mindfulness bell. The letter S represents stop. The participants were asked to stop whatever that they were doing temporary and currently rest the awareness. The letter T represents grasp deep breaths. The participants were then asked to have slow and relaxing breaths as well as breathe mindfully. Next, the letter O represents observe the present moment. The participants were instructed to perceive the sound, sight, and sensation in the environment as they were inhaling and exhaling. The letter P represents proceed with a smile. Afterward, the participants were instructed to continue with whatever they required to carry out with a smile. The instructions to carry out Mindful S.T.O.P. session were showed in Appendix G.

Control group. Participants in the control group obtained a 5-minute "reflective listening" period with the same interviewer. The participants were stimulated to talk during the listening session. The examples of questions asked during the 5-minute "reflective listening" period were how do you feel during the interview and arithmetic test, and how do you feel today.

Post-stress measurements. After the intervention, the subjective stress levels were being assessed using a questionnaire, in which the questionnaire consists of SUDS, S-anxiety, and TMS. Heart rate and heart rate variability were being recorded for 5 min. After that, the participants were being debriefed by the interviewer about the objectives of the study and analysis would not be carried out on neither voice frequency nor a video recording.

Data Analysis

The heart rate data that was collected by the Wild Devine Iom Grapher was then extracted by using Microsoft Excel. Visual basic code of split function was used to split the data in lines. The data was then being texted to column according to the variables. After that the mean of the heart rate was being calculated by using the function in Excel. The heart rate variability also been calculated by using the formula that showed in figure 5. Standard deviation of N-N intervals (SDNN) was then being calculated by using the function in excel.

The data collected was being analysed using SPSS 21. Outliers were being transformed by changing the value to the next highest or lowest (non-outlier) number with plus one unit increment higher or lower (Field, 2013). Normality test was being performed with the purpose to determine whether the set of data was well-modeled by a normal distribution. Normality test was carried out by determining the $Z_{Skewness}$ and $Z_{Kurtosis}$ of the data collected (Field, 2013; Ghasemi & Zahediasl, 2012). The formula of $Z_{Skewness}$ and $Z_{Kurtosis}$ are provided in figure 6. The score that larger than 1.96 or smaller than -1.96 is

significant at P < 0.05, whereas larger than 2.58 or smaller than -2.58 is significant at P < 0.01, and larger than 3.29 or smaller than -3.29 is significant at P<0.001 (Field, 2013; Ghasemi & Zahediasl, 2012).

Paired sample t-test was being employed to analyse the data within the intervention group and the control group. Moreover, independent sample t-test was being employed to analyse the data between the intervention group and control group.

$$Z_{\text{Skewness}} = \frac{\text{Skewness} - 0}{SE_{Skewness}}$$

$$Z_{\text{Kurtosis}} = \frac{\text{Kurtosis} - 0}{SE_{Kurtosis}}$$

Figure 6. The figure showed the formula of Z_{Skewness} and Z_{Kurtosis}.

4.0 Findings and Analysis

Transformation of Outliers

Intervention group. The outliers were being transformed by modifying the value to the next highest number with plus one unit increment higher (Field, 2013). One of the outlier from the data of standard deviation of N-N intervals (SDNN) that collected before Trier Social Stress Test (TSST), during TSST, and after mindfulness intervention had been transformed simultaneously. By replacing the outliers, it will help to improve the accuracy of the data.

Control group. The outliers were being transformed by modifying the value to the next highest number with plus one unit increment higher (Field, 2013). One of the outlier from the data of heart rate that collected before TSST had been transformed, during TSST, and after the reflective listening had been transformed simultaneously. Moreover, one of the outlier in the data of SDNN that collected before TSST and after the reflective listening had been transformed simultaneously. While for during the TSST, there were two outliers in the data of SDNN. The two outliers were being transformed by modifying the value to the third highest number with plus one unit increment higher. By replacing the outliers, it will help to improve the accuracy of the data.

Normality of The Data

From table 2 and table 3, all the values of $Z_{Skewness}$ and $Z_{Kurtosis}$ are between the range of 3.29 and -3.29, showing that all the values of $Z_{Skewness}$ and $Z_{Kurtosis}$ are not significant at $P<0.001$. Therefore, all the values of the data collected are normally distributed.

Table 2

The $Z_{Skewness}$ and The $Z_{Kurtosis}$ for The Data in Intervention Group

	$Z_{Skewness}$	$Z_{Kurtosis}$
SUDS (Pre)	0.115	-0.858
SUDS (Mid)	-1.543	-0.286
SUDS (Post)	1.594	0.203
STAI (Pre)	0.600	-0.099
STAI (Mid)	1.215	-0.770
STAI (Post)	1.238	0.505
TMS (Pre)	-2.465	2.421
TMS (Post)	-1.567	-0.321
HR (Pre)	-0.027	-1.403
HR (Mid)	-0.613	-1.146
HR (Post)	0.727	-0.595
R-R interval (Pre)	0.629	-1.218
R-R interval (Mid)	1.375	-0.771
R-R interval (Post)	0.303	-0.458
SDNN (Pre)	1.459	-1.475
SDNN (Mid)	0.629	-0.945
SDNN (Post)	0.268	-1.147

Note. SUDS = Subjective Unit of Distress Scale; STAI = State-Trait Anxiety Inventory; TMS = Toronto Mindfulness Scale; HR = Heart Rate; SDNN = Standard Deviation of All N-N Intervals; Pre = before Trier Social Stress Test (TSST); Mid = during TSST; Post = after ultra-bried mindfulness intervention.

Table 3

The $Z_{Skewness}$ and The $Z_{Kurtosis}$ for The Data in Control Group

	$Z_{Skewness}$	$Z_{Kurtosis}$
SUDS (Pre)	1.479	-0.452
SUDS (Mid)	-0.354	-0.828
SUDS (Post)	1.604	0.158
STAI (Pre)	-0.049	-1.254
STAI (Mid)	0.012	-0.739
STAI (Post)	0.473	-0.908
TMS (Pre)	1.270	0.289
TMS (Post)	0.477	-0.530
HR (Pre)	0.252	-1.002
HR (Mid)	0.344	-1.012
HR (Post)	0.412	-0.118
R-R interval (Pre)	-0.211	-0.099
R-R interval (Mid)	-0.482	-0.259
R-R interval (Post)	-0.707	1.606
SDNN (Pre)	0.529	-0.222
SDNN (Mid)	-1.041	-0.415
SDNN (Post)	1.299	-0.024

Note. SUDS = Subjective Unit of Distress Scale; STAI = State-Trait Anxiety Inventory; TMS = Toronto Mindfulness Scale; HR = Heart Rate; SDNN = Standard Deviation of All N-N Intervals; Pre = before Trier Social Stress Test (TSST); Mid = during TSST; Post = after reflective listening.

Subjective Unit of Distress Scale (SUDS)

Within intervention group. A paired-sample t-test was carried out to determine the effect of TSST and ultra-brief mindfulness intervention on SUDS in intervention group. On average, the participants had a higher score in SUDS during TSST (M = 6.60, SD = 2.34), than before TSST (M = 4.15, SD = 1.92). The difference, -2.45, 95% CI [-3.65, -1.25], was significant $t(19) = -4.273$, $p < 0.001$, and indicated a large effect size, $d = 1.28$. Furthermore, on average, the participants had a lower score in SUDS after the intervention (M = 2.70, SD = 1.78), when compared to that of during TSST (M = 6.60, SD = 2.34). The difference, 3.90, 95% CI [2.85, 4.95], was significant $t(19) = 7.767$, $p < 0.001$, and indicated a large effect size, $d = -1.67$. Moreover, on average, participants had a lower score in SUDS after intervention (M = 2.70, SD = 1.78), than before TSST (M = 4.15, SD = 1.92). The difference, 1.45, 95% CI [0.57, 2.33], was significant $t(19) = 3.454$, $p = 0.003$, and indicated a medium to large effect size, $d = -0.76$.

Within control group. A paired-sample t-test was carried out to determine the effect of TSST and reflective listening on SUDS in control group. On average, the participants had a higher score in SUDS during TSST (M = 5.80, SD = 2.48), than before TSST (M = 3.30, SD = 1.89). The difference, -2.50, 95% CI [-3.64, -1.36], was significant $t(19) = -4.585$, $p < 0.001$, and indicated a large effect size, $d = 1.32$. Furthermore, on average, the participants had a lower score in SUDS after reflective listening (M = 2.50, SD = 1.88), when compared to that of during TSST (M = 5.80, SD = 2.48). The difference, 3.30, 95% CI [2.07, 4.53], was significant $t(19) = 5.638$, $p < 0.001$, and indicated a large effect size, $d = -1.33$. Moreover, participants had a lower score in SUDS after reflective listening (M = 2.50, SD = 1.88), than before TSST (M = 3.30, SD = 1.89). The difference, 0.80, 95% CI [-0.13, 1.73], was not significant $t(19) = 1.798$, $p = 0.088$; however, it did represent a small to medium effect size, $d = -0.42$.

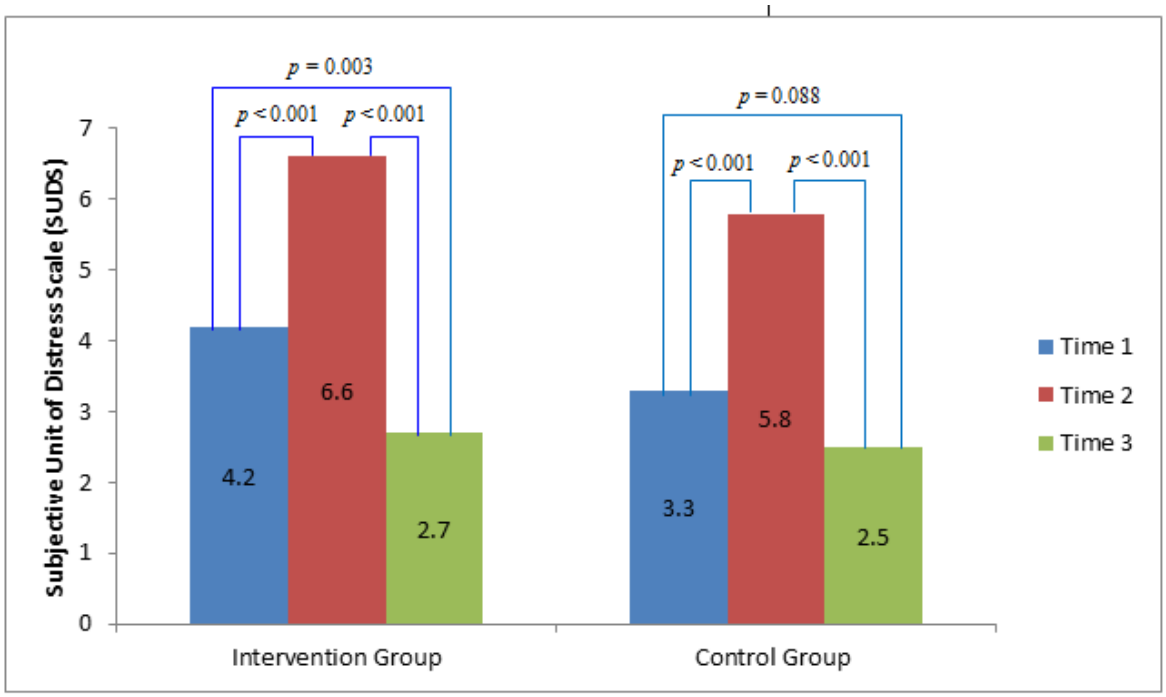

Figure 7. The mean differences within the intervention group and control group for Subjective Unit of Distress Scale (SUDS). Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

Between groups. An independent t-test was conducted to determine the difference of SUDS between intervention group and control group in three difference conditions which are before TSST, during TSST and after the intervention. On average, before TSST, participants in the intervention groups had a higher score on SUDS (M = 4.15, SD = 1.93), than those in control group (M = 3.30, SD = 1.89). This difference, 0.85, 95% CI [-0.373, 2.073], was not significant $t(38) = 1.407$, $p = 0.168$. In addition, on average, during TSST, participants in the intervention group had a higher score of SUDS (M = 6.60, SD = 2.35), than those in the control group (M = 5.80, SD = 2.48). This difference, 0.80, 95% CI [-0.747, 2.347], was not significant $t(38) = 1.047$, $p = 0.302$. Moreover, on average, after intervention, participants in the intervention group had a higher score of SUDS (M = 2.70, SD = 1.78), than those in the

control group (*M* = 2.5, *SD* = 1.88). This difference, 0.20, 95% CI [-0.971, 1.371], was not significant *t*(38) = 0.346, *p* = 0.731.

