The Effectiveness of Singing Bowls Music and Progressive Muscle Relaxation on Mood, Sleep, and Stress

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Abstract

Mental health trends show increased symptoms of mental illness across the globe. To combat these increases, more low-cost and easily accessible interventions should be identified. The current study is a parallel cohort non-comparative study investigating the effectiveness of quartz crystal singing bowls (SB) music and progressive muscle relaxation (PMR) on mood, sleep, and stress in young adults. Over eight weeks participants received reminders to complete online sessions of either SB music or PMR. For the first four weeks participants received reminders to complete sessions three times a week. From weeks five – eight participants received a weekly reminder but could complete as many sessions as they wanted. Participants completed questionnaires assessing Mood and Sleep Quality at three timepoints (baseline, week four, and week eight). Participants completed pre and post intervention measures for Overall Feeling, Relaxation, and Stress once a week for the first four weeks. Of the 108 recruited participants, 62 (mean age SB = 20.11 years, PMR = 20.53 years) completed the interventions, questionnaires, and measures (32 in SB group, 30 in PMR group). Both the SB group and the PMR group showed improvement in Mood and Sleep Quality throughout the study. The SB group showed decreases in Total Mood Disturbance (TMD), Tension, Fatigue, and Depression, an increase in Vigour and improvement in Sleep Quality. The effects were greatest in the first four weeks for the SB group. The PMR group showed decreases in TMD, Tension, Anger, Fatigue, and Confusion, and improvement in Sleep Quality. Both the SB group and the PMR group showed acute increases in Overall Feeling and Relaxation and decreases in Stress after the interventions when compared to before the interventions. Overall, the current findings

support the hypothesis that SB music and PMR have positive effects on mood, sleep, and stress in young adults.

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Chapter One: Introduction

The current study investigates the effectiveness of listening to singing bowls music, specifically the track "Tranquility", and progressive muscle relaxation on mood, sleep, and stress in young adults. This chapter will highlight current mental health issues, specifically anxiety and depression and the current common treatment options for these mental health issues. Past research of alternative low-cost interventions will be discussed as well as the gaps in the research and the current study.

Mental Health

Globally, 970 million people were living with a mental illness in 2019 (World Health Organization, 2024). Evidence suggests that poor mental health is becoming more common amongst young adults and adolescents (Lipson et al., 2022; Sutcliffe et al., 2023). For example, a study investigating university students (80.2% were aged 18 – 25 years) mental health trends from 2013 to 2021 in multiple United States (US) campuses found a 49.7% increase in students meeting criteria for one or more mental health issue (Lipson et al., 2022). Likewise, in New Zealand (NZ) secondary school students (12 – 18 years old), mental health trends from 2012 to 2019 showed a 7% increase (from 24% to 31%) in poor mental wellbeing (Sutcliffe et al., 2023).

Anxiety and depression are the most common mental illnesses globally (World Health Organization, 2024), with 4.05% of the world's population having an anxiety disorder (Javaid et al., 2023) and 5% of the global population having a depressive disorder (World Health Organization, 2023). NZ follows this global trend, with 1 in 5 New Zealanders aged over 15 being diagnosed with a mood/anxiety disorder (Wilson &

Nicolson, 2020) and 21.2% of those aged 15 – 24 experiencing high or very high rates of psychological distress (Ministry of Health, 2023). These increases of poor mental health among young people highlight how the rise in mental illness is not an isolated concern and demonstrates the need for early interventions.

Anxiety

Anxiety has been described as a vague sense of dread towards a danger that is specific or unknown (Christman et al., 2022). It is important to not get confused with stress as they are very similar. The key difference is that stress is a response to an external trigger whereas anxiety is an extended worry that continues in the absence of a trigger (American Psychological Association, 2022, February 14). Everyone experiences varying levels of anxiety throughout their life and mild anxiety can be beneficial through activation of a stress response (Christman et al., 2022) that will help motivate the individual to complete the task. However, prolonged activation of the stress response can result in negative outcomes.

Chronic and/or severe anxiety causes several issues. What distinguishes normal anxiety from clinical symptoms is the impairment, the duration, and the symptom intensity (American Psychiatric Association, 2022). For example, Generalized Anxiety Disorder (GAD) is one of the most common anxiety disorders and is characterized by excessive anxiety and worry about numerous activities or events lasting a minimum of six months (American Psychiatric Association, 2022). The anxiety is difficult to control, and the anticipated impact of the event is exaggerated in the intensity, duration, and/or frequency (American Psychiatric Association, 2022). GAD impacts the individual psychosocially through impairment in social, occupational, and other important areas

of functioning as the worrisome thoughts interfere with attention (American Psychiatric Association, 2022). GAD is accompanied by at least three of the following: restlessness, easily fatigued, difficulty concentrating, irritability, muscle tension, and sleep disturbances (American Psychiatric Association, 2022).

Prevalence of Anxiety

Anxiety prevalence rates are increasing globally, and young people are at the forefront of these rates. 4.6% of adolescents aged 15 – 19 experience anxiety (World Health Organization, 2021) which increases to 19.5% in adults aged 18 – 29 (Terlizzi & Villarroel, 2020). In 2019, NZ had the 4th highest anxiety prevalence rate globally (Javaid et al., 2023). Those aged 15 – 24 years had the highest rates of anxiety in NZ (Wilson & Nicolson, 2020), with 24% showing mild or greater symptoms (Ministry of Health, 2017a).

The rates of anxiety are higher in females compared to males (Javaid et al., 2023), showing a 2:1 ratio in women compared to men (American Psychiatric Association, 2022). These differences have been reported to be present in adolescence and proceed throughout adulthood (Farhane-Medina et al., 2022; McLean et al., 2011; Ohannessian et al., 2017; Silva et al., 2020). In US high school students aged 14 – 18 years, anxiety rates were 56.2% in females and 31.3% in males (Parodi et al., 2022). Within NZ, 18% of males and 31.9% of females experience mild or greater anxiety in those aged 15 – 24 (Ministry of Health, 2017a). These results were supported Samaranayake et al. (2014) who found NZ females had higher rates of anxiety than males (22% and 14% respectively). These differences exist on genetic and psychosocial levels (Farhane-Medina et al., 2022). Heritability for anxiety is stronger among females than males (Ask

et al., 2014). Psychosocial explanations include male and female differences in behavioural factors (Ask et al., 2014).

Ethnic differences in prevalence of anxiety are observed in adolescents and young adults. A US study found Non-Hispanic Black young adults (16 – 25 years) reported less anxiety symptoms than Non-Hispanic White and Latino/Hispanic young adults (Thomas et al., 2024). Lower anxiety scores for underrepresented minorities (URM) and Non-Hispanic Black young adults may be due to the social support of the families and communities that buffer the effects of anxiety (Asnaani et al., 2010). In NZ, Time et al. (2024) found second- and third-year Pasifika University students had significantly lower anxiety scores than NZ European students. This was also seen in NZ Māori aged 10 – 24 years where 3% of Māori experienced anxiety compared to 3.7% of non-Māori non-Pasifika (Theodore et al., 2022). However, the findings are not consistent with Sutcliffe et al. (2024) who found that European secondary school students had the lowest anxiety symptom rates (26.12%), those of "Other" ethnicity had the highest rates (31.71%) followed by Pasifika (31.09%), Asian (29.79%), and Māori (27.75%). The differences between studies could be due to Theodore et al. (2022) being a national cross sectional study whereas Sutcliffe et al. (2024) only included those who were part of their study.

Depression

Depression is described as feelings of guilt, worthlessness, and loss of self-esteem (Thase & Lang, 2023). Everyone experiences symptoms of depression throughout their lives, but they usually do not last long and are not recurrent. What distinguishes normal depression from clinical symptoms is the intensity, duration, and

impairment from the symptoms. For example, Major Depressive Disorder (MDD) is one of the most common depressive disorders. MDD requires at least one major depressive episode lasting a minimum of two continuous weeks (American Psychiatric Association, 2022). During the depressive episode the individual has a depressed mood or loss of interest/pleasure in all or nearly all activities for most of the day almost every day (American Psychiatric Association, 2022). In addition to the depressed mood individuals must also experience at least four of the following over the same continuous two weeks: trouble concentrating; thoughts about death; changes in sleep, appetite, and activity; loss of interest in activities; attempted suicide; making a suicidal behaviour plan (American Psychiatric Association, 2022). The symptoms mentioned must be new or have markedly worsened compared to the individual pre-episode and must be impairing the individual's functioning in social, occupational, or other important areas (American Psychiatric Association, 2022). Depressive disorders share the same symptoms but differ from each other in duration, timing and presumed aetiology (American Psychiatric Association, 2022).

Prevalence of Depression

Prevalence of depression is increasing globally (Goodwin et al., 2022; Moreno-Agostino et al., 2021), with 3.8% of the global population experiencing depression (World Health Organization, 2023). Depression rates are higher in adolescents and young adults compared to other ages groups (Goodwin et al., 2022) with 2.8% of 15 – 19 year olds experiencing depression (World Health Organization, 2021). In the US, 17.2% of 18 – 25-year-olds reported depressive symptoms in 2020 followed by 16.9% of those aged 12 – 17 years (Goodwin et al., 2022). In NZ secondary school students (12 – 18 year

olds), 23% reported symptoms of depression in 2019, this increased from 13% in 2012 (Fleming et al., 2020). In NZ, 28.6% of those aged 15 – 24 experienced mild or greater depression symptoms (Ministry of Health, 2017b).

Women are more likely than men to experience depression (4% of men and 6% of women) (World Health Organization, 2023). In Hong Kong undergraduate university students aged 18 – 29 years old, 43.3% of females and 25.4% of males experienced mild or greater depression (Lun et al., 2018). In NZ, 22.7% of men and 35% of women aged 15 – 24 experience mild or greater depression (Ministry of Health, 2017b). In NZ adolescents (12 – 18-year-olds), 29% of females and 16% - 17% of males reported significant depressive symptoms in 2019 (Fleming et al., 2020; Sutcliffe et al., 2023). These differences in depression may be due to psychosocial reasons. Females are more likely to engage in rumination and co-rumination than males and put more emphasis on social acceptance by their peers (Girgus & Yang, 2015). Depression is heritable, however there is currently a lack of consensus as to whether there are gender differences in heritability (Zhao et al., 2020).

Ethnic differences in prevalences of depression are observed. In the BlackDeer et al. (2023) US study of young adults aged 18 – 21 years, the rate of depression was highest in those who identified as multiple ethnicities (36.98%), followed by Asian (33.91%), URM (30.78%), and White (30.12%). In NZ, 2.6% of Māori had a depression diagnosis compared to 3.1% of non-Māori non-Pasifika participants aged 10 – 24 years (Theodore et al., 2022). In NZ secondary schools, Māori adolescents have the highest prevalence of depressive symptoms (28%), followed by “Other” (27%), Pasifika and Asian (both 25%), and European (20%) (Sutcliffe et al., 2023). As previously mentioned,

Theodore et al. (2022) was a national cross sectional study and Sutcliffe et al. (2023) only included those who were part of the study. This could explain the differences in rates between the studies.

Aetiology of Anxiety and Depression

There are several factors that contribute to the development of depression and anxiety in young adults and adolescents. Risk factors of GAD and MDD include genetic, comorbidity, and environmental (American Psychiatric Association, 2022). Genetics contribute to the development of anxiety and depression by increasing the risk of developing the disorder. Anxiety and depression disorders are comorbid (occur together) with each other and other mental disorders (American Psychiatric Association, 2022; Essau, 2003).