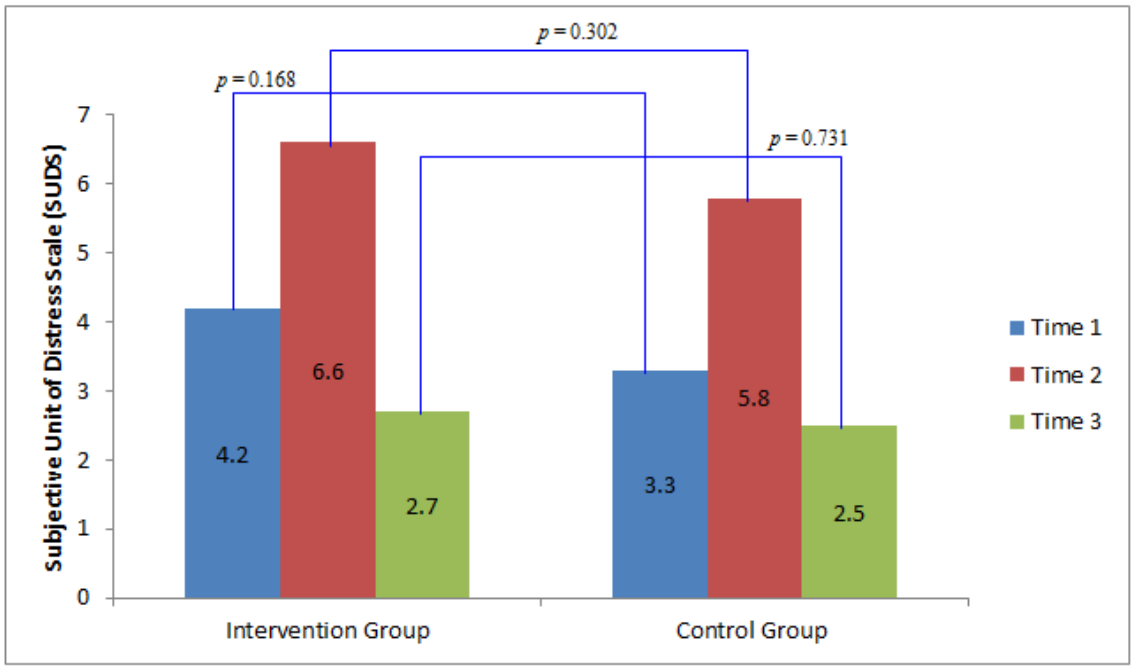

Figure 8. The mean differences between the intervention group and control group for SUDS. Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

State-Trait Anxiety Inventory (STAI)

Within intervention group. A paired-sample t-test was carried out to determine the effect of TSST and ultra-brief mindfulness intervention on S-anxiety in intervention group. On average, the participants had a higher score in S-anxiety during TSST (*M* = 58.25, *SD* = 10.64), than before TSST (*M* = 45.95, *SD* = 8.55). The difference, -12.30, 95% CI [-18.09, -6.51], was significant *t*(19) = -4.449, *p* < 0.001, and indicated a large effect size, *d* = 1.43. Furthermore, on average, the participants had a lower score of S-anxiety after the treatment (*M* = 40.45, *SD* = 6.56), when compared to that of during TSST (*M* = 58.25, *SD* = 10.64). The difference, 17.80, 95% CI [12.76, 22.84], was significant *t*(19) = 7.392, *p* < 0.001, and

indicated a large effect size, d = -1.67. Moreover, on average, participants had a lower score of S-anxiety after intervention (M = 40.45, SD = 6.56), than before TSST (M = 45.95, SD = 8.55). The difference, 5.50, 95% CI [2.40, 8.60], was significant $t(19) = 3.719$, $p = 0.001$, and indicated a medium effect size, d = -0.64.

Within control group. A paired-sample t-test was carried out to determine the effect of TSST and reflective listening on S-anxiety in control group. On average, the participants had a higher score in S-anxiety during TSST (M = 46.50, SD = 11.95), than before TSST (M = 38.50, SD = 11.79). The difference, -8.0, 95% CI [-12.82, -3.18], was significant $t(19) = -3.477$, $p = 0.003$, and indicated a medium effect size, d = 0.68. Furthermore, on average, the participants had a lower score of S-anxiety after reflective listening (M = 35.25, SD = 11.14), when compared to that of during TSST (M = 46.50, SD = 11.95). The difference, 11.25, 95% CI [6.65, 15.85], was significant $t(19) = 5.118$, $p < 0.001$, and indicated a large effect size, d = -0.94. Moreover, participants had a lower score of S-anxiety after reflective listening (M = 35.25, SD = 11.14), than before TSST (M = 38.50, SD = 11.79). The difference, 3.25, 95% CI [-1.76, 8.26], was not significant $t(19) = 1.359$, $p = 0.190$; however, it did represent a small-sized effect, d = -0.28.

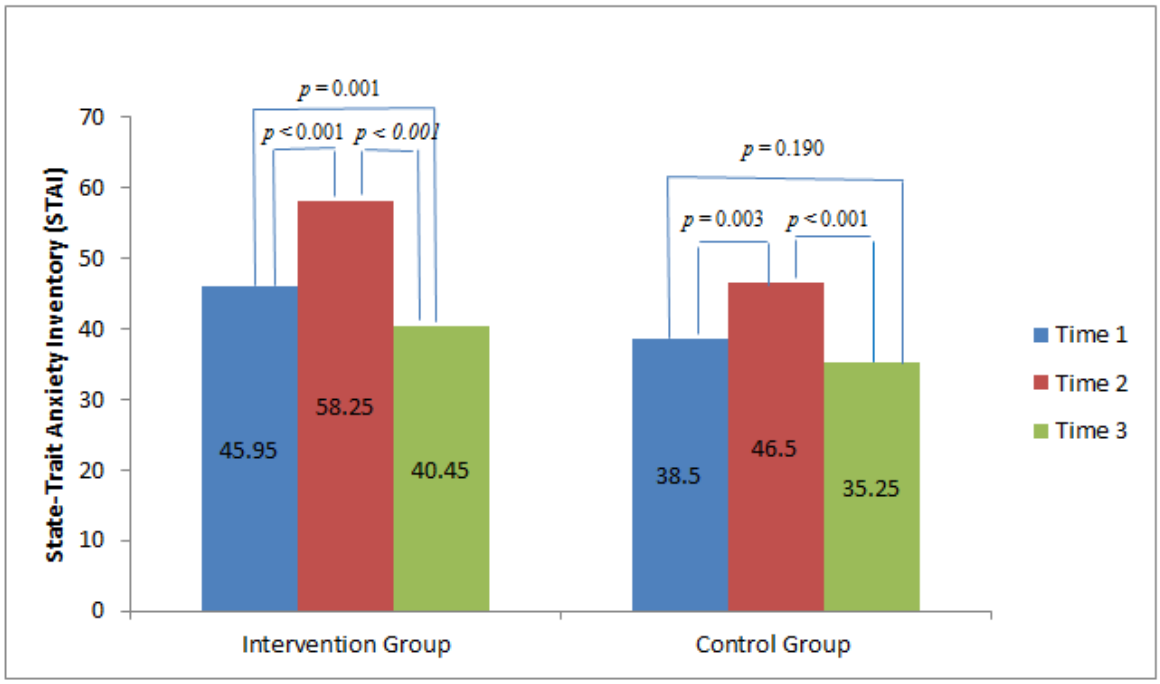

Figure 9. The mean differences within the intervention group and control group for only S-Anxiety in State-Trait Anxiety Inventory (STAI). Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

Between groups. An independent t-test was conducted to determine the difference of S-anxiety between intervention group and control group in three difference conditions which are before TSST, during TSST and after the intervention. On average, before TSST, participants in the intervention groups had a higher score on S-anxiety (M = 45.95, SD = 8.55), than those in control group (M = 38.5, SD = 11.79). This difference, 7.45, 95% CI [0.857, 14.04], was significant $t(38) = 2.288$, $p = 0.028$. In addition, on average, during TSST, participants in the intervention group had a higher score of S-anxiety (M = 58.25, SD = 10.64), than those in the control group (M = 46.50, SD = 11.95). This difference, 11.75, 95% CI [4.51, 18.99], was significant $t(38) = 3.284$, $p = 0.002$. Moreover, on average, after intervention, participants in the intervention group had a higher score of S-anxiety (M = 40.45, SD =6.56), than those in the control group (M = 35.25, SD =11.14). This difference, 5.20, 95% CI [-0.65, 11.05], was not significant $t(38) = 1.798$, $p = 0.080$; however, it did represent a small to medium effect size. $d = 0.47$.

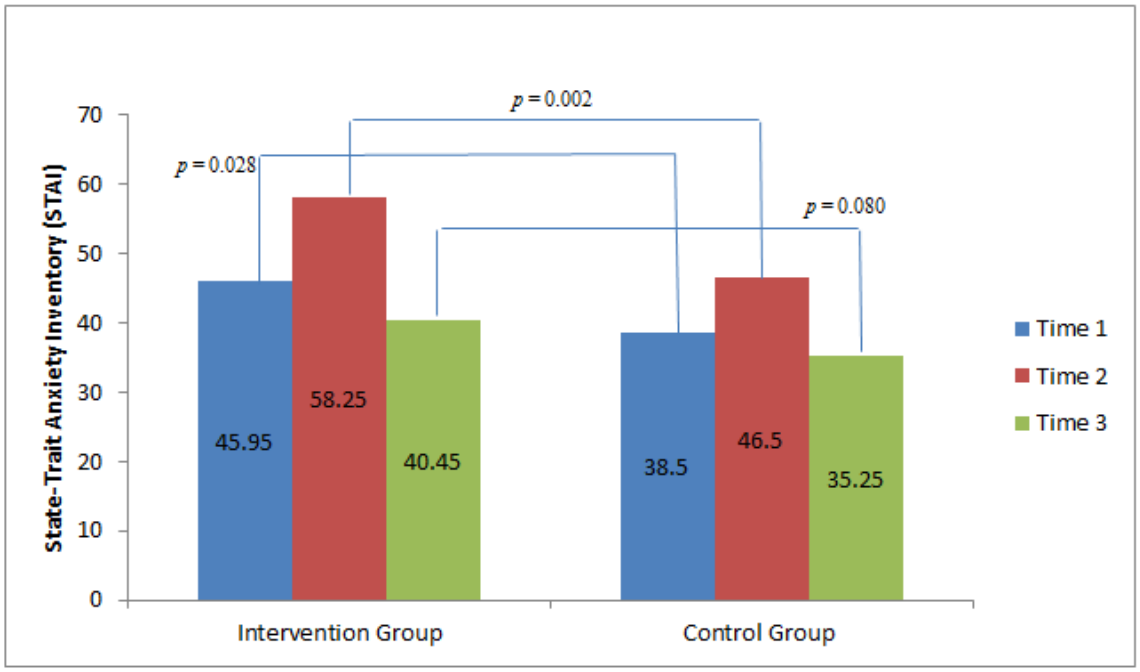

Figure 10. The mean differences between the intervention group and control group for only S-Anxiety in STAI. Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

Toronto Mindfulness Scale (TMS)

Within intervention group. A paired-sample t-test was carried out to determine the effect of ultra-brief mindfulness intervention on TMS in intervention group. On average, the participants had a higher score in TMS after intervention (M = 28.35, SD = 7.59), when compared to that of before TSST (M = 27.70, SD = 6.47). The difference, -0.65, 95% CI [-3.26, 1.97], was not significant $t(19) = -0.520$, $p = 0.609$.

A paired-sample t-test was carried out to determine the effect of ultra-brief mindfulness intervention on the curiosity factor of TMS in intervention group. On average, the participants had a lower score after intervention on curiosity (M = 13.35, SD = 4.90), when compared to that of before TSST (M = 14.15, SD = 4.39). The difference, 0.80, 95% CI [-1.11, 2.71], was not significant $t(19) = 0.876$, $p = 0.392$.

A paired-sample t-test was carried out to determine the effect of ultra-brief mindfulness intervention on the decentering factor of TMS in intervention group. On average, the participants had a higher score after intervention on decentering (M = 15.00, SD = 4.27), when compared to that of before TSST (M = 13.55, SD = 3.36). The difference, -1.45, 95% CI [-2.96, 0.06], was not significant $t(19) = -2.014$, $p = 0.058$; however, it did represent a small to medium effect size, $d = 0.43$.

Within control group. A paired-sample t-test was carried out to determine the effect reflective listening on TMS in control group. On average, the participants had a higher score

in TMS after reflective listening (*M* = 32.15, *SD* = 7.63), when compared to that of before TSST (*M* = 29.30, *SD* = 8.20). The difference, -2.85, 95% CI [-4.96, -0.74], was significant *t*(19) = -2.833, *p* = 0.011, and indicated a small to medium effect size, *d* = 0.35.

A paired-sample t-test was carried out to determine the effect of reflective listening on the curiosity factor of TMS in control group. On average, the participants had a higher score after reflective listening on curiosity (*M* = 16.15, *SD* = 4.88), when compared to that of before TSST (*M* = 15.00, *SD* = 5.08). The difference, -1.15, 95% CI [-2.06, -0.24], was significant *t*(19) = -2.632, *p* = 0.016, and indicated a small effect size, *d* = 0.23.

A paired-sample t-test was carried out to determine the effect of reflective listening on the decentering factor of TMS in control group. On average, the participants had a higher score after reflective listening on decentering (*M* = 16.00, *SD* = 3.18), when compared to that of before TSST (*M* = 14.80, *SD* = 4.02). The difference, -1.20, 95% CI [-2.49, -0.09], was not significant *t*(19) = -1.941, *p* = 0.067; however, it did represent a small to medium effect size, *d* = 0.30.

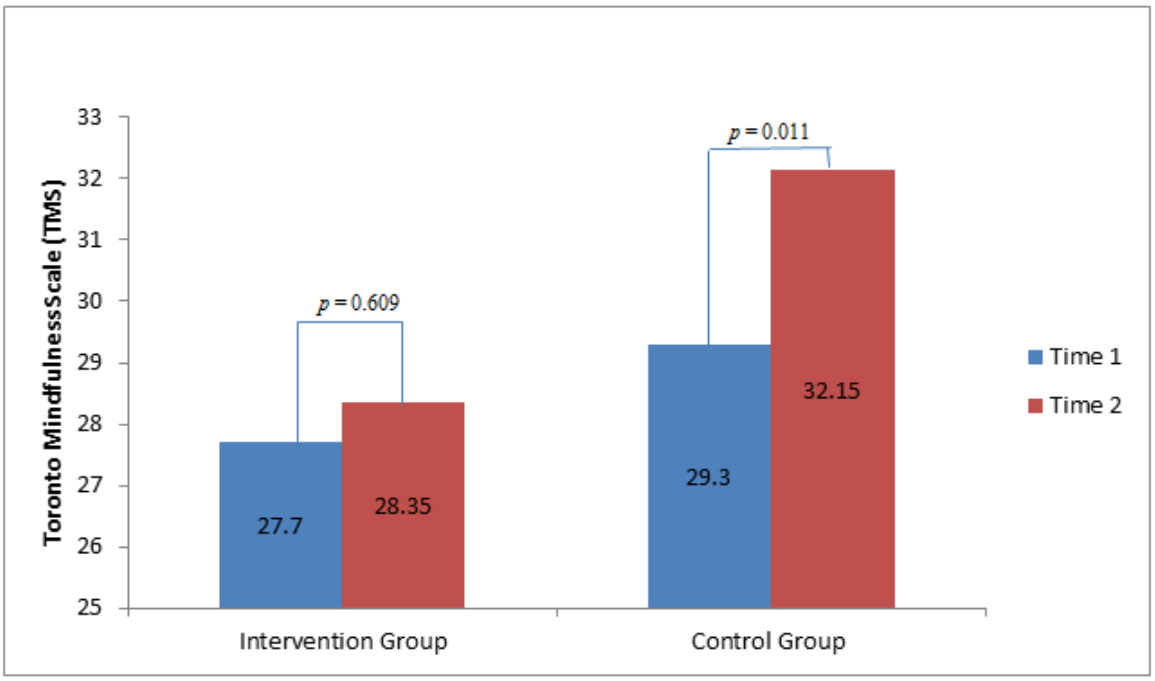

Figure 11. The mean differences within the intervention group and control group for Toronto Mindfulness Scale (TMS). Time 1 = before Trier Social Stress Test (TSST). Time 2 = after mindfulness intervention for intervention group and after reflective listening for control group.

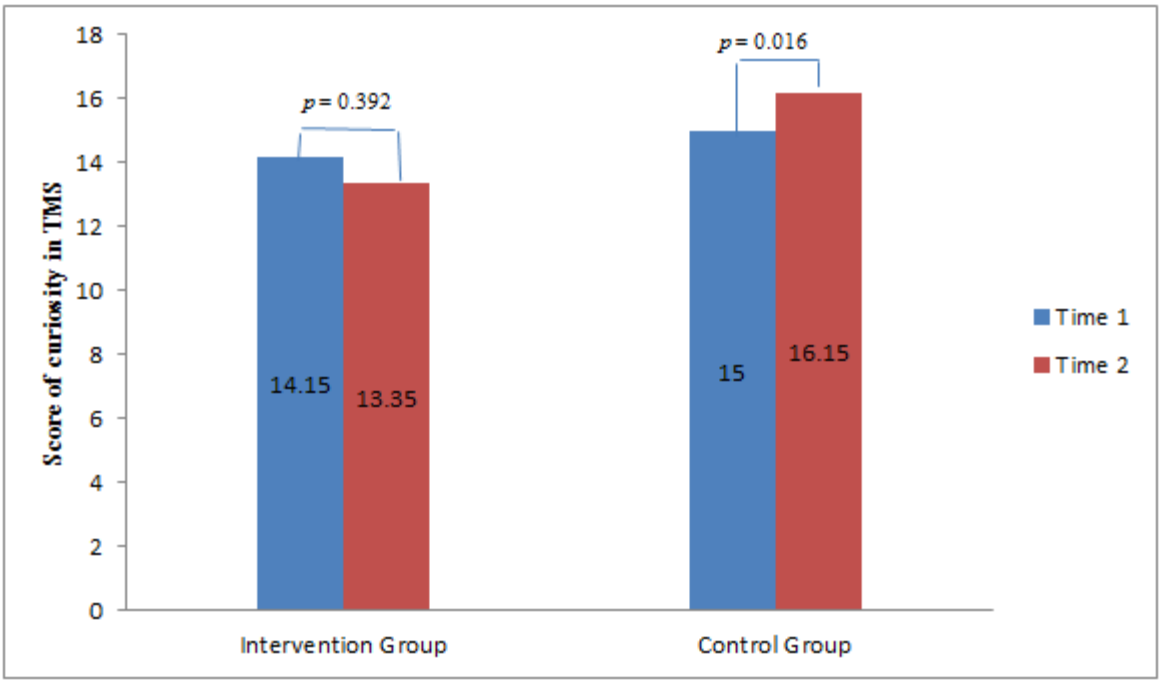

Figure 12. The mean differences within the intervention group and control group for curiosity factor of Toronto Mindfulness Scale (TMS). Time 1 = before Trier Social Stress Test (TSST). Time 2 = after mindfulness intervention for intervention group and after reflective listening for control group.

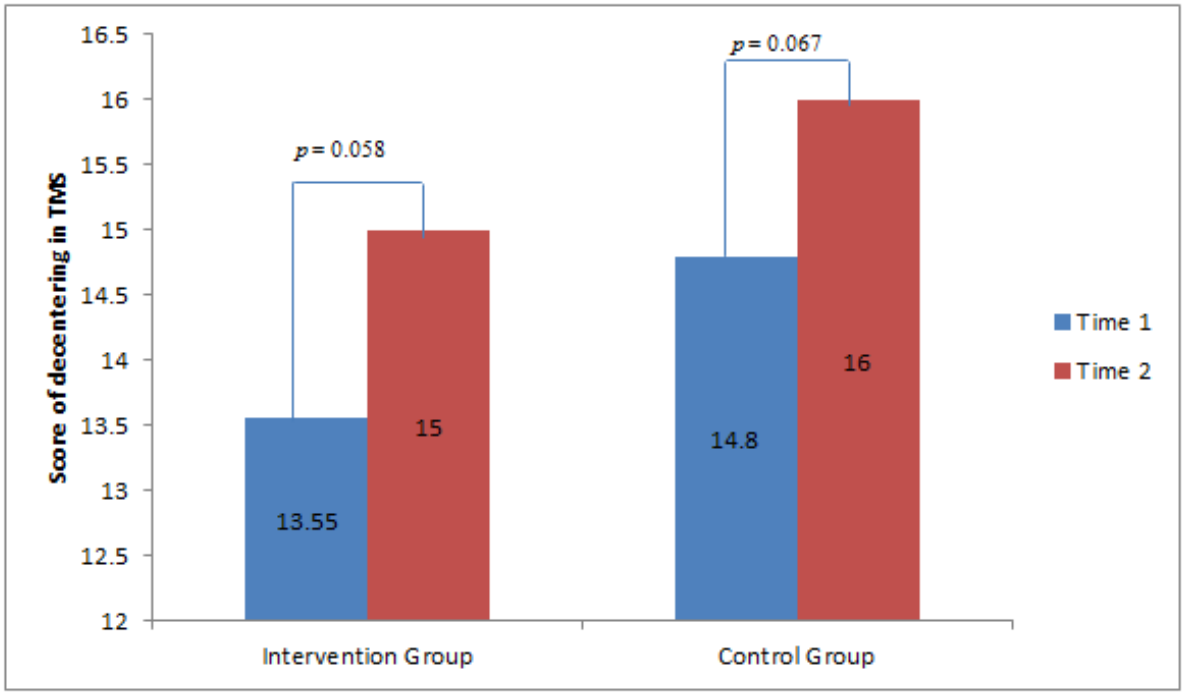

Figure 13. The mean differences within the intervention group and control group for decentering factor of Toronto Mindfulness Scale (TMS). Time 1 = before Trier Social Stress Test (TSST). Time 2 = after mindfulness intervention for intervention group and after reflective listening for control group.

Between groups. An independent t-test was conducted to determine the difference of TMS between intervention group and control group in two difference conditions which are before TSST and after the intervention. On average, before TSST, participants in the intervention groups had a lower score on TMS (M = 27.70, SD = 6.47), than those in control group (M = 29.30, SD = 8.20). This difference, -1.60, 95% CI [-6.33, 3.13], was not significant $t(38) = -0.685$, $p = 0.497$. Moreover, on average, after intervention, participants in the intervention group had a lower score of TMS (M = 28.35, SD = 7.59), than those in the control group (M = 32.15, SD = 7.63). This difference, -3.80, 95% CI [-8.67, 1.07], was not significant $t(38) = -1.579$, $p = 0.123$; however, it did represent a medium–sized effect, d = 0.50.

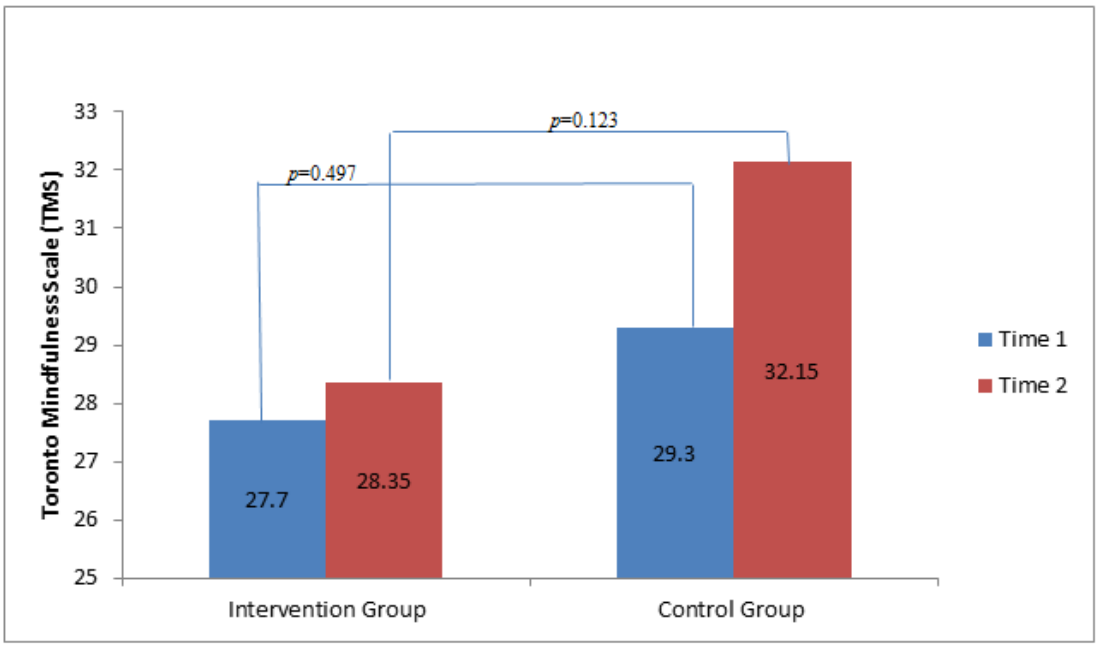

Figure 14. The mean differences between the intervention group and control group for TMS. Time 1 = before Trier Social Stress Test (TSST). Time 2 = after mindfulness intervention for intervention group and after reflective listening for control group.