Factors, such as adverse childhood experiences and parenting practices, are environmental risk factors for GAD (American Psychiatric Association, 2022). Adverse childhood experiences, low income, poor education, racism/discrimination, and stressful life events are environmental risks for MDD (American Psychiatric Association, 2022). These environmental factors can result in increased stress which contributes to the development of other issues. Stress has been shown to contribute to anxiety and depression (American Psychiatric Association, 2022). Adolescence and young adulthood are often stressful life stages (Chue et al., 2018), with stressful situations such as low socioeconomic status or household financial strain (Buli et al., 2023; Reiss, 2013; Sutcliffe et al., 2023; Yoo & Jang, 2023), school performance (Högberg, 2021), or poor peer and family relationships (Lin & Guo, 2024) negatively impacting adolescent mental health. The perceived pressure of performing well academically (Eisenberg et

al., 2007; Mahmoud et al., 2012), financial/work struggles (Gagné et al., 2021; Kim & Chatterjee, 2021), and low socioeconomic status (Generaal et al., 2019; Thomas et al., 2024) show increased stress on young adults.

Treatments

Psychological interventions such as Cognitive Behavioural Therapy (CBT) have shown to decrease the effects and symptoms of mental illness. CBT was developed by Aaron Beck and follows the theory that people's feelings are a result of how they interpret a situation rather than the situation itself (Fenn & Byrne, 2013). CBT is considered the best treatment for anxiety and depression in youth and adults (Cuijpers et al., 2013; Pegg et al., 2022), but requires regular sessions with a mental health professional. CBT focuses on identifying problematic thinking, beliefs, and behavioural patterns and helping the individual learn to change these maladaptive thought patterns (Fenn & Byrne, 2013; Pegg et al., 2022).

Medications have been developed to help minimize the symptoms of mental illness and may continue for long periods of time due to medication being used for symptom relief instead of rehabilitating mental illness (Drake et al., 2003). Medication can be a more convenient option for treating mental illness for some individuals. A combination of CBT and medication shows further improvement than one treatment alone (Cuijpers et al., 2013; Pegg et al., 2022). This could be due to medication providing reduction in symptoms and CBT changing the thinking and subsequent behaviour of the individual. Once medication is discontinued individuals will be able to use the skills learned through CBT to reduce future episodes.

These treatments have been shown to be effective in reducing symptoms of depression and anxiety. However, there are several reasons why they are not utilized by many of the population. CBT requires 5 – 20 sessions with a therapist to be effective in gaining the skills to reduce symptoms (Fenn & Byrne, 2013; Pegg et al., 2022). Individuals may not have the time or money to allow them to participate in therapy for such long periods of time. Within NZ, free or subsidized mental health counselling is available to those who have experienced sexual harm/physical injury or are low income earners (ACC, 2024; Mental Health Foundation, 2024); however, there are long wait lists and these services require individuals to have clinically significant symptoms to be eligible (ACC, 2019). Therefore, some individuals may be unable to access treatment due to cost. Medication side effects such as nausea, headaches, cardiovascular, and sexual dysfunction may result in low adherence (Chen et al., 2022). Often medication is taken for long periods of time and some of these medications are taken daily, this may cause issues at certain times in an individual's life and could result in infrequent use (Chen et al., 2022). Due to the issues of both treatments, they may not be utilized regardless of them showing promising results. Therefore, evaluation and access to low-cost interventions are necessary. Progressive muscle relaxation is an alternative method used to improve mental wellbeing to help improve subclinical symptoms.

Progressive Muscle Relaxation

Progressive Muscle Relaxation (PMR) was developed by Edmund Jacobson in the 1920s. It is based on the premise that when the body is relaxed there is less muscle tension and this will decrease anxiety and improve mental states (Kabakcıoğlu & Ayaz-Alkaya, 2024; Palkar et al., 2021; Talo & Turan, 2023). PMR is a relaxation technique

used to achieve deep mental and physical relaxation (Gopichandran et al., 2021). It focuses on tensing and relaxing individual muscles of the body (Chellew et al., 2015; Hashim et al., 2011; Talo & Turan, 2023), and learning the different feelings of tense and loose muscles to accomplish relaxation. Muscle tension is a symptom of anxiety (American Psychiatric Association, 2013) and through PMR, individuals are able to actively release muscle tension (Hashim et al., 2011; Talo & Turan, 2023) which may help to identify anxiety symptoms. PMR can be delivered both in person and online. PMR has shown improvements in stress, anxiety, mood, and sleep in adults and adolescents (Gao et al., 2018; Kabakcıoğlu & Ayaz-Alkaya, 2024; Talo & Turan, 2023).

PMR and Stress

There is a growing body of research that supports PMRs usefulness in reducing stress in diverse samples and settings. Gao et al. (2018) compared PMR, a mindfulness intervention, and a control group on mindfulness, wellbeing, stress, and mood over three months in university students. The participants were reminded daily to complete five-minute audio recordings of the interventions. Measures of mindfulness, wellbeing, stress, and mood were taken at baseline, after the three-month interventions, and one-month post-intervention. Both interventions led to significant increases in mindfulness, decreases in stress, improvement in mood, and a nonsignificant increase in wellbeing. The control group did not change. Only PMR showed further decreases in stress at one month follow up.

Palkar et al. (2021) investigated the impact of PMR on stress and test anxiety in university students for one month prior to a class test. The participants completed three in-person 45-minute sessions and then continued daily practice at home for the

remainder of the study. Palkar et al. (2021) found significant decreases in perceived stress and test anxiety after the intervention.

PMR and Sleep

PMR is reported to contribute to improvements in sleep in previous studies. Liu et al. (2020) compared a PMR intervention to a treatment as usual control group (TAU) on sleep quality and anxiety in COVID-19 patients for five days. PMR was in-person, twice a day, 30-minute sessions where a trainer was present and gave instructions through the hospital call system. Results showed significant increases in sleep quality and significant decreases in anxiety after PMR when compared to the TAU group.

Talo and Turan (2023) compared the effects of a PMR intervention to a control group on depression, sleep quality, and quality of life with epilepsy patients for four weeks. Participants completed three 30-minute sessions a week. PMR was delivered in-person once, the remaining sessions were completed at home via a WhatsApp group chat that was connected to the participants' cell phones. Results showed significant reductions in depression and increases in sleep quality and quality of life in PMR group. The changes in the control group did not reach significance.

Pickett et al. (2024) compared the effects of PMR and mindfulness breathing to a control group on stress, pre-sleep arousal, and sleep in university undergraduates for four weeks. Participants completed 15-minute sessions five times a week, online via Qualtrics. The results showed significant increases in relaxation and decreases in perceived stress, somatic pre-sleep arousal, and insomniac symptom severity in the PMR group. There were no significant changes for relaxation, mindfulness, or stress in the mindfulness or control groups. Somatic pre-sleep arousal and insomnia symptom

severity decreased in the control and mindfulness groups. Of the two interventions, PMR led to the greatest improvements.

PMR and Mood

PMR has shown to be beneficial for improving mood in several populations and settings. Gangadharan and Madani (2018) investigated the effectiveness of PMR on depression, anxiety, and stress on nursing students. The intervention was five weeks and PMR was delivered in-person only. The first 10 days of the study were daily sessions, after this, sessions were reduced to three times a week until the five weeks were completed. The intervention led to statistically significant reductions in depression, anxiety, and stress symptoms.

Kabakcıoğlu and Ayaz-Alkaya (2024) compared PMR to a self-monitored control group on depression, anxiety, and stress in 17 – 18-year-old adolescents for eight weeks. Participants completed two 30-minute sessions a week online with researchers observing attendance. Results showed depression, anxiety, and stress symptoms had statistically significant reductions in the PMR group.

Razali et al. (2017) compared the effect of PMR, autogenic relaxation, and music relaxation to a control group on mood states in university student athletes for four weeks. The interventions were two in-person 30-minute sessions a week. Results showed all the interventions had significant increases in Vigour and significant decreases in Confusion compared to the control group.

The previous PMR studies highlight the positive effects of PMR on stress, sleep, and mood. However, some of the studies did not clarify certain aspects of their interventions such as in Panchal et al. (2020) study of stress and test anxiety in

university students, did not clarify how they tracked session completion. Likewise, in Pickett et al. (2024) study of sleep in university students, did not clarify how they tracked sleep diary adherence, nor did they clarify how many sessions needed to be completed to be included in the analyses. In Razali et al. (2017) study of student athletes did not clarify what the control group did during the study. In Liu et al. (2020) study of COVID-19 patients did not clarify what treatments patients had. Additionally, Gangadharan and Madani (2018) only included female nursing students. Talo and Turan (2023) included confounding variables of river sounds with the PMR audio in their study of sleep in epilepsy patients. Similarly, Kabakcıoğlu and Ayaz-Alkaya (2024) also included confounding variables of river sounds with the PMR audio as well as not randomizing their groups in their online study with adolescents.

As shown in the preceding descriptions, the PMR interventions were delivered in a variety of ways, however this didn't appear to affect the results. The number of sessions in the studies ranged from 10 to 91. Session lengths varied from 15 minutes to 45 minutes. Interestingly, PMR was effective when delivered online, with several studies showing positive results. Some studies had both in-person and online sessions; however, this did not seem to have any extra benefit in intervention outcomes. The most successful studies appeared to be Gao et al. (2018), Gangadharan and Madani (2018), and Talo and Turan (2023) as these studies showed the most positive outcomes in most of their measures. There are several alternative interventions individuals can complete to help with stress, mood, and sleep. Previous literature suggested music listening improves stress, mood, and sleep.

Music Listening

Music is an ancient practice that has been documented throughout history, with one of the earliest evidence of musical practice dating 35,000 years ago in Southwestern Germany (Conard et al., 2009). Music has connections to every known human culture, because of this, music has become deeply rooted within our culture (Särkämö et al., 2013). Music has been shown to trigger attention and working memory to keep engaged with the music, episodic memory when listening to familiar music, the brains reward system when listening to emotionally touching music, and the sensory-motor networks of the brain when perceiving the rhythm of music (Särkämö et al., 2013). Emotionally touching music affects emotions, pleasure, reward, and regulates autonomic nervous system and endocrine system (Särkämö et al., 2013). Music listening (ML) has been shown to be beneficial in regulating stress and mood and improving sleep.

Music and Stress

Music has been found to improve perceived and physiological stress. Feneberg et al. (2023) investigated the effect of ML on perceived stress and mood changes during COVID-19. For seven days participants completed questions about ML, music characteristics, and visual analogue scales assessing momentary stress and mood. The questions were completed five times a day via an app while continuing their normal routine. The results showed ML was associated with lower momentary stress, higher mood valence, higher energetic arousal, and calmness. Those with high stress showed greater decreases, higher energetic arousal and mood valence after ML. Interestingly, if stress was low, it increased after ML.

Linnemann et al. (2015) examined the effect of ML on daily stress in university students. The intervention was administered at two timepoints, the beginning of the semester and the end of the semester. Participants completed assessments of ML behaviour, music valance, music arousal, purpose for ML, and subjective stress six times a day for five days while continuing their normal routine. Subjective stress was measured via a five point Likert scale. A subsample of participants completed physiological stress measures for two days. The results showed significant decreases in subjective stress after ML, this did not affect physiological stress levels. ML for the purpose of relaxation resulted in lower subjective stress. ML for distraction resulted in higher subjective stress. When the two timepoints were compared subjective stress was higher during exams; however, ML was higher in the beginning of the semester.

Linnemann et al. (2018) investigated duration and latency of ML and its association with stress in university students. Participants listened to music via an app that recorded ML duration for six – seven days and completed six assessments a day about stress and ML. Stress was measured via a 5-point Likert scale. The results showed that participant self-reports of ML were associated with significantly lower stress levels; however, the actual duration/frequency of ML was not association to stress levels. Significantly higher stress levels were reported when ML occurred for less than 20 minutes compared to more than 21 minutes. The authors concluded, for ML to be associated with stress reduction there is a time delay of approximately 20 minutes.

Music and Sleep

ML has been shown to improve sleep quality. Hausenblas et al. (2019) investigated the effectiveness of classical music and Wholetones 2Sleep Music on

sleep quality and daytime fatigue, stress, anxiety, and productivity in adults with insomnia symptoms. Wholetones 2Sleep Music is music that has been developed to provide sleep aid. All participants completed both conditions; the participants completed 10 days of listening to one condition audio before bed for 30-minutes, followed by a four day wash out period where no music was played, and then another 10 days in the other condition. Participants completed daily sleep diaries and wellbeing was measured at baseline and day 10 of each condition. The results showed both interventions had significant improvements in all measures, except for vigour. Both interventions were equally as effective in increasing sleep quality and improving all next day outcomes.