An independent t-test was conducted to determine the difference of curiosity factor of TMS between intervention group and control group in two difference conditions which are before TSST and after the intervention. On average, before TSST, participants in the intervention groups had a lower score on curiosity factor (M = 14.15, SD = 4.39), than those in control group (M = 15.00, SD = 5.08). This difference, 0.85, 95% CI [-2.19, 3.89], was not significant $t(38) = 0.566$, $p = 0.575$. Moreover, on average, after intervention, participants in the intervention group had a lower score of curiosity factor (M = 13.35, SD = 4.90), than those in the control group (M = 16.15, SD = 4.88). This difference, 2.80, 95% CI [-0.33, 5.93], was not significant $t(38) = 1.810$, $p = 0.078$; however, it did represent a medium effect size, d = -0.57.

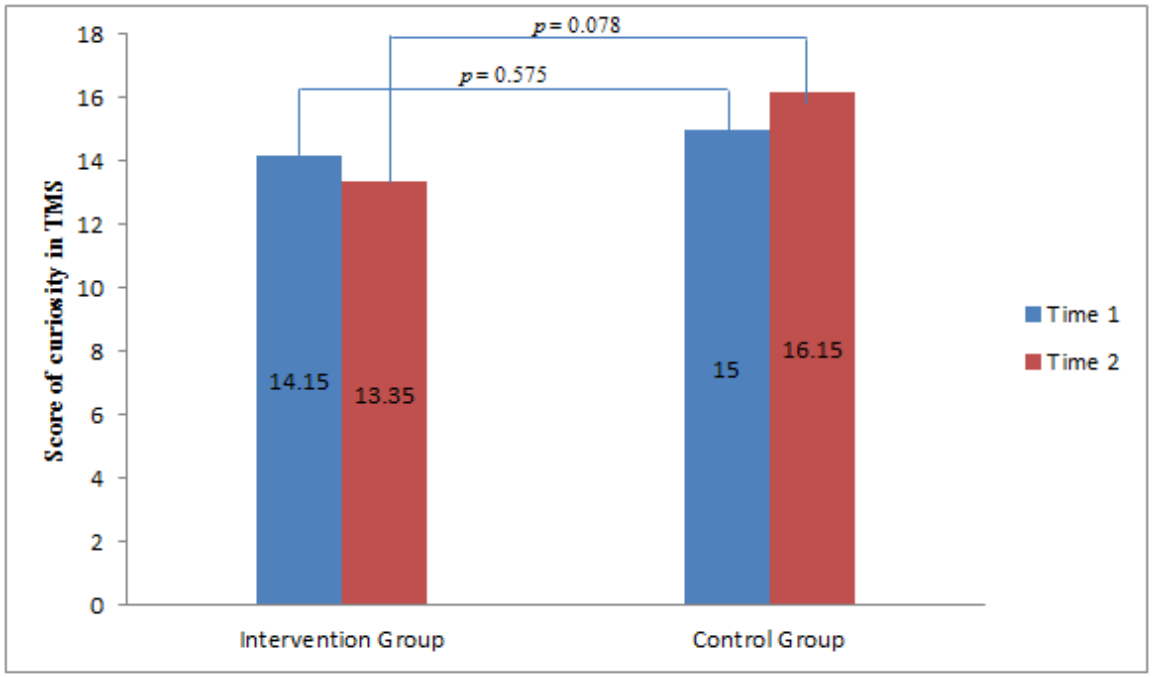

Figure 15. The mean differences between the intervention group and control group for curiosity factor of TMS. Time 1 = before Trier Social Stress Test (TSST). Time 2 = after mindfulness intervention for intervention group and after reflective listening for control group.

An independent t-test was conducted to determine the difference of decentering factor of TMS between intervention group and control group in two difference conditions which are before TSST and after the intervention. On average, before TSST, participants in the intervention groups had a lower score on decentering factor (M = 13.55, SD = 3.36), than those in control group (M = 14.80, SD = 4.02). This difference, 1.25, 95% CI [-1.12, 3.62], was not significant $t(38) = 1.066$, $p = 0.293$; however, it did represent a small to medium effect size, d = -0.31 Moreover, on average, after intervention, participants in the intervention group had a lower score of curiosity factor (M = 15.00, SD = 4.27), than those in the control group (M = 16.00, SD = 3.18). This difference, 1.00, 95% CI [-1.41, 3.41], was not significant $t(38) = 0.840$, $p = 0.406$; however, it did represent a small to medium effect size, d = -0.31.

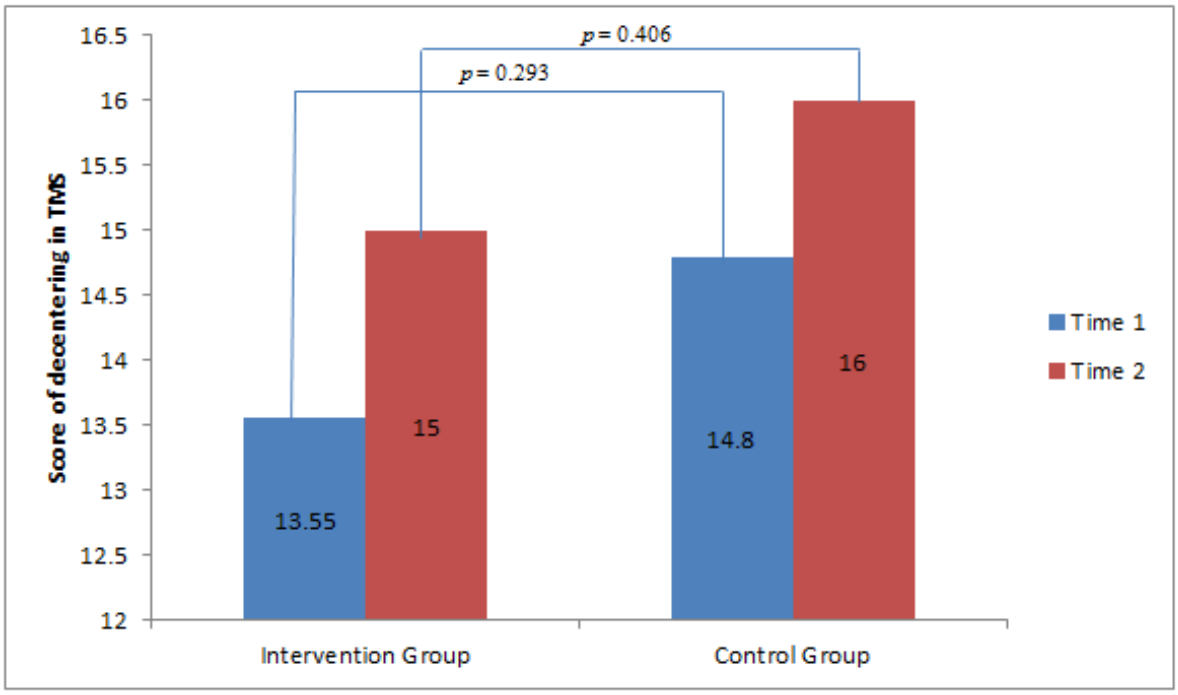

Figure 16. The mean differences between the intervention group and control group for decentering factor of TMS. Time 1 = before Trier Social Stress Test (TSST). Time 2 = after mindfulness intervention for intervention group and after reflective listening for control group.

Heart Rate

Within intervention group. A paired-samples t-test was conducted to determine the effect of the TSST and ultra-brief mindfulness intervention on heart rate in intervention group. On average, the participants had a higher heart rate during TSST (M = 92.73, SD = 14.12), than before TSST (M = 83.59, SD = 11.82). This difference, -9.146, 95% CI [-12.35, -5.94], was significant $t(19) = -5.969$, $p < 0.001$, and indicated a medium to large effect size, d = 0.77. In addition, on average, the participants had a lower heart rate after the intervention (M = 80.71, SD = 10.77), than during TSST (M = 92.73, SD = 14.12). This difference, 12.03, 95% CI [8.17, 15.89], was significant $t(19) = 6.517$, $p < 0.001$, and indicated a large–sized effect, d = -0.85. Moreover, on average, the participants had a lower heart rate after the intervention

(*M* = 80.71, *SD* = 10.77), than before TSST (*M* = 83.59, *SD* = 11.82). This difference, 2.88, 95% CI [0.75, 5.02], was significant *t*(19) = 2.827, *p* = 0.011, and indicated a small–sized effect, *d* = -0.24.

Within control group. A paired-samples t-test was conducted to determine the effect of the TSST and reflective listening on heart rate in control group. On average, the participants had a higher heart rate during TSST (*M* = 94.06, *SD* = 10.62), than before TSST (*M* = 82.57, *SD* = 10.52). This difference, -11.49, 95% CI [-15.28, -7.70], was significant *t*(19) = -6.346, *p* < 0.001, and indicated a large–sized effect, *d* = 1.09. In addition, on average, the participants had a lower heart rate after the reflective listening (*M* = 81.01, *SD* = 8.57), than during TSST (*M* = 94.06, *SD* = 10.62). This difference, 13.05, 95% CI [9.85, 16.26], was significant *t*(19) = 8.526, *p* < 0.001, and indicated a large–sized effect, *d* = -1.23. Moreover, on average, the participants had a lower heart rate after reflective listening (*M* = 81.01, *SD* = 8.57), than before TSST (*M* = 82.57, *SD* = 10.52). This difference, 1.558, 95% CI [-0.850, 3.966], was not significant *t*(19) = 1.354, *p* = 0.191.

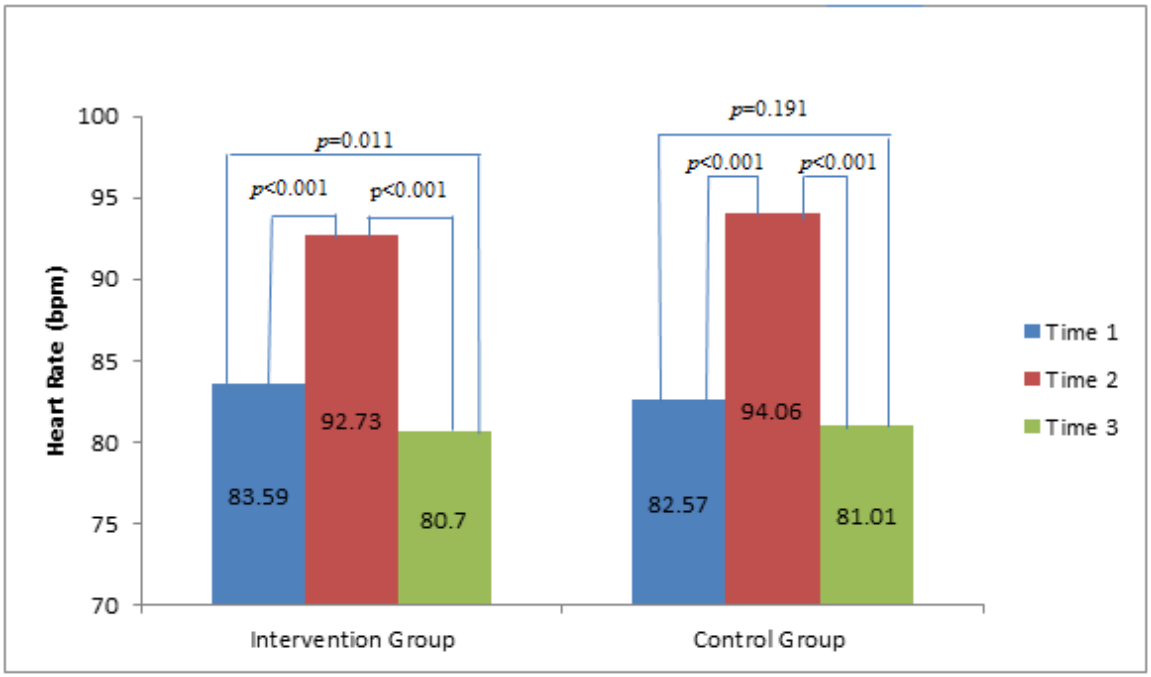

Figure 17. The mean differences within the intervention group and control group for heart rate. Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

Between groups. An independent t-test was conducted to determine the difference of heart rate between intervention group and control group in three difference conditions which are before TSST, during TSST and after the intervention. On average, before TSST, participants in the intervention groups had a higher heart rate (M = 83.59, SD = 11.82), than those in control group (M = 82.57, SD = 10.52). This difference, 1.02, 95% CI [-6.14, 8.18], was not significant $t(38) = 0.289$, $p = 0.774$. In addition, on average, during TSST, participants in the intervention group had a lower heart rate (M = 92.73, SD = 14.12), than those in the control group (M = 94.06, SD = 10.62). This difference, -1.33, 95% CI [-9.32, 6.67], was not significant $t(38) = -0.336$, $p = 0.739$. Moreover, on average, after intervention, participants in the intervention group had a lower heart rate (M = 80.70, SD = 10.77), than those in the control group (M = 81.01, SD = 8.57). This difference, -0.303, 95% CI [-6.53, 5.93], was not significant $t(38) = -0.098$, $p = 0.922$.

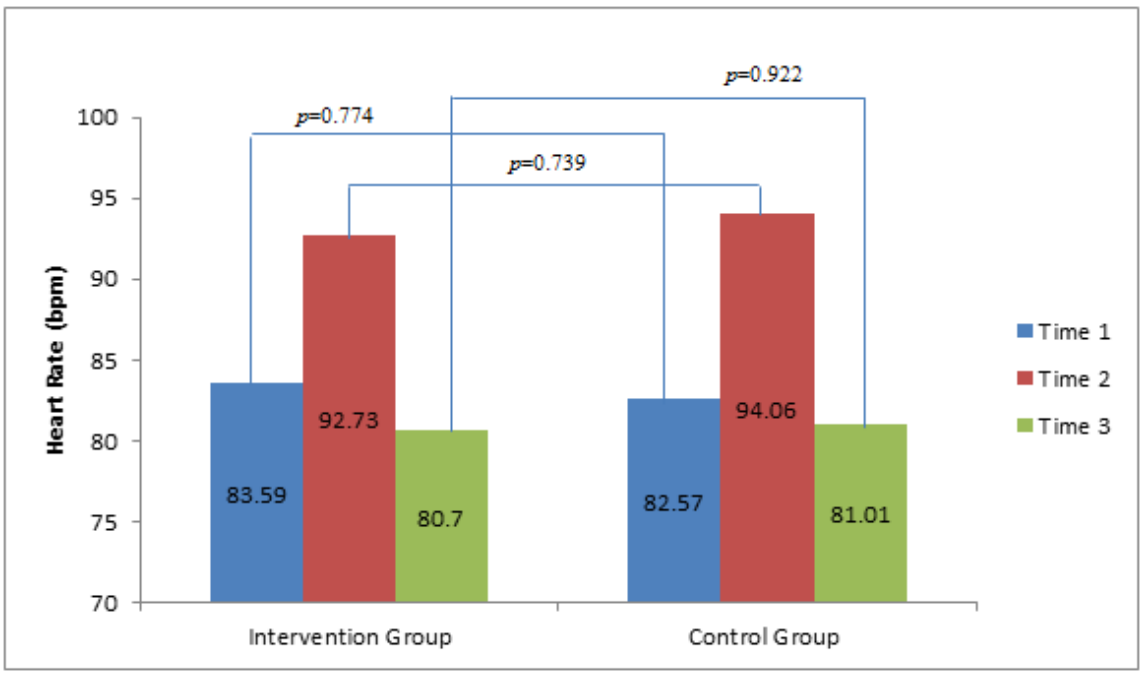

Figure 18. The mean differences between the intervention group and control group for heart rate. Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

R-R Intervals

Within intervention group. A paired-samples t-test was carried out to determine the effect of TSST and ultra-brief mindfulness intervention on heart rate variability, R-R interval in intervention group. On average, the participants had a lower R-R interval during TSST (M = 669.76, SD = 109.92), than before TSST (M = 735.85, SD = 107.81). This difference, 66.09, 95% CI [40.59, 91.59], was significant $t(19) = 5.425$, $p < 0.001$, and indicated a medium-sized effect, d = -0.61. In addition, on average, the participants had a higher R-R interval after the intervention (M = 759.85, SD = 101.73), than during TSST (M = 669.76, SD = 109.92). This difference, -90.09, 95% CI [-119.41, -60.77], was significant $t(19) = -6.431$, $p < 0.001$, and indicated a large–sized effect, d = 0.82. Moreover, on average, the participants had a higher R-R interval after the intervention (M = 759.85, SD = 101.73), than before TSST (M = 735.85, SD = 107.81). This difference, -24.00, 95% CI [-43.52, -4.48], was significant $t(19) = -2.573$, $p = 0.019$, and indicated a small–sized effect, d = 0.22.

Within control group. A paired-samples t-test was conducted to determine the effect of the TSST and reflective listening on heart rate variability, R-R interval in control group. On average, the participants had a lower R-R interval during TSST (M = 652.55, SD = 79.18), than before TSST (M = 737.53, SD = 106.58). This difference, 84.98, 95% CI [54.52, 115.45], was significant $t(19) = 5.839$, $p < 0.001$, and indicated a large effect size, d = -0.80. In addition, on average, the participants had a higher R-R interval after the reflective listening (M = 747.02, SD = 94.37), than during TSST (M = 652.55, SD = 79.18). This difference, -

94.47, 95% CI [-120.51, -68.43], was significant $t(19) = -7.593$, $p < 0.001$, and indicated a large effect size, $d = 1.19$. Moreover, on average, the participants had a higher R-R interval after reflective listening ($M = 747.02$, $SD = 94.37$), than before TSST ($M = 737.53$, $SD = 106.58$). This difference, -9.49, 95% CI [-32.75, 13.77], was not significant $t(19) = -0.854$, $p = 0.404$.

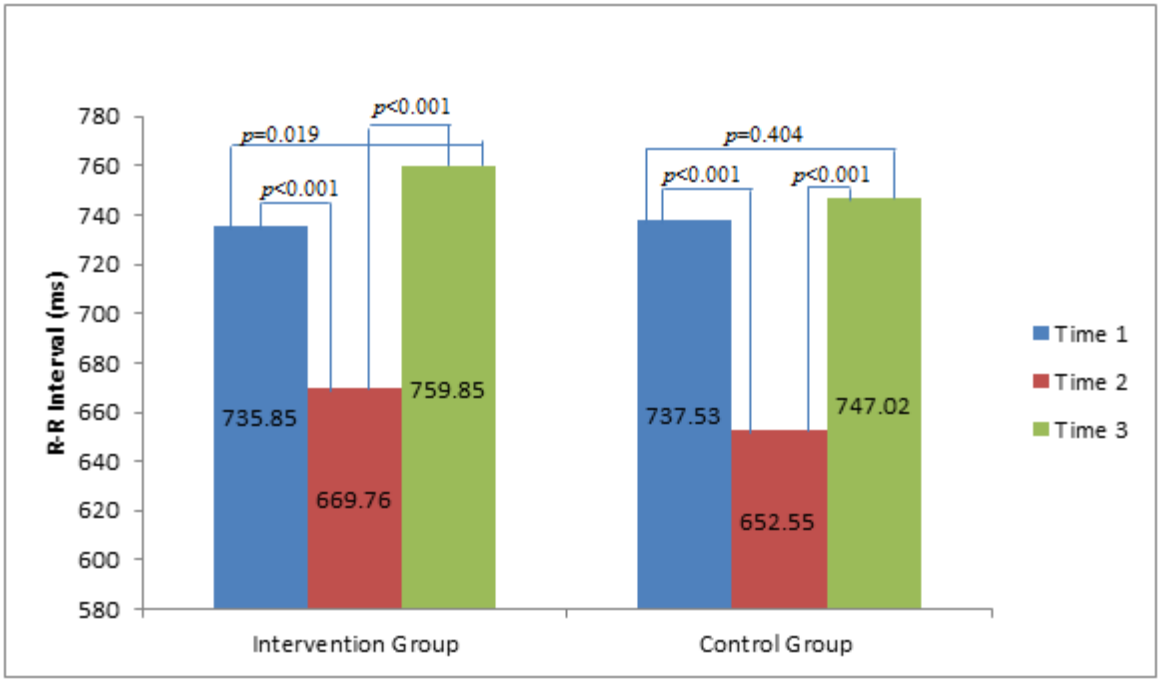

Figure 19. The mean differences within the intervention group and control group for R-R interval. Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

Between groups. An independent t-test was conducted to determine the difference of R-R interval between intervention group and control group in three difference conditions which are before TSST, during TSST and after the intervention. On average, before TSST, participants in the intervention groups had a lower R-R interval ($M = 735.85$, $SD = 107.81$), than those in control group ($M = 737.53$, $SD = 106.58$). This difference, -1.68, 95% CI [-70.31, 66.94], was not significant $t(38) = -0.050$, $p = 0.961$. In addition, on average, during

TSST, participants in the intervention group had a higher R-R interval (*M* = 669.76, *SD* = 109.92), than those in the control group (*M* = 652.55, *SD* = 79.18). This difference, 17.21, 95% CI [-44.11, 78.54], was not significant *t*(38) = 0.568, *p* = 0.573. Moreover, on average, after intervention, participants in the intervention group had a higher R-R interval (*M* = 759.85, *SD* = 101.73), than those in the control group (*M* = 747.02, *SD* = 94.37). This difference, -12.83, 95% CI [-49.99, 75.64], was not significant *t*(38) = 0.413, *p* = 0.682.

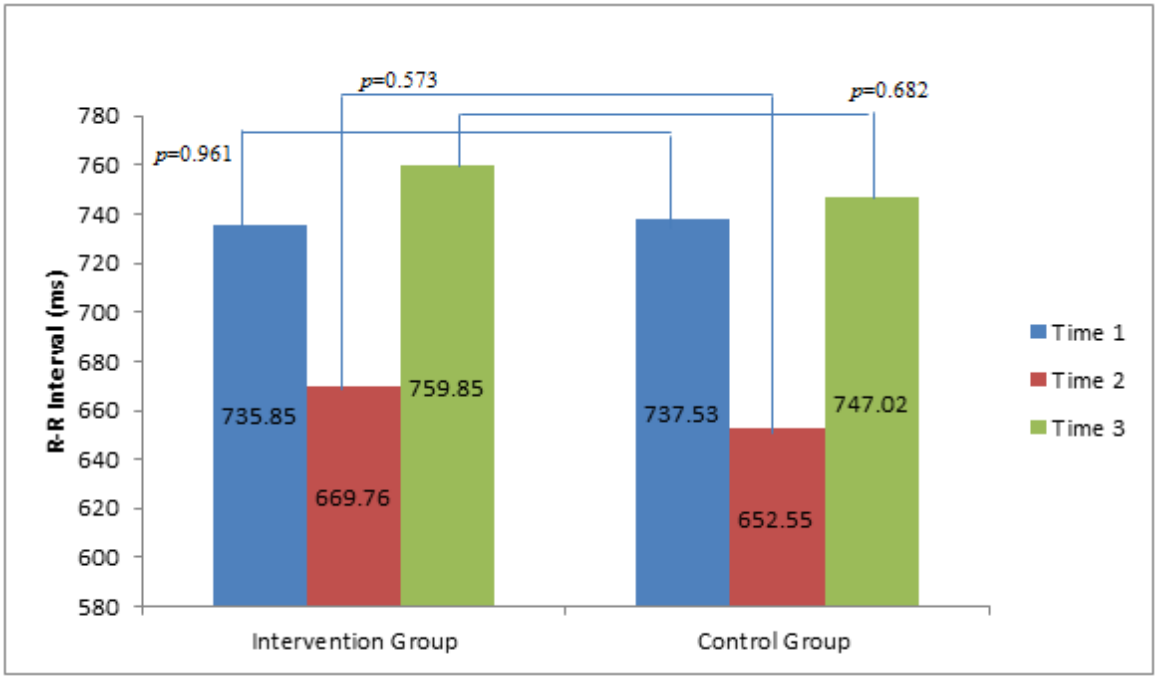

Figure 20. The mean differences between the intervention group and control group for R-R interval. Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

Standard Deviation of N-N intervals (SDNN)

Within intervention group. A paired-samples t-test was conducted to determine the effect of the TSST and ultra-brief mindfulness intervention on SDNN in intervention group. On average, the participants had a higher SDNN during TSST (*M* = 64.85, *SD* = 21.31), than before TSST (*M* = 48.24, *SD* = 20.40). This difference, -16.61, 95% CI [-25.02, -8.20], was significant *t*(19) = -4.132, *p* = 0.001, and indicated a large effect size, *d* = 0.81. In addition,

on average, the participants had a lower heart rate after the intervention (M = 48.71, SD = 18.30), than during TSST (M = 64.85, SD = 21.31). This difference, 16.14, 95% CI [10.12, 22.16], was significant $t(19) = 5.607$, $p < 0.001$, and indicated a medium to large effect size, d = -0.76. Moreover, on average, the participants had no difference in SDNN after the intervention (M = 48.71, SD = 18.30), and before TSST (M = 48.24, SD = 20.40). This difference, -0.469, 95% CI [-6.24, 5.31], was not significant $t(19) = -0.170$, $p = 0.867$.