Majeed et al. (2021) examined the effects of happy and sad music on subjective sleep quality and next day outcomes compared to a control group in young adults. Happy music was determined to be any music played in a major key and sad music was any music played in a minor key, neither music contained lyrics or vocals. The control group was pink noise, a sound similar to steady rain or wind and rustling leaves. All participants completed all conditions. The participants listened to the audio for 30-minutes at bedtime for five nights, followed by a two day wash out period where no music was played, before completing the next condition. This was repeated until all conditions were completed. Participants completed a nightly check-in and upon completion were sent the audio link for the night. Upon waking, participants completed a morning survey rating their sleep quality and current well-being. The results showed that both happy and sad music had significant improvements in subjective sleep quality when compared to the control group. There was no difference between happy and sad music on subjective sleep quality. Next day outcomes showed decreases in stress and

negative affect and increases in positive affect and life satisfaction for both music types.

Music and Mood

ML has been shown to help in mood regulation in different age groups (Hennessy et al., 2021; Saarikallio & Erkkilä, 2007). Saarikallio and Erkkilä (2007) investigated the function of music on mood regulation in adolescents. The participants completed two group interview sessions; the sessions were one week apart. In between sessions participants completed follow up forms each time they engaged in a musical activity. The follow-up forms asked to describe the musical activity, the pleasantness and energy levels experienced, and reflect on the affective experience. The results suggested the specific needs of the individual determines the use of music in mood regulation. This includes mood, attitudes and personal experiences, as well as the situation around them. Another suggestion was that the emotional fit of the music to was key to mood regulation.

Hennessy et al. (2021) investigated the function of ML on mood and emotion regulation in adults. Participants completed questionnaires measuring depression, anxiety, emotion regulation, empathy, music-related mood-regulation strategies, ML habits currently and a year previously, and the subjective effect of the COVID-19 pandemic. The results showed that ML for the purpose of increasing positive mood predicted better mood after ML. Those who felt they were more affected by the COVID-19 pandemic and those who had higher depression and/or anxiety symptoms were more likely to turn to music to improve their wellbeing. As a result, they would have

greater increases in positive mood after ML. Soft, calm, quiet, and slow music was the most listened to genre for those who were most affected by COVID.

The previous ML studies show promise for ML to be an effective tool for stress, sleep, and mood improvement. However, Feneberg et al. (2023), in their study of ML and COVID-19, did not track when ML occurred. Likewise, Linnemann et al. (2015), in their study of ML and stress in university students, did not track when ML occurred. Both studies increased the risk for confounding variables. Additionally, Linnemann et al. (2018), in their study of duration and latency of ML, used an app to track ML; however, participants did not listen exclusively through the app. Some of the studies did not clarify certain aspects of their procedure such as Hausenblas et al. (2019), in their Wholetones2Sleep study, did not clarify how they tracked sleep diary entries. Majeed et al. (2021), in their study of happy and sad music, did not clarify what the night-time check-ins entailed, or if they completed baseline measures. Additionally, Saarikallio and Erkkilä (2007), in their study of adolescent mood regulation, had a small sample size. Hennessy et al. (2021), in their study of the function of ML on mood, was a single time point survey in countries (some of where English is not the first language) without an English comprehension assessment.

As shown in the preceding descriptions ML has beneficial outcomes in stress, mood, and sleep. The interventions were delivered in a variety of ways with different age groups. The length of the interventions ranged from five to 20 days. Due to the outcomes of ML showing promise, another potential intervention for improving stress, sleep, and mood could be the use of singing bowls.

Quartz Crystal Singing Bowls

Singing Bowls (SB) is a traditional practice that has been performed for centuries in Tibetan and Buddhist cultures to promote relaxation, healing and meditation (Goldsby & Goldsby, 2020; Landry, 2014; Seetharaman et al., 2024). Tibetan Singing Bowls (or Himalayan singing bowls) are thought to be as ancient as the Himalayan fire cults of 5th century BC (Terwagne & Bush, 2011). TSB, traditionally, are made of bronze alloy that include gold, copper, zinc, tin, nickel, iron, and silver (Terwagne & Bush, 2011). Crystal singing bowls are made of quartz crystal. The bowls vary in size and thickness, each producing different sound frequencies. All variations of SB are tapped or rubbed using a mallet that vibrates the side of the bowl and produces a vibrational sound (Terwagne & Bush, 2011), the vibrations produced can be felt at close proximity (Goldsby & Goldsby, 2020). Research on SB have shown they are beneficial in improving mental wellbeing, spirituality, and have physiological effects (Goldsby & Goldsby, 2020; Seetharaman et al., 2024; Stanhope & Weinstein, 2020). However, there is limited research focusing on the beneficial effects of SB.

Singing Bowls and Stress

Previous research has suggested SB has subjective and physiological effects on mental wellbeing and stress. Trivedi and Saboo (2019) compared SB music and supine silence (SS) on physiological relaxation outcomes in adults. They measured heart rate (HR) and Kubois Stress Index data and were recorded at five minute intervals. The SB participants completed a single in-person 20-minute session using SB and Tingsha (Tibetan musical instrument). The SS session was the same as the SB but completed in silence. The results showed both interventions resulted in continuous decreases in

stress index. Only SB showed statistically significant decreases at each five-minute interval. HR had significant decreases in all records except 0-5 minute to 5-10 minute for the SB group.

Rio-Alamos et al. (2023) compared SB, PMR, and a control waitlist group (CLW) on the acute physiological and subjective relaxation response in nonclinical anxious young adults. The measures were heart rate variability – high frequency (HRV-HF), electroencephalography (EEG), and self-reported anxiety (Spielberg's State Anxiety Inventory). Participants completed a single 50-minute in-person session laying in an armchair. The SB were played live, the PMR audio was delivered via speaker, and the CLW was silence. Both PMR and SB resulted in decreases on self-reported anxiety in comparison to the control group; the SB group resulted in a greater effect than the PMR. HRV-HF increased as the session progressed in both PMR and SB groups (an indication of more parasympathetic activity). EEG showed reduction in alpha power band in both PMR and SB; the SB group resulted in greater reduction than PMR. Reduction in alpha power band indicates a decrease in brain activity, showing more relaxation.

Cotoia et al. (2018) compared SB music and silence on cognitive and emotional responses in patients waiting for urologic surgery. The measures were self-reported anxiety and physiological measures of stress. Participants listened to a 30-minute recording of SB music via headphones before arriving in the operating room. The results showed significant decreases in anxiety after the intervention in the SB group only. There were significant changes in the physiological measures that suggest stress reduction in the SB group only.

Singing Bowls and Sleep

SB has traditionally been used to enhance relaxation, this could cross over into helping with sleep. Bergmann et al. (2020) investigated the effects of SB on subjective and objective sleepiness with an adult sample. The participants completed two 20 – 23.5-minute sessions of either silence or SB. Participants were suspended in a hammock inside a giant singing bowl for the session. The SB were struck seven times (lasting 3.5 minutes) in the SB group. Participants then continued relaxing for 20 minutes. Participants in the control group relaxed in silence for 20 minutes. Results showed objective sleepiness, as measured by the pupillographic sleepiness test, did not change before or after the intervention in either group. Overall, there was a significant decrease in subjective sleepiness, as measured by the Karolinska sleepiness scale, in both groups after the session. SB group had lower subjective sleepiness compared to the control group. Gender analyses revealed this effect was more prominent in women compared to men.

Singing Bowls and Mood

Goldsby et al. (2017) investigated the effect of SB on mood, anxiety, and spiritual wellbeing in adults. Participants completed a 60-minute in-person session laying down. The session included more instruments than SB; however, 95% of the session was SB. The results showed significant reductions in all the mood measures after the session. There were significant increases in spirituality and faith measures after the session. Those who were SB naïve had larger reductions in tension, anxiety, and depression compared to SB experienced participants.

Panchal et al. (2020) assessed SB effect on subjective mood, and physiological stress in adults. Participants were invited to complete four in-person 40-minute sessions over two months. In the first three minutes of the session participants practiced PMR. Results showed statistically significant increases and decreases in positive and negative affect. Tension, Anger, Depression, Fatigue, and Confusion significantly decreased, and Esteem-Related Affect significantly increased after the intervention. Vigour increased but this did not reach significance. Physiological measures of stress showed significant decreases.

Matthews et al. (2023) assessed the effects SB had on mood outcomes with adolescent males (16 – 17-year-olds). Participants completed a single in-person 25-minute session. The mood measure (POMS-Adolescence) was administered four times, pre-intervention, immediately post-intervention, one-week post-intervention, and three-weeks post-intervention. The results showed reduction in all mood subscales immediately post-intervention; however, only depression reached significance.

The previous studies have shown that SB is an effective tool in improving stress, sleep, and mood in a range of ages. However, all of the studies measured the acute effects of SB and not the long term effects. Goldsby et al. (2017), in their study of SB and mood in adults, Matthews et al. (2023), in their study of adolescent males and mood, and Panchal et al. (2020), in their study of subjective mood and physiological stress, did not include control groups. Additionally, Matthews et al. (2023) had a small sample size. Panchal et al. (2020) lacked clarity in session completion as well as including confounding variable of using PMR in the session. Goldsby et al. (2017) included

confounding variable by having more instruments than SB. All the studies except Cotoia et al. (2018) were in-person only, minimizing accessibility.

The Current Study

As discussed, PMR and SB have shown to be beneficial in combating negative symptoms of stress, mood, and sleep in several age groups. For PMR, being in-person, online, or a combination of both can result in improvement in mood, stress, and sleep. The length of the PMR sessions and interventions resulted in positive effects and in some studies, this was continued at follow up. The SB studies showed that the participants had positive physiological and subjective responses to the SB when listening to a recording or in-person.

The current study is a parallel cohort non-comparative study and aims to investigate the effects of quartz crystal singing bowls music and PMR on mood, stress, and sleep in young adults. The study will address some of the gaps in previous research such as, targeting young adults, being online to increase accessibility to participants, repeated sessions with session reminders being sent to participants to increase engagement, and measure session completion. The overarching research aim for this study is to examine the effects of quartz crystal singing bowls music and PMR on mood, sleep, and stress outcomes in young adults. Additionally, the current study will investigate if the time of day the sessions are listened to contributes to sleep quality outcomes, if the number of sessions completed correlated with the outcome measures, and the acute effects of the interventions. We hypothesized that SB music and PMR would result in positive outcomes in mood, sleep, and stress in young adults. PMR was used in place of a no treatment control group due to being an effective low-

cost intervention that is easily accessible and would make a good positive control for the current study. The intervention is well researched and was a good intervention to use to determine the effectiveness of SB music without directly comparing the results.

Chapter Two: Method

Ethics

The study was approved by the University of Waikato Human Research Ethics Committee (Health) (HREC 2024#03).

Participants

Participants were university students recruited from the University of Waikato via flyers placed around the campus (Appendix A), online in university courses, and the first year Introduction to Psychology Research Programme (IPRP). IPRP is a university website that allows students enrolled in psychology classes to participate in research. Participants received either up to 10% course credit (n = 107) or a $30 Warehouse voucher (n = 1) for participation. Volunteers emailed researchers to express their interest in the study. Participants were ineligible if they were undergoing psychiatric treatment, aged outside of 16 – 25 years, participated in guided relaxation more than once a month or listened to singing bowls more than once a month.

Materials

The study materials (questionnaires and interventions) were made available to participants on the Qualtrics platform (http://www.qualtrics.com/). The participant responses to the questionnaires and their engagement with each of the interventions were recorded in Qualtrics.

Interventions

The audio track used in the current study were quartz crystal singing bowls (see Figure 1). The quartz crystal singing bowls audio track used in the current study was

“Tranquility” by Annie Jameson. The audio track was 570 seconds (9.5 minutes) for all sessions. Annie Jameson composed the track herself and gave permission for its use. The full Tranquility track can be found on YouTube (https://www.youtube.com/watch?v=0mX3Vqvo5k4) or Spotify.