Within control group. A paired-samples t-test was conducted to determine the effect of the TSST and reflective listening on SDNN in control group. On average, the participants had a higher SDNN during TSST (M = 67.06, SD = 19.34), than before TSST (M = 51.54, SD = 20.31). This difference, -15.52, 95% CI [-25.39, -5.65], was significant $t(19) = -3.291$, p = 0.004, and indicated a medium to large effect size, d = 0.76. In addition, on average, the participants had a lower SDNN after the reflective listening (M = 49.27, SD = 23.81), than during TSST (M = 67.06, SD = 19.34). This difference, 17.79, 95% CI [5.65, 29.93], was significant $t(19) = 3.067$, $p = 0.006$, and indicated a large–sized effect, d = -0.92. Moreover, on average, the participants had lower SDNN after reflective listening (M = 49.27, SD = 23.81), than before TSST (M = 51.54, SD = 20.31). This difference, 2.27, 95% CI [-1.77, 6.31], was not significant $t(19) = 1.177$, $p = 0.254$.

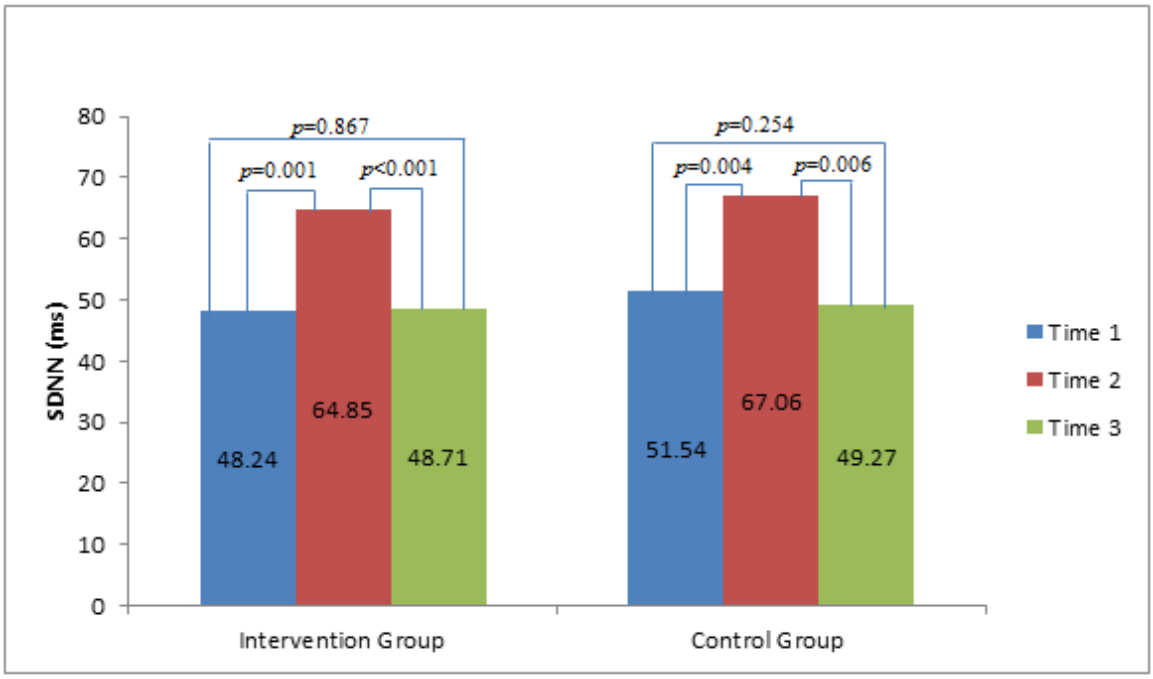

Figure 21. The mean differences within the intervention group and control group for SDNN. Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

Between groups. An independent t-test was conducted to determine the difference of SDNN between intervention group and control group in three difference conditions which are before TSST, during TSST and after the intervention. On average, before TSST, participants in the intervention groups had a lower SDNN (M = 48.24, SD = 20.40), than those in control group (M = 51.54, SD = 20.31). This difference, -3.29, 95% CI [-16.32, 9.74], was not significant $t(38) = -0.511$, $p = 0.612$. In addition, on average, during TSST, participants in the intervention group had a lower SDNN (M = 64.85, SD = 21.31), than those in the control group (M = 67.06, SD = 19.34). This difference, -2.20, 95% CI [-15.23, 10.82], was not significant $t(38) = -0.342$, $p = 0.734$. Moreover, on average, after intervention, participants in the intervention group had a lower SDNN (M = 48.71, SD = 18.30), than those in the control

group (*M* = 49.27, *SD* = 23.81). This difference, -0.55, 95% CI [-14.14, 13.04], was not significant *t*(38) = -0.082, *p* = 0.935.

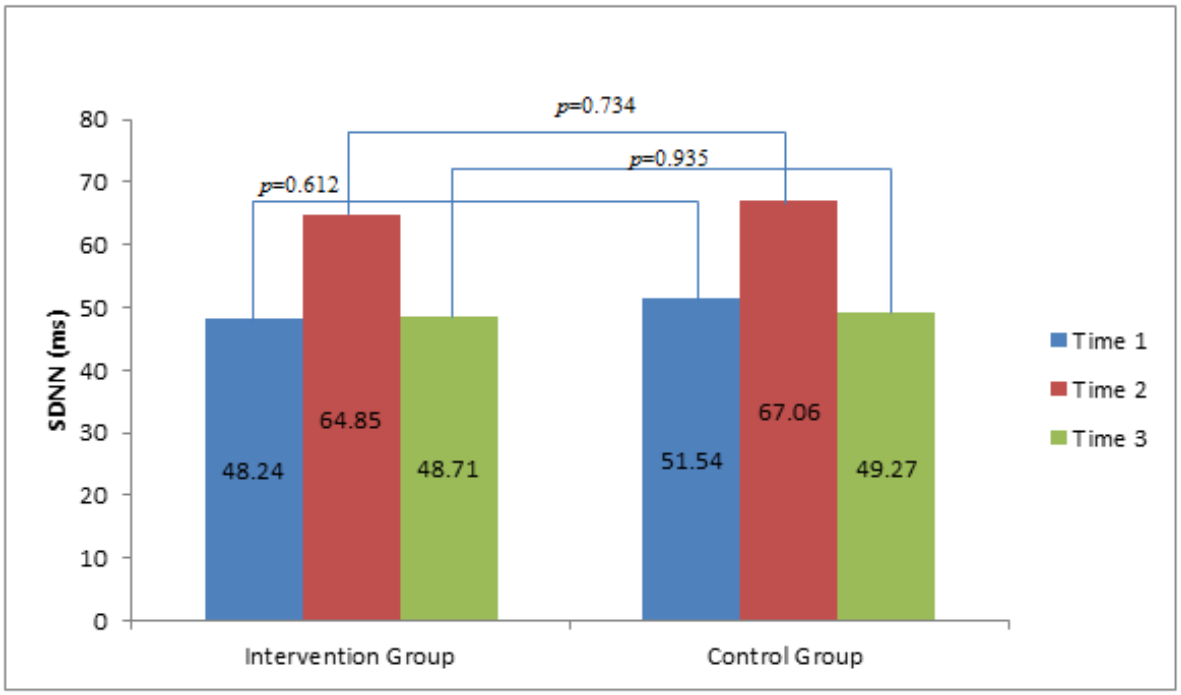

Figure 22. The mean differences between the intervention group and control group for SDNN. Time 1 = before Trier Social Stress Test (TSST). Time 2 = during TSST. Time 3 = after mindfulness intervention for intervention group and after reflective listening for control group.

5.0 Discussion

In this study, we investigated whether ultra-brief mindfulness intervention, which was mindful STOP could decrease acute distress and immediately buffer the physiological responses, which were the heart rate and heart rate variability after a standardized social stress test, which was Trier Social Stress Test. Young adults were randomly assigned to either an ultra-brief mindfulness intervention or a reflective listening group. The objective level and subjective level of distress were being assessed before the social stress test, during the social stress test, and after the intervention.

Through the analysis in our study, it was found that Trier Social Stress Test proved to be successful, as demonstrated by significant rises of distress in both groups subjectively and objectively. It was found that state anxiety (Rimmele et al., 2007), heart rate (Hellhammer & Schubert, 2012; Kirschbaum et al., 1993), and SDNN (Bernadi et al., 2000; Deepak et al., 2014) increased significantly in other studies too. Moreover, the significant decrease in mean R-R intervals in our study was also in line with the studies done by Bernadi et al. (2000) and Tharion et al. (2009). This can be explained as one of the core dimensions of acute stress is anxiety (Warr, 1990). Moreover, the participants viewed the social stress test as threatening and less controllable, thus activating the sympathetic nervous system (Rimmele et al., 2007). Activation of sympathetic nervous system further provoked adrenal gland to release catecholamines (Terathongkum, 2006), causing an increase of heart rate and a decrease in heart rate variability.

Furthermore, the results in our study also revealed that there was no significant difference in state mindfulness before and after the ultra-brief mindfulness intervention. This can be explained as the Toronto Mindfulness Scale examined on the factors of curiosity and decentering, which both of the factors required participants to have some internal thought

(Lau et al., 2006). However, ultra-brief mindfulness intervention that had been employed in this study was mindful STOP in which it is made up of four components. The component "O" that represents observe the present moment (Phang et al., 2014) was only occupied about one minute in our taped recording. Thus, Mindful STOP may not long enough to give arise to mindfulness. Moreover, in contrast to the study done by Cruess et al. (2015), participants in the brief enhanced-mindfulness intervention group were guided through experiential exercises in which the participants were taught to observe and label their thoughts as well as visualized negative thoughts as waves. Besides, in the development and validation test of TMS, 15 minutes of mindfulness meditation was used in which the participants were required to maintain attention on the breath as well as observed the thoughts, affections, and sensations in order to raise the mindfulness state (Lau et al., 2006). Therefore, it is possible that the 5 minutes Mindful STOP may not be long enough to induce state mindfulness.

However, state mindfulness significantly increased after reflective listening compared to before reflective listening in control group. Moreover, the curiosity factor in TMS increased significantly in control group after reflective listening. According to the person-centered approach, reflective listening is a form of empathetic technique in which counselor understands the client's feelings and able to bring out the exact meanings of speech during the active listening (Corey, 2012). The paraphrasing of spoken words from participants and feedbacks from experimenter hold a sense of security in participants as reflections from experimenter helped participants to undergo self-exploration and thus increased self-awareness on own feelings and thoughts, and also the surroundings (Katz & McNulty, 1994). This also helped in increasing curiosity scale as it increased the desire to gain more knowledge about one's experience. Therefore, state mindfulness tended to increase significantly after reflective listening in our study as reflective listening assisted the participants to aware of their internal thoughts.

Moreover, the significant increased in state mindfulness in control group rather than in intervention group can also be explained by Hawthorne effect. Hawthorne effect is being referred to the change in behaviour that takes place when individuals aware that they are being investigated, either increased in the performance or decreased in the performance (Henslin, 2008). The Hawthorne effect might be possible as we used tape recording for the ultra-brief mindfulness intervention and face-to-face reflective listening for the control group. Although the other randomised controlled study had found that DVD-delivered mindfulness-based intervention was effective in increasing mindfulness (Phang, Firdaus, Normala, Keng, & Sherina, 2015), these results did not appear in our study. It may be due to the active control group that we employed in our study. It can be explained as the participants in the active control group tended to pay more attention due to the presence of the experimenter during reflective listening compared to the participants in the intervention group in which they were left alone in the room. Thus, they may pay less attention to the tape recording of ultra-brief mindfulness intervention as the reason of fatigue due to the long run of the social stress test. Therefore, state mindfulness tended to increase significantly in control group rather than intervention group.

Furthermore, within group results also showed positive outcomes. Within the intervention group, it was found that ultra-brief mindfulness intervention reduced distress subjectively and objectively. Other studies also found that mindfulness based interventions helped in reducing state anxiety and distress (Khoury et al., 2013; Tan et al., 2015), heart rate (Jones, 2013; Zeidan et al., 2010) as well as increasing heart rate variability (Krygier et al., 2013; Shearer et al., 2015). Since there was no difference in state mindfulness before and after the intervention in our study, it is unlikely that the reduction of distress level in participants was due to mindfulness. The effect of reduction in distress level objectively and subjectively may be caused mainly by the breathing relaxation technique in Mindful STOP.

It is found that slow breathing was able to regulate the autonomic nervous system by activating the parasympathetic nervous system and reducing sympathetic activity (Pal & Velkumary, 2004). It will then further decrease heart rate and reduce stress responses (Brown, Gerbarg, & Muench, 2013; Busch et al. 2012). Moreover, study also found that deep and slow breathing practice increased heart rate variability (Tharion, Samuel, Rajalakshmi, Gnanasenthil, & Subramanian, 2012).

In addition, within the control group, participants showed a decrease in the level of distress subjectively and objectively after reflective listening. In our research, full concentration of the experimenter on what the participants had commented and appropriate reflective responses to the feelings and thoughts of participants were crucial. Semi-structured interview was being conducted. Supportive short statements or minimal encouragers such as "Hmm..," and "OK," were used by experimenter in reflective listening to encourage the participants to speak further (McNaughton, Hamlin, McCarthy, Head-Reeves, & Schreiner, 2007). Moreover, restating of words in reflective listening helped to verify the feelings and thoughts of participants (Bauer, Figl, & Motschnig-Pitrik, 2010). Studies revealed that reflective listening helped in increasing own emotional awareness and in enhancing emotional recognizing (Bodie, Vickery, Cannava, & Jones, 2015; Weger, Bell, Minei, & Robinson, 2014). Besides, reflective listening also made the participants felt being heard and understood (Myers, 2000; Weger et al., 2014). These elements contributed to the feeling of being empathic and being mentally supported, making the participants felt equally relaxed and showed a reduction in distress level subjectively and objectively after reflective listening. Moreover, studies also showed that listening attitude and skill had an influence on psychological stress reactions in which active listening tended to reduce the psychological stress in the participants (Mineyama, Tsutsumi, Takao, Nishiuchi, & Kawakami, 2007).

However, through our analysis, it was found that there was no significant difference in subjective level and objective level of distress between intervention group and control group at the post-test. Thus, there are two possible interpretations of our results. First, both ultra-brief mindfulness intervention and reflective listening were not effective in reducing distress either subjectively or objectively. The reduction of distress in both the groups was mainly due to the nature negative feedback mechanism of the body as the acute distress that threatened the participants had over. The other interpretation of our results was both ultra-brief mindfulness intervention and reflective listening were effective in reducing distress either subjectively or objectively.

Nevertheless, we adhered to the second interpretation of our results that both ultra-brief mindfulness intervention and reflective listening were effective in reducing distress subjectively and objectively. This is because prior studies had successfully showed that mindfulness based interventions helped in reducing distress subjectively and objectively (Jones, 2013; Khoury et al., 2013; Krygier et al., 2013; Shearer et al., 2015; Tan et al., 2015; Zeidan et al., 2010) as well as breathing relaxation practice also helped in reducing distress (Brown et al., 2013; Busch et al. 2012; Tharion et al., 2012). Besides, prior study also showed that active listening inclined to reduce the psychological (Mineyama et al., 2007).

Results in this study were contradicted with the study done by Cruess et al. (2015) in which Cruess et al. (2015) revealed that the enhanced-mindfulness intervention group demonstrated a lower score in subjective distress compared to the control group. Moreover, our results also contradicted with study done by Jones (2013) in which Jones (2013) showed that brief mindfulness intervention was able to reduce heart rate compared to the control group. This contradiction can be explained as the mindfulness interventions that employed in those studies were longer which were 15 to 20 minutes compared to our study with only 5-minute mindfulness intervention. Thus, it can be said that the 5 minutes mindfulness

intervention may not be effective enough to reduce stress. The autonomous nervous system (ANS) is divided into two, which are sympathetic nervous system (SNS) and parasympathetic nervous system (PNS). SNS is characterized for the "fight or flight" response when a person faces an acute stress, while PNS is characterised by "rest and digest" that aids in producing an equilibrium state in the body (Olsson, 2010). However, SNS acts faster than PNS as SNS transmits the impulse along very short and fast neurons compared to PNS (McCorry, 2007). In other words, PNS takes a longer time compared to SNS to transmit the impulse to decrease the heart rate. Thus, 5-minute mindfulness intervention may not able to perceive the effect of PNS obviously compared to the 15 to 20 minutes enhanced-mindfulness intervention.

Moreover, the results in our study also showed a contrast result with the study done by Tan et al. (2015) in which Tan et al. (2015) revealed that 5-minute mindful breathing had reduced distress in the intervention group compared to the control group. It is more likely to say that 5-minute mindful breathing is more effective in chronic distress as the sample used by Tan et al. (2015) was palliative patients and caregivers, rather than acute distress in our study. Acute stress arises from particular incidents or circumstances, including novelty, unpredictability, or a threat to the ego, leaving an individual with a poor sense of control (Powers, 2015). However, chronic stress is a reaction to emotional tension for a prolonged time over which a person sees he or she has no control (Đordevic, 2014). Chronic stress can arise in reaction to daily stressors that are ignored or badly managed, and exposure of traumatic incidents (Đordevic, 2014). Thus, acute stress only causes short-lived alterations within the body, while chronic stress may prolong the fight or flight responses in the body (Đordevic, 2014). Therefore, the effectiveness of the 5-minute mindful breathing in chronic distress (Tan et al., 2015) can be explained as the mindfulness intervention caused the participants to aware about their daily stressors that they had ignored.

In addition, the internal factors that served as influential elements in our research were being considered too. As shown in our result, even though intervention group had decreases in distress level after ultra-brief mindfulness intervention, control group that employed the technique of reflective listening showed similar effectiveness and there was no significant difference in outcomes between the groups. Internal factors such as the participants' inner problems, the readiness to accept interventions as well as the length of the mindfulness intervention should take into consideration. The internal factors might affect the effectiveness of ultra-brief mindfulness intervention in our study. For example, participants' inner problems such as their affects in which how the participants perceive the experiment internally, especially their emotions might contribute to the unprecised outcome of objective data and subjective ratings.

Furthermore, the external factors such as the temperature of the room might also affect the outcomes of the research leading to non-significant difference between the groups as the experimental laboratory areas are using the centralized air-conditioner that the temperature is uncontrollable by the experimenters. The temperature will affect the reading of the heart rate by either increasing the heart rate (Franco, Szliwowski, Dramaix, & Kahn, 2000) or decreasing the heart rate (Chung, Cooper, Graff, & Cooper, 2012). Besides, study also showed that longer exposure at lower temperature such as 20.0 °C was viewed as the least comfortable, causing cooling sensations because of lower skin temperatures (Tham & Willem, 2010). This cooling sensation will trigger the brain and stimulate the nervous system, leading to the stimulation of sympathetic nervous system which rises mental alertness and further increased the performance in task (Tham & Willem, 2010). Moreover, according to Huizenga, Zhang, Arens, and Wang (2004), decrease of skin temperature owing to the cooling sensation influence was associated with higher body temperature due to skin blood flow control. The slight increase in body temperature of 0.15 °C could enhance self-

perceived alertness and decrease lapses in attention (Wright, Hull, & Czeisler, 2002). Thus, the uncontrolled temperature that changed in between the experiments may actually activate the sympathetic nervous system, further increase the heart rate, enhance alertness as well as performance, in which this situation will affect the outcomes of our results in both groups.

Implications

Since there was no significant difference between intervention group and control group in subjective level and objective level of distress, it can be said that reflective listening is as effective as Mindful STOP. Reflective listening with attentive and non-judgemental listening is an important component in the action plan of mental health first aid (Kitchener & Jorm, 2002) as well as in psychological first aid (World Health Organization, War Trauma Foundation, & World Vision International, 2013). Listen attentively and non-judgementally will let the listener feels that he or she is being understood as well as make the listener feel free to talk about their problems (Kitchener & Jorm, 2002).

The findings of our study which demonstrated that reflective listening helped in reducing acute distress may able to further strengthen the advantanges of using reflective listening in the mental health first aid. It may bring the implication that listening reflectively and non-judgementally not only enable the listerners feel free to talk about their problems but also enable them to reduce their distress at the particular moment. Thus, ultra-brief mindfulness intervention, such as Mindful STOP may be used as the mass intervention during the crisis and it can be administered by any crisis workers to the survivors with minimal training. Reflective listening may be provided to the survivors after the mass intervention if the survivors still feel distress.

In addition, as state-anxiety is one of the signs of burnout among individuals, ultra-brief mindfulness intervention may be employed as a burnout prevention for crisis workers.

This is supported when Mackenzie et al. (2006) found that a brief 4-week MBSR helped in reducing the burnout symptoms of nursing professions. This ultra-brief mindfulness intervention may be act as the self-help technique for the crisis workers during the crisis as they can practice it anytime and anywhere during the time of crisis to minimize or prevent the burnout symptoms.

Limitations

There were some limitations in our research study. First of all, the repeated running of paired sample t-test will increase the probability of Type I error. Type I error happens when we think that there is a true influence in our population, when actually there is not (Field, 2013). The probability of Type I error is 0.05 (or 5%) if using the conventional criterion (Field, 2013). However, the repeated running of paired sample t-test may increase the probability of Type I error. Thus, the probability of Type I error may be larger than 5% in this study. In other words, the results obtained in this study may be more than 5% when there is no effect in the population.

Moreover, the uncontrollable of the room temperature may influence the outcome of our research. Temperature may exert impact on the heart rate readings and performance of the participants during the research. Study had revealed that lower environmental or ambient temperature which was the cold weather caused organisms to have a reduction in heart rate activity, thus lowered the reactivity of functioning and responsiveness (Chung et al., 2012). In addition, Franco et al. (2000) reported that the increase in environmental temperature caused an acceleration in the individual's heart rate reading and also a decrease in heart rate interval. In our progress of the experiment, the room temperature was inconsistent with sometime the air-conditioner was turned on, sometimes it was turning off. The freezing temperature or increasing in the temperature in the room had caused the participants to

perform inconsistently during the experiment as commented by the participants after the research. The inconsistency of room temperature had caused instability in participant's heart rate reading and their reactivity. This might also affect their ability to pay attention throughout the experiment.

Besides, mental alertness of participants before the experiment might also affect our study. Mental alertness is the mental state that favoured in executing or carrying out tasks that demand attention, awareness, endurance, and stamina (Tham & Willem, 2010), while alertness is being defined as the vigilance, attentional control, and selective attention (Van Dongen & Dinges, 2000). It was found that some of the participants may have a low mental alertness while participating in our study as the participation was right after their classes. The attending of classes may make the participants felt fatigue and decrease in energy level in which fatigue is being referred to the participants' loss or decrease in desire or ability to continue performing in tasks (Van Dongen & Dinges, 2000). Study also showed that the span of attention decreased as mental fatigue increased, leading to the poor performance of the task (Boksem, Meijman, & Lorist, 2005). Moreover, our research that required approximately one hour of participation also believed to influence the participants' alertness, further causing them to have the inability to concentrate and think precisely. Therefore, it is believed that the non-attending attitudes of participants played an important role in the non-significant results in our study as precise thinking was not present when intervention was given and during the survey periods.

In addition, our study did not include a passive control group in which no treatment is given to the group. The passive control group will be able to let us have a clear cut outcomes about the effectiveness of Mindful STOP compared to the active control group. Therefore, the effectiveness of Mindful STOP is not well determined in our study.

Recommendations for Future Research

There are some recommendations for the future research. First of all, it is suggested that the future study should analysis the data collected by using mixed Anova test rather than repeated running of the paired sample t-test. This will decrease the probability of Type I error, thus increase the accuracy of the results obtained.

Moreover, it is suggested that the future study might able to extend the length of the component "O" in Mindful STOP. This is because it might help in increasing the state-mindfulness of the participants in the study. It is recommended that the length of the component "O" in Mindful STOP to be extended to around 10 to 15 minutes as comparable to the studies done by Cruess et al. (2015) and Jones (2013).