Figure 1

Quartz Crystal Singing Bowls

The PMR audio track was produced by the New Zealand Cancer Society (https://www.youtube.com/watch?v=Zydrp3rfJdY). The audio was verbal guidance of PMR only. For the first session the audio began with a short explanation of PMR. This included how to perform it, what to focus on, position to be in, and the amount of tension to use. The audio asked participants to begin by focusing on their breathing, taking deep relaxing breathes. The audio asked participants to begin active PMR, tensing the target muscle for 10 seconds before releasing. The target muscles began in their feet and travelled to their calves, thighs, buttocks, stomach, back, hands, arms, chest, neck, shoulders, forehead, scalp, eyes, and jaw. Finally, the audio asked participants to remain in the relaxed state for a few seconds before slowly bringing their attention to their surroundings. The first session of PMR was 820 seconds (13.66

minutes), this was the only session that included the PMR explanation. The following sessions were active PMR only and were 730 seconds (12.17 minutes).

Both recordings were delivered online via Qualtrics, and participants were asked to wear headphones and be in a quiet area during the sessions. Participants were encouraged to listen as often as they liked.

Measures

Participants completed the eligibility and demographic questionnaires at baseline only. Participants completed the Abbreviated Profile of Mood States – Revised Version Questionnaire (POMS-RV) and the Auckland Sleep Questionnaire: Current Sleep (ASQ: Current Sleep) three times: at baseline, week four, and end of the intervention (week eight). Visual Analogue Scales (VAS) were completed once a week throughout the first four weeks immediately before and after the intervention session. Feedback Questions were completed at the end of the study intervention period.

The Eligibility Questionnaire (Appendix B) was a five-item self-report questionnaire. The questionnaire asked participants their age, access to mobile/tablet/computer with internet access, use of singing bowls, use of guided meditation, and if they were currently receiving treatment from a psychologist/psychiatrist.

Demographic Questionnaire (Appendix C) asked participants to report their gender identity, ethnicity, first language, level of education, and occupational training.

The POMS-RV (Appendix D) is a 40-item self-report questionnaire designed to measure mood. It is derived from the original 65-item POMS measure developed by

McNair, Lorr and Droppleman in 1971. The POMS-RV is designed to measure transient mood states (Grove & Prapavessis, 1992) and is not used as a diagnostic tool in practice.

The POMS-RV questionnaire is a series of adjectives and asks participants to rate them, in accordance with their current feeling, on a scale of 0 – 4 (0 = not at all, 1 = a little, 2 = moderately, 3 = quite a lot, 4 = extremely). The POMS-RV has seven subscales: Fatigue, Depression, Confusion, Anger, Tension, Vigour, and Esteem-Related Affect (ERA). Five of the subscales are negative subscales (Tension, Fatigue, Confusion, Depression, Anger) and two are positive subscales (Vigour, ERA). Each subscale is the sum of the relevant responses. The Total Mood Disturbance (TMD) was calculated by subtracting the sum of the positive scores from the sum of the negative scores. For the TMD higher scores reflect a more negative mood state.

The POMS-RV was chosen due to its widespread usage and because the pilot study by Matthews et al. (2023) used the POMS adolescent version. The POMS has been modified numerous times to be applicable to many ages and languages (Petrowski et al., 2021; Terry et al., 1999). The POMS-RV internal reliability, as measured by Cronbach's alpha, is moderate to high. The subscales Fatigue, Vigour, and Anger are the highest (.954 - .872), ERA, Tension, and Confusion show moderate internal consistency (.766 - .701), and Depression show acceptable internal consistency (.664) (Grove & Prapavessis, 1992). The Depression subscale should be interpreted with caution due to its lower levels of internal consistency. Moderate to high levels of test retest reliability was found for all the POMS subscales with older adults (Gibson, 1997).

ASQ: Current Sleep (Appendix E) is an eight-item self-report questionnaire designed to measure participants' current sleep disturbance. The ASQ: Current Sleep is a subscale taken from the full ASQ. The ASQ: Current Sleep was chosen due to its widespread use in general practice in New Zealand. The ASQ: Current Sleep asks participants if they have any issues with their sleep that it affects the next day's functioning. If they answered yes, they are asked the frequency, duration, and reason of their sleep issues. The next section of questions asked if they take medication to help their mood, sleep, or stress, how often, and the name of the medication. Finally, participants are asked to rate their sleep quality for the past week on a four-point scale (1 = very good, 2 = fairly good, 3 = fairly bad, 4 = very bad). The ASQ: Current Sleep was selected to assess participant's subjective perception of their current sleep because sleep disturbances are associated with several mood disorders. The ASQ has shown to have a moderate to high sensitivity and specificity when compared to a clinical interview with a psychiatrist trained in sleep disorders for diagnosing primary insomnia (0.78, 0.77), mood disorders (0.67, 0.97), obstructive sleep apnoea (0.8, 0.94), delayed sleep phase disorder (0.8, 0.97), and health problems (0.92, 0.76) (Arroll et al., 2011). The ASQ is a tool used in diagnosing sleep disorders and has shown moderate to high validity when compared to clinical interview (Arroll et al., 2011). In this study, sleep quality scores from the ASQ: Current Sleep were used in the analysis, high scores reflected worse sleep quality.

The Visual Analogue Scales (VAS) (Appendix F) is a three-item Likert scale designed to measure participants' transient and subjective psychological states (Abend et al., 2014). The VAS assesses the acute effect of the interventions on participants' Relaxation, Overall Feeling, and Stress. Participants were asked to complete the VAS

immediately before and after one session each week for the first four weeks. Participants were asked to respond to three statements i) “overall, how do you feel right now?” and responded by choosing a value between 0 “worst I have ever felt” and 100 “best I have ever felt”. ii) “how relaxed do you feel right now?” (from 0 “not relaxed” to 100 “very relaxed”), and iii) “how stressed do you feel right now?” (from 0 “not stressed” to 100 “very stressed”). Each of the VAS were scored individually with higher scores indicating better Overall feeling, increased Relaxation, and increased Stress.

The VAS has shown to be a reliable measure in several areas including state anxiety (Abend et al., 2014), bipolar and unipolar depression (Ahearn & Carroll, 1996), and stress (Lesage & Berjot, 2011). The VAS has shown to correlate to several validated scales such as the perceived stress scale (PSS) (r = .68) (Lesage & Berjot, 2011) and Spielberger’s state trait-anxiety (r = .44) (Abend et al., 2014). Test-retest reliability of the VAS have been positive (Ahearn & Carroll, 1996) and have had high discriminate validity (Abend et al., 2014). Correlation coefficients were high for bipolar and unipolar depression (r = 0.82 – 0.89) (Ahearn & Carroll, 1996). The VAS has been shown to be a useful tool for measuring subjective psychological states, however caution should be advised when interpreting the results due to the varying strengths of correlation coefficients.

Feedback Questions (Appendix G) were two open-ended questions where participants could give feedback about their experience and if they would recommend the intervention to other young people.

Study Design

The study was a parallel cohort non-comparative study design. The participants were randomly allocated to either SB or PMR group. The participants completed questionnaires at baseline (T1), week four (T2), and week eight (T3), measuring Mood and Sleep Quality. The participants completed weekly visual analogue scales measuring Stress, Overall Wellbeing, and Relaxation for the first four weeks.

Procedure

After participants expressed their interest in the study researchers emailed participants the information sheet (Appendix H). Participants were then asked to complete the consent form (Appendix I) and eligibility questionnaire. Eligible participants were automatically directed to the demographic questions and the first questionnaire (T1). This included the POMS-RV, ASQ: Current Sleep, and a link to the allocated audio. Those who were ineligible were thanked for their interest in the study and automatically directed to the end of the questionnaire. Eligible participants were emailed three times a week and asked to complete the allocated audio sessions for the first four weeks; one of these sessions included a link to the VAS. At the end of week four (T2) participants were asked to complete the POMS-RV and ASQ: Current Sleep again. For the remaining four weeks of the study participants were emailed a link to the allocated audio once a week and were invited to listen as often as they wished. Two weeks after the T2 link was emailed reminder emails were sent to those who had not complete the T2 questionnaire. At the end of week eight participants were emailed a link to complete the final questionnaire (T3). The T3 included the POMS-RV, ASQ: Current Sleep, and feedback questions. Participants were also sent the link to both

audio tracks at the end of the study for their personal use (their uses were not recorded). Participants who had not completed T2 continued to be monitored and asked to complete T3. Two weeks after the T3 link was emailed reminder emails were sent to those who had not completed T3. At the end of the study participants were thanked for their participation and granted the course credit or received the vouchers.

Statistical Analysis

All statistical analyses were conducted using SPSS. The data was downloaded from Qualtrics into SPSS. Identifying information such as student ID, email address, and ineligible participants were removed. Participants who had completed/listened to at least one audio session and completed all questionnaires were included in the per-protocol analysis. A completed session was determined to be at least 50% of a session (a minimum of 365 seconds (6.08 minutes) for PMR and 285 seconds (4.75 minutes) for SB). Independent samples t-test were conducted to determine if there were statistically significant differences between the PMR and SB groups at baseline for the demographics and baseline measures, and chi-square for categorical values.

To determine the overall effects of the interventions one-way repeated measures analysis of variance (ANOVA) were conducted to determine the changes over time for the TMD, the POMS-RV subscales, and Sleep Quality for each group separately. The cohort used were the participants who completed the intervention and all questionnaires. This cohort was used due to it showing the most completed change over time of each participant. An alpha level of .05 was used. Effect sizes (partial eta squared) were calculated from the ANOVA to examine the extent of change for each of the measures. Effect size values for partial eta squared were .01 for small, .06 for

medium, and .14 for large (Field, 2013). The Green-House Giesser correction was used for interpreting the ANOVA when Mauchly's test was significant (p = <.05) (Field, 2013). If the ANOVA was significant post hoc tests using Bonferroni adjusted p value were conducted.

Additional exploratory analyses were conducted as there were several participants (n = 16) who completed the outcome measures T2 (n = 14) and T3 (n = 11) but did not engage in the intervention (i.e. they listened to less than half of one of the audio sessions). We realized this group could be considered a no intervention 'control' group as they completed each of the measures but not the intervention. Two-way Mixed ANOVAs were conducted comparing weeks one – four of each group separately to the control group for each of the POMS-RV subscales, TMD, and Sleep Quality. Two-way Mixed ANOVAs were conducted comparing weeks five – eight of each group separately to the control group for each of the TMD, the POMS-RV subscales, and Sleep Quality. The analyses were split into the separate timepoints (baseline – T2, T2 – T3) to maximise the sample size.

Paired samples t-test were conducted to determine differences in the number of sessions completed between weeks one – four and five – eight in each group separately. This was done to investigate the acceptability and use of the interventions between the timepoints.

Additional exploratory analyses were conducted to determine the time-of-day participants listened to the sessions the interventions. The data was sorted into one of four time periods (12am – 6am, 6am – 12pm, 12pm – 6pm, and 6pm – 12am). Chi-

square analyses were conducted to determine the time-of-day participants most often listened to the sessions in each group separately.

Additional exploratory analyses were conducted to determine the day of session and questionnaire completion. This was to determine if participants completed sessions and questionnaires on the day they received them. Chi-square analyses were used to determine this in each group separately.

Additional exploratory analysis was conducted to determine if the number of sessions completed correlated with outcome measures using Bivariate Pearson's correlations. Differences in TMD, POMS-RV subscales, and sleep quality for T1 – T2, T2 – T3, and T1 – T3 were calculated for each group separately. These differences were used in the Bivariate Pearson's correlation.

Additional analyses were conducted to determine the acute effects of the intervention sessions in each group separately. The VAS pre and post scores for the ratings of Overall Feeling, Relaxation, and Stress were averaged separately for each participant. The VAS bar graphs confidence intervals are calculated using standard error. Paired sample t-test were conducted for each of the VAS measures separately to compare the averaged pre and post scores for the SB and PMR groups separately. Only those who completed at least one VAS rating were included in the analysis.

Chapter 3: Results

The aim of the research was to evaluate the effectiveness of quartz crystal singing bowls music, specifically the "Tranquility" audio track, and PMR on mood, sleep, and stress in young adults. The study is a parallel cohort, non-comparative design (therefore, the interventions were not directly compared to each other at any point in the analysis). Thirty-two participants completed the SB intervention, thirty participants completed the PMR intervention. The first section details the demographics of all study participants, and their participation over the course of the study. The second section compares the baseline measures for both intervention groups and non-intervention comparison group, followed by the effect of the interventions on mood and sleep. The next section focuses on comparing the interventions to the comparison group, followed by the visual analogue scales analyses, session listening, session time-of-day, session and questionnaire day of listening, and finally, bivariate Pearson's correlations of the study will be reported.

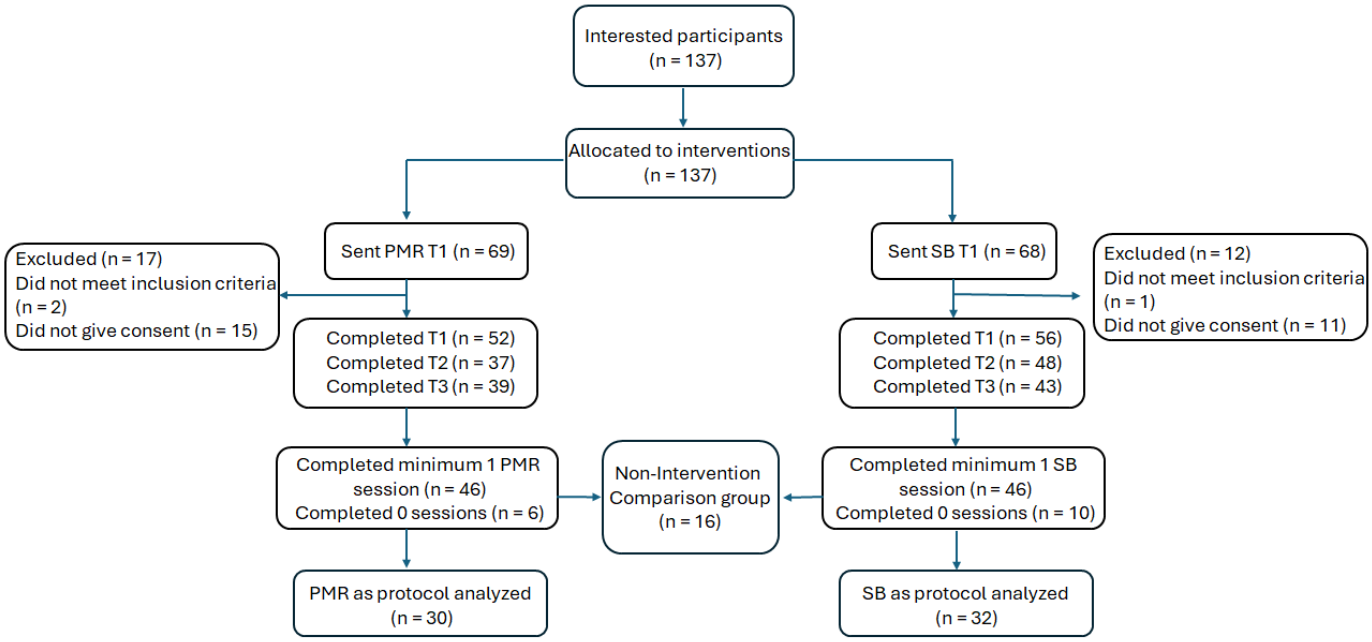
Participants

Figure 2 depicts participant progress through the study. As shown in Figure 2 there were 137 potential participants, three were excluded due to being over 25 years, using guided relaxation, and receiving psychiatric treatment. 26 of the potential participants did not give consent and were not included in the study. The remaining 108 participants were alternately allocated to either PMR or SB group. As seen in Figure 2, 137 participants who responded to the invitation were allocated alternately to the PMR and SB groups, 108 of whom were eligible, consented to the study and are included in the analysis. Of 91 participants who completed at least one intervention session, 62

completed questionnaires at both T2 and T3, 29 completed them at either T2 or T3. Those who did not listen to any intervention but completed T2 and/or T3 questionnaires were assigned to a 'no-intervention control' group for exploratory analysis (n = 16).

Figure 2

Participant Flow Chart



Participant demographics are summarized in Table 1. As shown in the table, gender, age, and ethnicity were well balanced between the SB group and PMR group. Some of the participants did not answer/selected more than one option for the completed qualifications and education questions.

Table 1

Participant Demographics of Participants who Completed Baseline Questionnaires.

		SB (N = 46)	PMR (N = 46)	Control (N = 16)
Gender	Male, n (%) Female, n (%) Non-Binary/Third Gender, n (%) Prefer not to say	6 (13%) 38 (82.6%) 2 (4.3%) 0	8 (17.4%) 36 (78.3%) 1 (2.2%) 1 (2.2%)	1 (6.3%) 15 (93.8%) 0 0
Age	Mean (SD)	20.11 (2.093)	20.53 (2.727)	19.44 (1.672)
Ethnicity	NZ European Māori Pasifika Other	19 (41.3%) 15 (32.6%) 2 (4.3%) 10 (21.7%)	16 (34.8%) 10 (21.7%) 3 (6.5%) 17 (37%)	9 (56.3%) 2 (12.5%) 0 5 (31.3%)
First Language	English Other	39 (84.8%) 7 (15.2%)	33 (71.7%) 13 (28.3%)	13 (81.3%) 1 (6.3%) 2 (12.5%)
Completed Qualifications	NCEA level 1 NCEA level 2 NCEA level 3 Tertiary Other	19 (41.3%) 21 (45.6%) 31 (67.4%) 4 (.8%) 6 (1.3%)	15 (32.6%) 18 (39.1%) 31 (67.4%) 5 (1.1%) 3 (.6%)	5 (31.2%) 5 (31.2%) 16 (100%) 0 0
Education	High school At University/Tech	9 (19.5%) 45 (97.8%)	3 (.6%) 46 (100%)	3 (18.7%) 16 (100%)

Note. SB = Singing Bowls, PMR = Progressive Muscle Relaxation

Baseline Measures

To determine if there were differences between the PMR and SB groups at baseline for the total mood disturbance (TMD), the POMS subscales, and Sleep Quality independent samples t-tests were conducted. Table 2 shows the baseline independent samples t-test for the whole study cohort, excluding the control group. As seen in Table 2 there were no significant differences between the two groups mean scores at baseline for the POMS subscales, TMD, or Sleep Quality. Additional independent samples t-tests

were conducted using data from participants who completed the full intervention (all questionnaires and a minimum of one session) to determine if there were significant differences at baseline. There were no significant differences at baseline (see Table J1 in Appendix J).

Table 2

TMD, POMS Subscales, Sleep Quality: Independent Samples t-test between Intervention Groups at Baseline

Variable	SB N = 46		PMR N = 46				
	Mean	SD	Mean	SD	t(90)	*p*	Cohen's d
TMD	118.28	26.52	115.22	25.61	.564	.574	0.118
Tension	8.90	6.06	9.11	5.49	-.180	.857	-0.038
Anger	3.93	4.35	4.35	5.20	-.413	.680	-0.086
Fatigue	8.87	4.52	7.85	4.46	1.091	.278	0.227
Depression	6.48	6.84	6.46	6.06	.016	.987	0.003
Confusion	6.93	4.32	6.72	4.69	.213	.818	0.048
Esteem-Related Affect	12.28	4.17	13.22	4.02	-1.095	.277	-0.228
Vigour	4.54	3.86	6.04	4.02	-1.826	.071	-0.381
Sleep Quality	2.50	.548	2.61	.682	-.842	.402	-0.176

*Significant at <.05 level

Note. Only those who completed the measures at T1 and a minimum of one session were included.

SB = Singing bowls, PMR = Progressive muscle relaxation, TMD = Total mood disturbance.

Additional independent samples t-tests were conducted using data from all participants who consented to the study to determine if there were significant

differences at baseline between those who completed the interventions and those who did not in TMD, the POMS subscales, and Sleep Quality. This was to determine if there was a potential reason for some participants completing the interventions and some not. There were no significant differences between those who completed the interventions and those who did not in the SB group (see Tabe K1 in Appendix K). There was a significant difference between those who completed the interventions and those who did not in the POMS subscale Esteem-Related Affect (ERA) in the PMR group (see Table L1 in Appendix L). Those who engaged with the intervention had higher ERA scores.

Effects of PMR and SB on Mood and Sleep

To assess the effect the interventions had on mood and sleep, one-way repeated measures ANOVAs were conducted for TMD, the POMS subscales and Sleep Quality ratings for the SB and PMR group separately. Table 3 shows the descriptive statistics and ANOVA for the TMD, the POMS subscales, and Sleep Quality ratings at each timepoint for SB group. The scores for TMD, Tension, Fatigue, Depression, Confusion, Anger, and Sleep Quality decreased. Anger had the smallest overall decrease. Scores ERA and Vigour increased overall. As shown in Table 3, TMD, Tension, Fatigue, Depression, Vigour, and Sleep Quality had statistically significant changes (improvements) in scores over time for the SB group. TMD, Tension, Fatigue, and Sleep Quality had large effect sizes. Depression and Vigour had medium effect sizes.

Post-hoc analysis (Bonferroni corrected) revealed significant decreases between baseline and week four in TMD scores (p = .001), Tension scores (p = .003), Sleep Quality scores (p = .027), Fatigue scores (p = .002), Depression scores (p = .045). Post-hoc

analysis (Bonferroni corrected) revealed a significant increase in Vigour scores from baseline to week four (p = .031).

Post-hoc analysis (Bonferroni corrected) revealed significant decreases between baseline and week eight in TMD scores (p = .026), Tension scores (p = .011), and Sleep Quality scores (p = .001).

Table 3

TMD, POMS subscales, and Sleep Quality: Descriptive statistics at Baseline, Week Four, and Week Eight, and Repeated Measures ANOVA for the SB Group.

Variable	T1 N=32		T2 N=32		T3 N=32		ANOVA
	Mean	SD	Mean	SD	Mean	SD	F(2,62)
TMD	113.94	21.10	101.41	21.45	103.50	23.95	8.352 p = <.001 ηp^2 = .212*
Tension	8.47	5.78	5.59	4.91	5.34	5.21	8.471 p = <.001 ηp^2 = .215*
Anger	3.44	3.68	2.53	3.29	2.69	3.75	1.074 p = .348 ηp^2 = .033
Fatigue	8.09	3.74	5.69	3.99	6.28	4.52	6.727 p = .002 ηp^2 = .178*
Depression	5.53	5.69	3.84	4.68	3.84	5.30	3.240 p = .046 ηp^2 = .095*
Confusion	6.09	3.42	4.84	3.40	4.81	3.91	2.607 p = .082 ηp^2 = .078
Esteem-related Affect	12.84	3.31	14.28	3.44	13.47	4.47	2.572 p = .085 ηp^2 = .077
Vigour	4.84	3.32	6.81	4.33	6.00	4.15	4.149 p = .020 ηp^2 = .118*
Sleep Quality	2.53	0.57	2.28	0.68	2.03	0.82	9.300 p = <.001 ηp^2 = .231*

*Significant at <.05 level.

Note. T1 = Baseline, T2 = Week 4, T3 = Week 8, TMD = Total mood disturbance.

Table 4 shows the descriptive statistics and ANOVA results for the TMD, the POMS subscales, and Sleep Quality ratings at each timepoint for PMR group. There were overall decreases in scores for TMD, Tension, Anger, Fatigue, Depression, Confusion, and Sleep Quality. ERA and Vigour had small overall increases. As can be seen from the ANOVA results in Table 4 TMD, Tension, Anger, Fatigue, Confusion, and Sleep Quality showed a statistically significant change (improvement) over time for the PMR group. Tension, Confusion, and Sleep Quality had large effect sizes. TMD, Anger, and Fatigue had medium effect sizes.