As studies had shown that room temperature did stimulate the sympathetic nervous system, thus further increase the heart rate and performance (Tham & Willem, 2010; Wright et al., 2002), the room temperature of the setting is needed to be concerned in the future study. It is suggested that future study should manipulate the room temperature at a consistent temperature in order to yield a more accurate and consistent results in the experiment.

In addition, it is recommended to adjust the participants to appropriate and the most desired time slots. It is suggested the slots that the participants agreed to join are free from classes before or after the experiment or any unfinished business. The tiredness and fatigue feelings after lectures and tutorials as well as the nervous feelings not to be late for class after the experiment played an important role in keeping the participants to stay alert and focus during the research. Hence, obstacle-free condition will help to increase and maintain participant's mental alertness. Moreover, it is suggested that to let the participants to rate their mental alertness subjectively on a thermometer rating scale, ranging from 0 (least

mental alertness) to 10 (most mental alertness) in the future study. This will help the researchers to ensure the mental alertness of the participants.

Furthermore, a passive control group that does nothing is being suggested to be included in the future study. This is because it will allow the researchers to have a clear cut results about the effectiveness of ultra-brief mindfulness intervention. However, it is required to consider the ethical issue in this study as it is not ethical to let the participants remain in the condition of distress even though the risk of harm is not greater than in ordinary life. Therefore, a waitlist control group can take in as a consideration as well.

Conclusion

As a conclusion, Trier Social Stress Test proved to be successful in increasing distress level in participants. There was no significant difference between intervention group and control group at subjective level and objective level of distress during the social stress test. Moreover, the study showed that there was no significant difference in the distress level subjectively and objectively after ultra-brief mindfulness intervention or reflective listening. Thus, it can be concluded that reflective listening is as effective as mindfulness intervention which is Mindful STOP. Therefore, it is suggested that the future study in exploring the effectiveness of ultra-brief mindfulness intervention by extending the component that represents the observation of the present moment.

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Appendix A

Form of Informed Consent

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF ARTS AND SOCIAL SCIENCE

Purpose of the study:

We are the undergraduate students of **Bachelor of Social Science (Hons) Psychology** at **UTAR**. We are taking the course **UAPZ 3023 Final Year Project II**. As the project requirement, we are working on a research project whereby we need to collect data on the effect of interview structure on interview performance and how ultra-brief mindfulness intervention helps to improve the performance during interview. The project is guided by Mr Pheh Kai Shuen (phehks@utar.edu.my). We are therefore asking if you would agree to participate in our research.

What will be done:

In this research, you will be asked to go through an interview session. Moreover, an ultra-brief mindfulness intervention will be taught as well. In addition, you are required to complete a questionnaire, comprising of four sections. Those questions include details about your demographic, your feelings and experiences towards anxiety and mindfulness. The overall time needed for the research is about 1 hour.

Confidentiality:

You do not have to participate at all or even if you agree now, you can terminate your participation at any time when you feel uncomfortable. You also do not have to answer individual questions you don't want to answer. Your name will not be attached to the questionnaire and we will ensure that your participation remains confidential. (This consent form will be kept separately from the questionnaire.)

Risks or discomforts:

The risks or discomfort that you experience is not greater than what you might experience in your daily lives.

Benefits of the study:

You may learn and experience a greater knowledge of ultra-brief mindfulness intervention.

How the findings will be used:

The results of the study will only be used for our project purposes only. The results of the study will be presented in education settings during the presentation of our project.

_____ _____

(Participant Signature) (Date)

---------- Tear here ----------

Contact information:

If you have any questions or concerns, please feel free to contact our group member :

Lim Kwey Hwa joanne0818@1utar.my

Loke Ke Jun kejun.loke.@1utar.my

Pheh Kai Shuen phehks@utar.edu.my

Appendix B

Participants' Personal Demographic

Age: _____

Gender: _____

Year of study: _____

Faculty / Course: _____

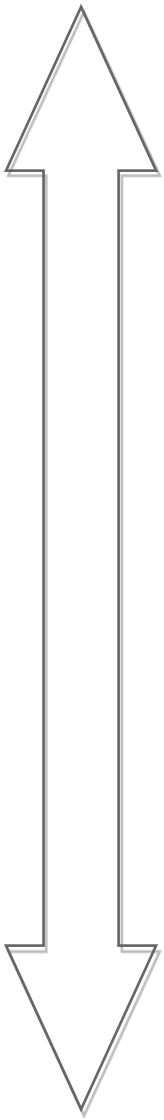
Have you ever had the following medical conditions?

- Psychological / mental disorder(s) □ Yes □ No
  If yes, please specify_____
- Neurological disorder(s) □ Yes □ No
  If yes, please specify_____
- Cardiological disorder(s) □ Yes □ No
  If yes, please specify_____

Appendix C

Subject Unit of Distress Scale (SUDS)

Imagine you have a ‘distress thermometer’ to measure your feelings according to the following scale. Rate your distress, fear, anxiety or discomfort on a scale of 0-10, in which 0 indicates most relaxed and 10 indicates the worst.



10 - Highest distress/fear/anxiety/discomfort that you have ever felt

9 - Extremely anxious/distressed

8 - Very anxious/distressed, can’t concentrate

7 - Quite anxious/distressed, interfering with performance

6 -

5 - Moderate anxiety/distress, uncomfortable but can continue to perform

4 -

3 - Mild anxiety/distress, no interference with performance

2 - Minimal anxiety/distress

1 - Alert and awake, concentrating well

0 - Totally relaxed

Appendix D

State-Trait Anxiety Inventory (STAI)

Instructions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate value to the right of the statement to indicate how you *feel right now*, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

Statements	**Not at all**	**Somewhat**	**Moderately so**	**Very much so**
1. I feel calm.	1	2	3	4
2. I feel secure.	1	2	3	4
3. I am tense.	1	2	3	4
4. I feel strained.	1	2	3	4
5. I feel at ease.	1	2	3	4
6. I feel upset.	1	2	3	4
7. I am presently worrying over possible misfortunes.	1	2	3	4
8. I feel satisfied.	1	2	3	4
9. I feel frightened.	1	2	3	4
10. I feel comfortable.	1	2	3	4
11. I feel self-confident.	1	2	3	4
12. I feel nervous.	1	2	3	4
13. I am jittery.	1	2	3	4

14. I feel indecisive.	1	2	3	4
15. I am relaxed.	1	2	3	4
16. I feel content.	1	2	3	4
17. I am worried.	1	2	3	4
18. I feel confused.	1	2	3	4
19. I feel steady.	1	2	3	4
20. I feel pleasant.	1	2	3	4

Instructions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate value to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

Statements	**Almost never**	**Sometimes**	**Often**	**Almost always**
21. I feel pleasant.	1	2	3	4
22. I feel nervous and restless.	1	2	3	4
23. I feel satisfied with myself.	1	2	3	4
24. I wish I could be as happy as others seem to be.	1	2	3	4
25. I feel like a failure.	1	2	3	4
26. I feel rested.	1	2	3	4

27. I am “calm, cool, and collected”.	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them.	1	2	3	4
29. I worry too much over something that really doesn’t matter.	1	2	3	4
30. I am happy.	1	2	3	4
31. I have disturbing thoughts.	1	2	3	4
32. I lack self-confidence.	1	2	3	4
33. I feel secure.	1	2	3	4
34. I make decisions easily.	1	2	3	4
35. I feel inadequate.	1	2	3	4
36. I am content.	1	2	3	4
37. some unimportant thought runs through my mind and bothers me.	1	2	3	4
38. I take disappointments so keenly that I can’t put them out of my mind.	1	2	3	4
39. I am a steady person.	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests.	1	2	3	4

Appendix E

Toronto Mindfulness Scale (TMS)

Instructions: We are interested in what you just experienced. Below is a list of things that people sometimes experience. Please read each statement. Next to each statement are five choices: "not at all," "a little," "moderately," "quite a bit," and "very much." Please indicate the extent to which you agree with each statement. In other words, how well does the statement describe what you just experienced, just now?

Questions	**Not at all**	**A little**	**Moderately**	**Quite a bit**	**Very much**
1. I experienced myself as separate from my changing thoughts and feelings.	0	1	2	3	4
2. I was more concerned with being open to my experiences than controlling or changing them.	0	1	2	3	4
3. I was curious about what I might learn about myself by taking notice of how I react to certain thoughts, feelings or sensations.	0	1	2	3	4
4. I experienced my thoughts more as events in my mind than as a necessarily accurate reflection of the way things 'really' are.	0	1	2	3	4
5. I was curious to see what my mind was up to from moment to moment.	0	1	2	3	4
6. I was curious about each of the thoughts and feelings that I was having.	0	1	2	3	4
7. I was receptive to observing unpleasant thoughts and feelings without interfering with them.	0	1	2	3	4
8. I was more invested in just watching my experiences as they arose, than in figuring out what they could mean.	0	1	2	3	4

9. I approached each experience by trying to accept it, no matter whether it was pleasant or unpleasant.	0	1	2	3	4
10. I remained curious about the nature of each experience as it is arose.	0	1	2	3	4
11. I was aware of my thoughts and feelings without overidentifying with them.	0	1	2	3	4
12. I was curious about my reactions to things.	0	1	2	3	4
13. I was curious about what I might learn about myself by just taking notice of what my attention gets drawn to.	0	1	2	3	4

Appendix F

Debriefing From

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF ARTS AND SOCIAL SCIENCE

Debriefing for study entitled Effectiveness on Ultra-Brief Mindfulness Intervention on Stress Reduction Subjectively and Objectively

Thank you for your participation in this research. The purposes of this study were to examine the effect of ultra-brief mindfulness intervention on stress reduction subjectively and objectively. In this research, your stress level was first measured subjectively through questionnaire and objectively by recording your heart rate and heart rate variability. This data will be act as your baseline data. You were then went through a stress induction protocol which consisted of two parts that are open speech in interview and arithmetic subtraction. Your readings of heart rate was being taken for 5 minutes during the stress induction protocol. You were then taught with an intervention for reducing your stress which is ultra-brief mindfulness breathing for 5 minutes. Your stress level was then measured again subjectively and objectively.

Your participation is not only greatly appreciated by the researchers involved, but the data collected could possibily be advantages to individuals such as students and caregivers who are not able to participate in mindfulness based intervention due to the reason of long time commitment that probably taken up to eight weeks. Moreover, this will bring a solid empirical data to the practitioners when they implemente ultra-brief mindfulness intervention on stress reduction.

The nature of the phenomenon we are looking into demanded minor deception on our part. For instance, we had to construct a credible “cover story” for why you need to participate in an interview session. Moreover, there will not have any voice frequency

analysis of nonverbal behaviour or video analysis of subject's performance. We set this is to stimulate the stress level in you.

If you have any questions about this research, please contact us:

Lim Kwey Hwa (joanne0818@1utar.my)
Loke Ke Jun (kejun.loke.@1utar.my)
Supervisor: Mr. Pheh Kai Shuen (phehks@utar.edu.my)

If you feel uncomfortable after this research and need help from counselling departments, you may have the below contacts:

Counseling and Guidance Unit in Department of Student Affairs at Block C103

- Ms Ng Kai Yean, Chloe (05-468 8888 ext. 2283 / nkyean@utar.edu.my)
- Ms Ho Sheau Huey(05-468 8888 ext. 2283 / hshuey@utar.edu.my)

Finally, we urge you not to discuss this research with anyone else who is currently participating or might participate at a future point in time. Thank you!

I have been debriefed and I understand the procedures of the research.

_____ _____

(signature of participant) (date)

Appendix G

Mindful STOP

00.03 Ding

00.11 Ding

00.19 Ding

00.28 Mindful stop and falling awake

00.35 Temporary stop whatever you have busy with and take a slow deep breath

00.54 On your next breath gently bring your awareness to the movement of the breath

01.06 Breathing in, I know I am breathing in, breathing out, I know I am breathing out

01.24 Breathing in

01.31 Breathing out

01.40 Breathing in

01.45 Breathing out

01.53 [Bird chipping sound]

02.15 On your next breath, gently expand your awareness into your entire body

02.25 Imagine breathing in and out into each and every part of the body

02.36 And with each out breath you are relaxing more and more

02.48 [Bird chipping sound]

03.22 On your next breath, further expand your awareness to the space, things and people around you

03.42 Breathing in at all means well

03.50 Breathing out at all means be happy

03.59 [Bird chipping sound]

04.34 You may now continue to fall awake and proceed with whatever you need to do with a clam and wise smile.

04.52 Ding