Post-hoc analysis (Bonferroni corrected) revealed significant a decrease between baseline and week four in Sleep Quality scores (p = <.001). Post-hoc analysis (Bonferroni correction) revealed a significant decrease between week five and week eight in Confusion scores (p = .005). Post-hoc analysis (Bonferroni corrected) revealed significant decreases between baseline and week eight in Tension scores (p = .014), and Sleep Quality scores (p = .002).

Table 4

TMD, POMS subscales, and Sleep Quality: Descriptive statistics at Baseline, Week Four, and Week Eight, and Repeated Measures ANOVA for the PMR Group.

Variable	T1 N = 30		T2 N = 30		T3 N = 30		ANOVA
	Mean	SD	Mean	SD	Mean	SD	F(2, 58)
TMD	108.27	22.56	105.90	22.49	96.80	17.98	3.737 p = .030 ηp^2 = .114*
Tension	7.70	5.07	6.33	5.05	4.63	3.96	6.289 p = .003 ηp^2 = .178*
Anger	2.83	3.76	3.77	4.33	1.87	2.87	3.296 p = .044 ηp^2 = .102*
Fatigue	6.90	4.00	5.50	3.65	5.13	4.18	3.247 p = .046 ηp^2 = .101*
Depression	4.47	5.02	4.60	5.46	2.53	3.69	2.763 p = .071 ηp^2 = .087
Confusion	6.03	4.39	6.47	3.89	4.27	3.35	5.506 p = .006 ηp^2 = .160*
Esteem-Related Affect	13.77	4.03	14.43	3.56	14.70	3.29	.591 p = .557 ηp^2 = .020
Vigour	5.90	3.38	6.33	3.70	6.93	3.35	1.184 p = .313 ηp^2 = .039
Sleep Quality[1]	2.60	0.68	2.07	0.52	2.03	0.67	13.261[2] p = <.001 ηp^2 = .314*

*Significant at <.05 level. [2] F value is 1.65, 47.71

Note. [1] Greenhouse-Geisser used, T1 = Baseline, T2 = Week 4, T3 = Week 8, TMD = Total mood disturbance.

SB Group vs Comparison Group

Several participants did not engage with either intervention but still completed the questionnaires at baseline (n = 16), week four (n = 14), and week eight (n = 11). We realised this group could be used as a non-intervention control group. To maximise the sample size of the control group we carried out two separate 2x2 mixed ANOVAs from baseline to week four and week five to week eight.

Exploratory analyses (2x2 mixed ANOVAs) were conducted comparing the SB group (n = 38) to the 'control' group (n = 14) for TMD, the POMS subscales, and Sleep Quality for baseline (T1) to week four (T2). As seen in Table 5 Confusion had a significant Time x Group interaction for the SB group. The control group increased in Confusion scores from baseline to T2 while the SB group decreased in Confusion scores from baseline to T2. Confusion had a medium effect size.

Table 5 shows there was a significant main effect of Time for TMD, Tension, Fatigue, ERA, and Sleep Quality. Fatigue and Sleep Quality had large effect sizes; TMD, Tension, and ERA had medium effect sizes. As seen in Table 5 there were no significant main effects of Group for any of the measures.

Post hoc analysis (Bonferroni corrected) revealed a significant decrease in the SB group Confusion scores from baseline to week four (p = .019). The control group score difference was not significant from baseline to week four (p = .166).

Another series of 2x2 mixed ANOVA analyses were conducted comparing the SB group (n = 32) to the 'control' group (n = 11) for TMD, the POMS subscales, and Sleep Quality for week four (T2) to week eight (T3). As seen in Table 6 ERA had a significant

Time x Group interaction. The SB group decreased in ERA scores from T2 to T3 while the control group increased from T2 to T3. ERA had a medium effect size.

Table 6 shows there were no significant main effects of Time or Group for any measures.

Post hoc analysis (Bonferroni corrected) revealed SB group decreased in ERA scores and control group increased in ERA score from week five to week eight. However, these did not reach significance.

Table 5

TMD, POMS Subscales, and Sleep Quality: Descriptive Statistics at Baseline and Week 4, and Repeated Measures ANOVA for the SB and Control Groups.

Variable	SB N = 38		Control N = 14		ANOVA		
	T1 Mean (SD)	T2 Mean (SD)	T1 Mean (SD)	T2 Mean (SD)	Time F(1, 50)	Group F(1,50)	Time x Group F(1, 50)
TMD	119.16 (25.89)	106.00 (24.41)	119.57 (23.95)	118.43 (18.70)	4.391, p = .041, ηp^2 = .081*	.899, p = .348, ηp^2 = .018	3.10, p = .084, ηp^2 = .058
Tension	9.16 (6.09)	6.34 (5.01)	8.29 (6.32)	7.42 (4.45)	4.375, p = .042, ηp^2 = .080*	.005, p = .943, ηp^2 = .000	1.244, p = .270, ηp^2 = .024
Anger	4.13 (4.63)	2.84 (3.23)	5.07 (6.28)	5.07 (3.71)	.643, p = .427, ηp^2 = .013	2.124, p = .151, ηp^2 = .041	.643, p = .427, ηp^2 = .013
Fatigue	8.87 (4.27)	6.53 (4.51)	9.14 (4.13)	7.71 (3.50)	9.002, p = .004, ηp^2 = .153*	.389, p = .535, ηp^2 = .008	.528, p = .471, ηp^2 = .010
Depression	6.76 (6.69)	4.74 (5.67)	6.71 (5.85)	7.71 (5.40)	.412, p = .524, ηp^2 = .008	.727, p = .398, ηp^2 = .014	3.585, p = .064, ηp^2 = .067
Confusion	7.03 (4.30)	5.61 (4.00)	6.00 (4.21)	7.36 (3.86)	.003, p = .955, ηp^2 = .000	.098, p = .755, ηp^2 = .002	6.051, p = .017, ηp^2 = .108*
ERA	11.97 (4.01)	13.55 (4.12)	10.79 (2.39)	11.57 (3.67)	4.430, p = .040, ηp^2 = .081*	2.235, p = .141, ηp^2 = .043	.499, p = 483, ηp^2 = .010
Vigour	4.82 (3.97)	6.50 (4.25)	4.86 (3.42)	5.29 (2.87)	2.884, p = .096, ηp^2 =.055	.316, p = .577, ηp^2 = .006	1.019, p = .318, ηp^2 = .020
Sleep Quality	2.53 (0.56)	2.32 (0.65)	2.71 (0.73)	2.43 (0.65)	9.563, p = .003, ηp^2 = .161*	.654, p = .423, ηp^2 = .013	.220, p = .641, ηp^2 = .004

*Significant at <.05 level.

Note. SB = Singing Bowls, ERA = Esteem-related affect, TMD = Total mood disturbance.

Table 6

TMD, POMS Subscales, and Sleep Quality: Descriptive Statistics at Week 5 and Week 8, and Repeated Measures ANOVA for the SB and Control Groups.

Variable	SB N = 32		Control N = 11		ANOVA		
	T2 Mean (SD)	T3 Mean (SD)	T2 Mean (SD)	T3 Mean (SD)	Time F(1, 41)	Group F(1, 41)	Time x Group F(1, 41)
TMD	101.41(21.45)	103.50(23.95)	118.73(19.11)	110.09(15.34)	1.223, p = .275, ηp^2 = .029	2.983, p = .092, ηp^2 = .068	3.290, p = .077, ηp^2 = .074
Tension	5.59 (4.91)	5.34 (5.21)	7.18 (4.75)	6.73 (2.72)	.212, p = .648, ηp^2 = .005	.991, p = .325, ηp^2 = .024	.018, p = .894, ηp^2 = .000
Anger	2.53 (3.29)	2.69 (3.75)	4.91 (4.01)	4.27 (3.98)	.144, p = .707, ηp^2 = .003	3.204, p = .081, ηp^2 = .072	.391, p = .535, ηp^2 = .009
Fatigue	5.69 (4.00)	6.28 (4.52)	7.91 (3.86)	7.36 (3.96)	.002, p = .967, ηp^2 = .000	1.507, p = .227, ηp^2 = .035	.993, p = .325, ηp^2 = .024
Depression	3.84 (4.68)	3.84 (5.30)	7.64 (5.70)	5.00 (3.71)	3.125, p = .085, ηp^2 = .071	2.503, p = .121, ηp^2 = .058	3.125, p = .085, ηp^2 =.071
Confusion	4.84 (3.40)	4.81 (4.01)	7.09 (4.13)	5.91 (4.01)	1.180, p = .284, ηp^2 = .028	1.963, p = .169, ηp^2 =.046	1.061, p = .309, ηp^2 = .025
ERA	14.28 (3.44)	13.47 (4.47)	11.27 (3.13)	13.27 (4.47)	.960, p = .333, ηp^2 = .023	1.660, p = .205, ηp^2 = .039	5.386, p = .025, ηp^2 = .116*
Vigour	6.81 (4.33)	6.00 (4.15)	4.73 (2.69)	5.91 (2.39)	.081, p = .778, ηp^2 = .002	.828, p = .368, ηp^2 = .020	2.348, p = .133, ηp^2 = .054
Sleep Quality	2.28 (0.68)	2.03 (0.82)	2.36 (0.67)	2.55 (0.69)	.088, p = .768, ηp^2 = .002	1.664, p = .204, ηp^2 = .039	3.549, p = .067, ηp^2 = .080

*Significant at <.05 level.

Note. SB = Singing bowls, ERA = Esteem-related affect, TMD = Total mood disturbance.

PMR Group vs Comparison Group

Exploratory analyses (2x2 mixed ANOVAs) were conducted comparing the PMR group (n = 33) to the 'control' group (n = 14) for TMD, the POMS subscales, and Sleep Quality for baseline (T1) to week four (T2). As seen in Table 7 there were no significant Time x Group interactions for any of the measures.

Table 7 shows there was a significant main effect of Time for Fatigue and Sleep Quality, with scores decreasing from baseline to week four. Fatigue had a medium effect size and Sleep Quality had a large effect size. As seen in Table 7 TMD, Fatigue, and ERA had a significant main effect of Group. TMD and Fatigue had higher scores in the control group. ERA had higher scores in the PMR group. ERA had a large effects size; TMD and Fatigue had medium effect sizes.

Another series of 2x2 mixed ANOVA analyses were conducted comparing the PMR group (n = 30) to the 'control' group (n = 11) for TMD, the POMS subscales, and Sleep Quality for week four (T2) to week eight (T3). As seen in Table 8 there were no significant Time x Group interactions.

Table 8 shows there were significant main effects of Time for TMD, Depression, and Confusion, with scores decreasing from T2 to T3. Confusion had a large effect size; TMD and Depression had medium effect sizes.

As seen in Table 8 there were significant main effect of Group for TMD, Depression, ERA, and Sleep Quality. TMD, Depression, and Sleep Quality scores were higher in the control group in T2 and T3. ERA showed higher scores in the PMR group for T2 and T3. TMD, Depression, ERA, and Sleep Quality had medium effect sizes.

Table 7

TMD, POMS Subscales, and Sleep Quality: Descriptive Statistics at Baseline and Week 4, and Repeated Measures ANOVA for the PMR and Control Groups.

Variable	PMR N = 33		Control N = 14		ANOVA		
	T1 Mean (SD)	T2 Mean (SD)	T1 Mean (SD)	T2 Mean (SD)	Time F(1, 45)	Group F(1, 45)	Time x Group F(1, 45)
TMD	108.67 (22.22)	105.82 (21.70)	119.57 (23.95)	118.43 (18.70)	.246, p = .622, ηp^2 = .005	4.281, p = .044, ηp^2 = .087*	.045, p = .833, ηp^2 = .001
Tension	7.79 (4.91)	6.33 (4.92)	8.29 (6.32)	7.42 (4.45)	1.549, p = .220, ηp^2 = .033	.360, p = .551, ηp^2 = .008	.103, p = .749, ηp^2 = .002
Anger	3.30 (4.26)	3.67 (4.29)	5.07 (6.28)	5.07 (3.71)	.045, p = .833, ηp^2 = .001	1.834, p = .182, ηp^2 = .039	.045, p = .833, ηp^2 = .001
Fatigue	6.85 (3.90)	5.70 (3.58)	9.14 (4.13)	7.71 (3.50)	4.161, p = .047, ηp^2 = .085*	4.450, p = .040, ηp^2 = .090*	.048, p = .828, ηp^2 = .001
Depression	4.91 (5.43)	4.55 (5.42)	6.71 (5.85)	7.71 (5.40)	.109, p = .743, ηp^2 = .002	2.905, p = .095, ηp^2 = .061	.499, p = .484, ηp^2 = .011
Confusion	5.94 (4.40)	6.24 (3.83)	6.00 (4.21)	7.36 (3.86)	1.600, p = .212, ηp^2 = .034	.270, p = .606, ηp^2 = .006	.645, p = .426, ηp^2 = .014
ERA	13.88 (4.08)	14.33 (3.44)	10.79 (2.39)	11.57 (3.67)	.684, p = .413, ηp^2 = .015	11.429, p = .002, ηp^2 = .203*	.049, p = .826, ηp^2 = .001
Vigour	6.24 (3.61)	6.33 (3.81)	4.86 (3.42)	5.29 (2.87)	.158, p = .693, ηp^2 = .004	1.716, p = .197, ηp^2 = .037	.067, p = .797, ηp^2 = .001
Sleep Quality	2.58 (0.66)	2.09 (0.52)	2.71 (0.73)	2.43 (0.65)	17.394, p = <.001, ηp^2 = .279*	1.822, p = .184, ηp^2 = .039	1.162, p = .287, ηp^2 = .025

*Significant at <.05 level.

Note. PMR = Progressive muscle relaxation, ERA = Esteem-related affect, TMD = Total mood disturbance.

Table 8

TMD, POMS Subscales, and Sleep Quality: Descriptive Statistics at Week 5 and Week 8, and Repeated Measures ANOVA for the PMR and Control Groups.

Variable	PMR N = 30		Control N = 11		ANOVA		
	T2 Mean (SD)	T3 Mean (SD)	T2 Mean (SD)	T3 Mean (SD)	Time F(1, 39)	Group F(1, 39)	Time x Group F(1, 39)
TMD	105.90(22.50)	96.80(17.98)	118.73(19.11)	110.09(15.34)	5.405, p = .025, ηp^2 = .122*	5.119, p = .029, ηp^2 = .116*	.004, p = .952, ηp^2 = .000
Tension	6.33 (5.05)	4.63 (3.96)	7.18 (4.75)	6.73 (2.72)	2.103, p = .155, ηp^2 = .051	1.183, p = .283, ηp^2 = .029	.703, p = .407, ηp^2 = .018
Anger	3.77 (4.33)	1.87 (2.87)	4.91 (4.01)	4.27 (3.98)	2.632, p = .113, ηp^2 = .063	2.751, p = .105, ηp^2 = .066	.653, p = .424, ηp^2 = .016
Fatigue	5.50 (3.65)	5.13 (4.18)	7.91 (3.86)	7.36 (3.96)	.452, p = .505, ηp^2 = .011	3.714, p = .061, ηp^2 = .087	.017, p = .896, ηp^2 = .000
Depression	4.60 (5.46)	2.53 (3.69)	7.64 (5.70)	5.00 (3.71)	5.902, p = .020, ηp^2 = .131*	4.188, p = .048, ηp^2 = .097*	.087, p = .770, ηp^2 = .002
Confusion	6.47 (3.89)	4.27 (3.35)	7.09 (4.13)	5.91 (4.01)	7.664, p = .009, ηp^2 = .164*	.934, p = .340, ηp^2 = .023	.695, p = .695, ηp^2 = .018
ERA	14.43 (3.56)	14.70 (3.29)	11.27 (3.13)	13.27 (4.47)	2.671, p = .110, ηp^2 = .064	4.872, p = .033, ηp^2 = .111*	1.562, p = .219, ηp^2 = .039
Vigour	6.33 (3.70)	6.93 (3.35)	4.73 (2.69)	5.91 (2.39)	2.324, p = .135, ηp^2 = .056	1.704, p = .199, ηp^2 = .042	.248, p = .621, ηp^2 = .006
Sleep Quality	2.07 (0.52)	2.03 (0.67)	2.36 (0.67)	2.55 (0.69)	.549, p = .463, ηp^2 = .014	4.316, p = .044, ηp^2 = .100*	1.153, p = .290, ηp^2 = .029

*Significant at <.05 level.

Note. PMR = Progressive muscle relaxation, ERA = Esteem-related affect, TMD = Total mood disturbance.

Visual Analogue Scale

Visual analogue scales (VAS) were completed once a week for the first four weeks of the study. Ratings of Overall Feeling, Relaxation, and Stress were taken before and after the sessions, to determine the acute effects of the interventions. In the SB group, 53 participants completed at least one of the weekly VAS measures; however, only 35 of these participants listened to at least one audio track (session). In the PMR group, 48 participants completed at least one of the weekly VAS measures; however, only 24 of these participants completed at least one session. Average scores of all pre and post VAS measures were calculated for the 35 participants in the SB group and the 24 participants in the PMR group who completed at least one VAS session. The averaged scores were for each of the three VAS measures separately. Paired samples t-tests (pre versus post) for each of the averaged VAS measures were conducted. Table 9 shows ratings of Overall Feeling significantly increased post session in both the SB and PMR group (p = <.001). Similarly, Relaxation ratings significantly increased post session in both SB and PMR groups (p = <.001). Finally, Stress ratings significantly decreased post session in both SB and PMR groups (p = <.001). Figure 3 shows the pre and post session scores of the VAS measures for the SB group. Figure 4 shows the pre and post session scores of the VAS measures for the PMR group.

Table 9

Visual Analogue Scale Descriptive Statistics for Overall Feeling, Relaxation, and Stress Pre and Post Session for SB and PMR Groups.

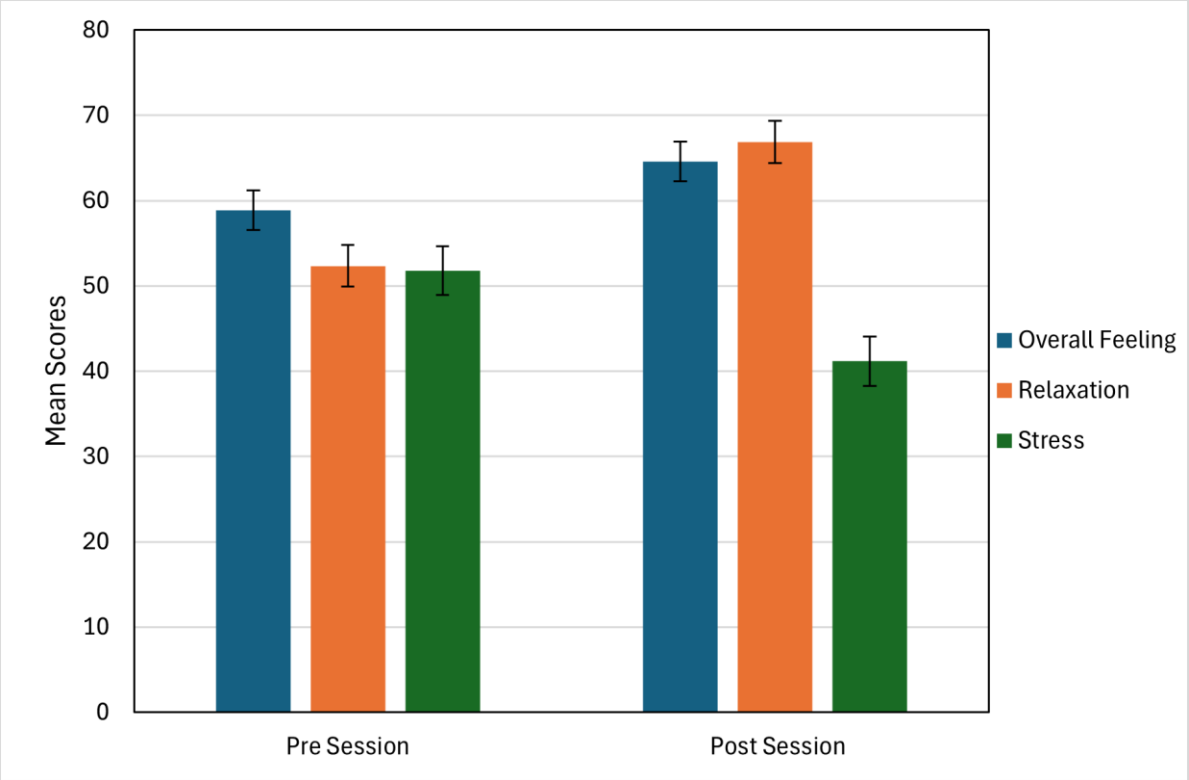
	SB N = 35		PMR N = 24	
Variable	Pre-Session Mean (SD)	Post-Session Mean (SD)	Pre-Session Mean (SD)	Post-Session Mean (SD)
Overall Feeling	58.84 (13.70)	64.60 (14.15)	60.02 (14.30)	71.65 (12.83)
Relaxation	52.33 (14.51)	66.86 (17.26)	52.98 (22.09)	74.90 (16.27)
Stress	51.79 (16.97)	41.16 (18.71)	48.08 (18.07)	32.92 (16.59)

Note. Only those who completed at least one session were included in the analyses.

SB = Singing bowls, PMR = Progressive muscle relaxation.

Figure 3

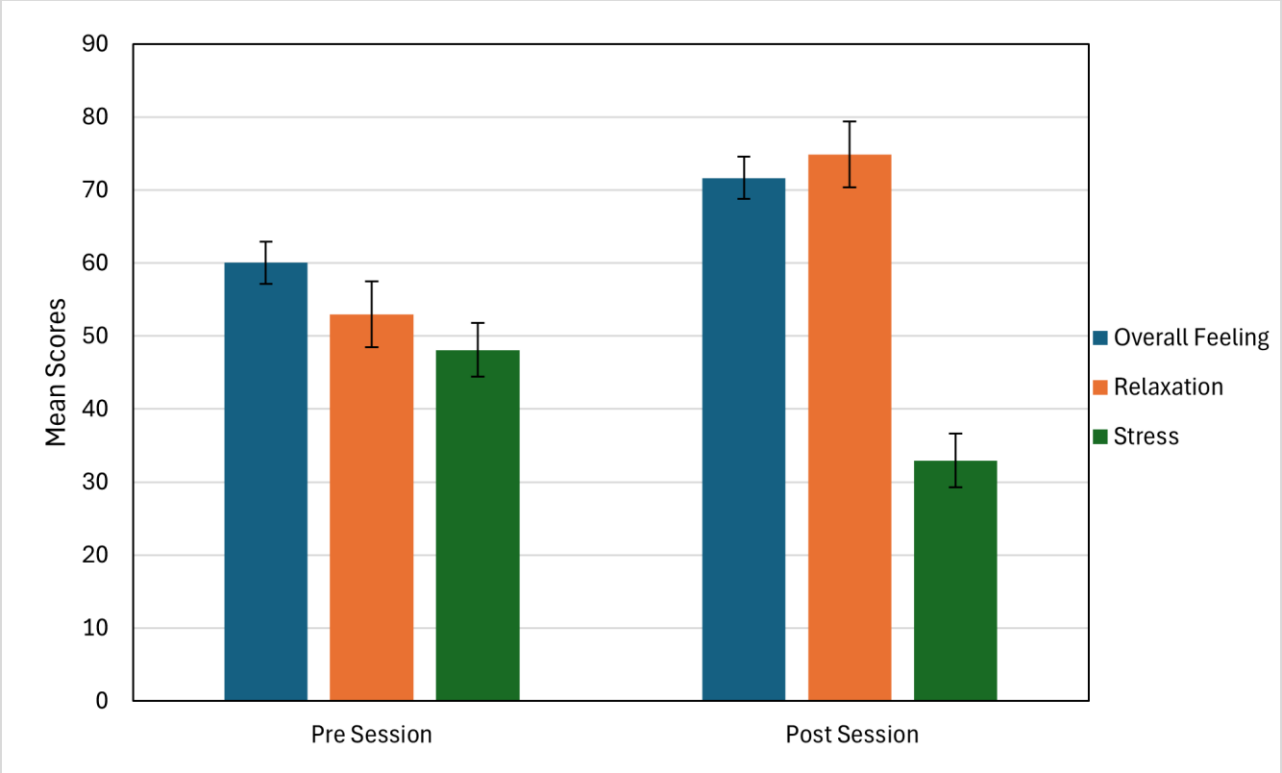
SB Visual Analogue Scales Pre and Post Session Means



Note. The figure depicts the pre and post session scores for overall feeling, relaxation, and stress for the Singing bowls (SB) group for those who completed minimum one session.

Figure 4

PMR Visual Analogue Scales Pre and Post Session Means

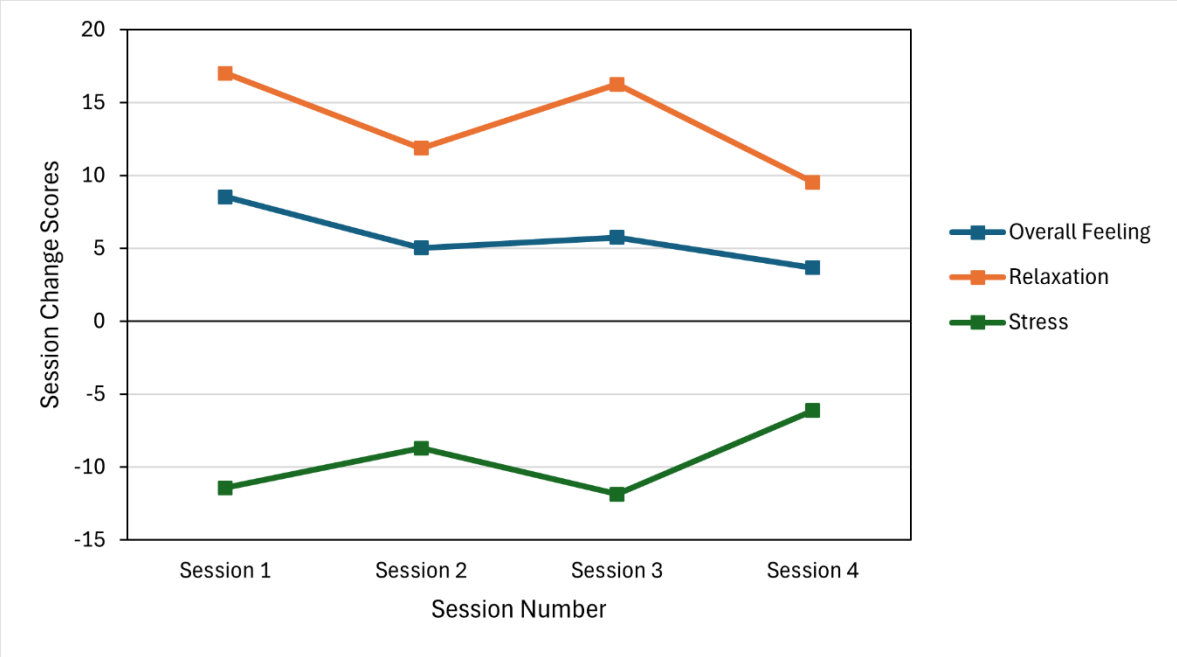


Note. The figure depicts the pre and post session scores for overall feeling, relaxation, and stress for the Progressive muscle relaxation (PMR) group for those who completed minimum one session.

Figures 5 and 6 show the mean change scores across the four VAS sessions for each of the measures for the SB and PMR groups. As seen in Figures 5 and 6, large changes were observed in the first session in all measures in both interventions. Smaller changes were observed in session 2 in all measures except Stress in the PMR group. Session 2 Stress maintained a constant large change score. Large changes were observed in session 3 in all measures except Stress in the PMR group. Session 3 Stress maintained a constant large change score. Session 4 showed a smaller change score in all measures.

Figure 5

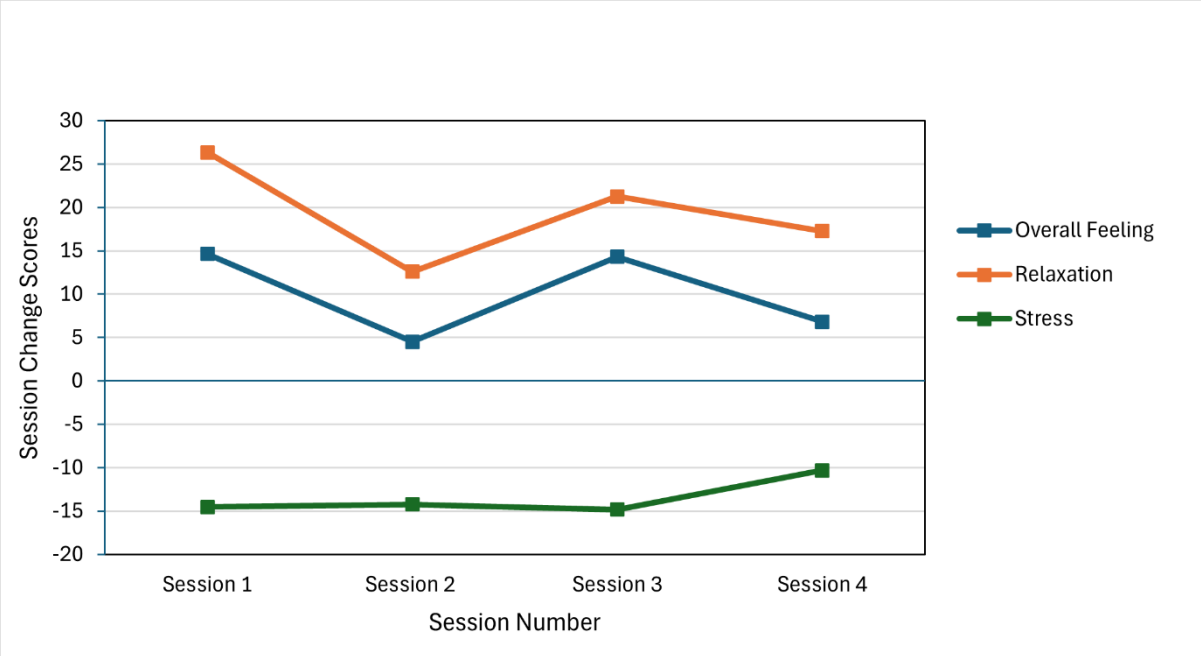
SB Visual Analogue Scales Mean Change Scores Over Sessions



Note. This figure depicts the change scores of four visual analogue scales sessions in overall feeling, relaxation, and stress for the Singing bowls (SB) group for those who completed at least one session.

Figure 6

PMR Visual Analogue Scales Mean Change Scores Over Sessions

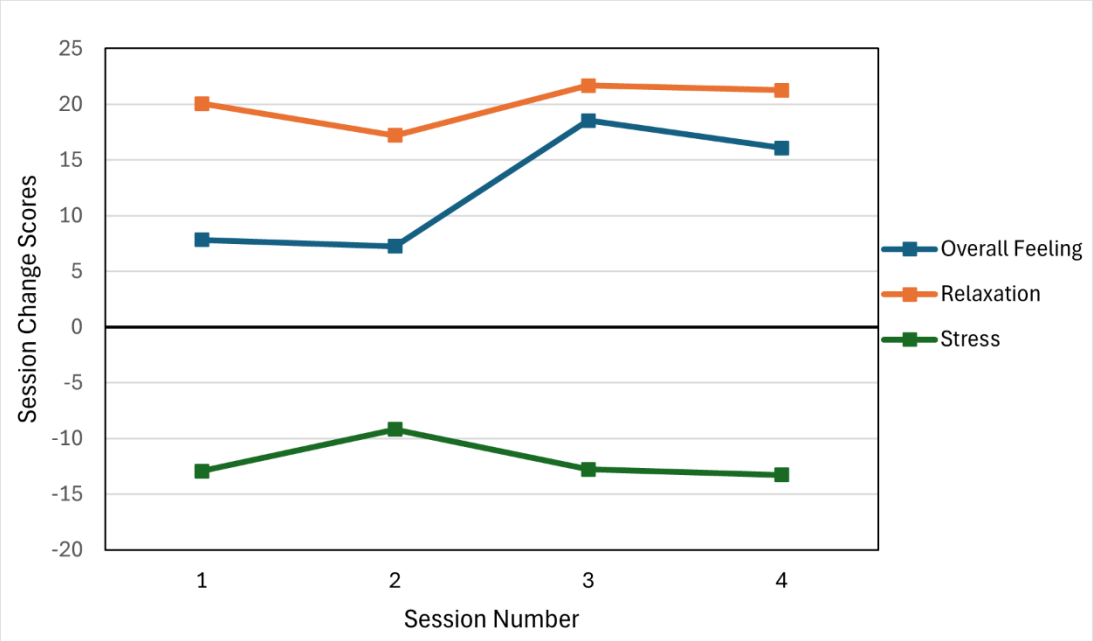


Note. This figure depicts the change scores of four visual analogue scales sessions in overall feeling, relaxation, and stress for the Progressive muscles relaxation (PMR) group for those who completed at least one session.

Figure 7 shows the mean change scores across the four VAS sessions for each of the measures for the participants who did not listen to the sessions but completed the VAS measures. As seen in Figure 7, Overall Feeling remained constant between sessions 1 and 2. Session 3 shows a large increase in change score before a slight decrease at session 4. Relaxation and Stress change scores remain fairly constant across the sessions with Relaxation showing a slight decrease at session 2 and Stress showing a slight increase at session 2.

Figure 7

Control Visual Analogue Scales Mean Change Scores Over Sessions



Note. This figure depicts the change scores of four visual analogue scales sessions in overall feeling, relaxation, and stress for the participants who did not complete the session but did complete the visual analogue scale measures.

Session Completion

To investigate the acceptability and use of the interventions between baseline and week four and between week five and week eight, session listening frequencies were analysed. Paired samples t-tests were conducted to compare session completion between the first and second half of the study for SB and PMR group separately. As shown in Table 10 there was a significant difference in session completion between baseline and week four and week five and week eight for both groups.

Table 10

Descriptive Statistics of Session Completion in the Intervention Groups from Baseline to Week Four and Week Five to Week Eight.

Session Completion	Baseline – T2		T2 – T3			
	Mean	SD	Mean	SD	t(45)	*p*
SB (n = 46)	6.26	4.34	1.72	2.59	9.12	<.001*
PMR (n = 46)	4.13	3.82	0.96	1.91	8.04	<.001*

*Significant at <.05 level

Note. Only those who completed at least one session were included in the analyses.

SB = Singing Bowls, PMR = Progressive muscle relaxation.

Session Listening Time

We were interested in the time-of-day participants were listening to the sessions. Qualtrics recorded the time and date participants listened to the sessions. Using this information, these times were recoded into one of four time periods of the day. 12am – 6am, 6am – 12pm, 12pm – 6pm, 6pm – 12am. Using these recoded timepoints participants most common listening time was taken as the time they listened to the sessions. Chi-square analyses were conducted to determine the time of day most participants listened to the sessions. As seen in Table 11, most of the participants listened to the sessions between 12pm and 6pm.

Table 11

Time-of-Day Session Listening Descriptive Statistics for the Intervention Groups

Session listening time	SB N = 46		PMR N = 46	
	N	% of group	N	% of group
12am – 6am	3	6.5%	2	5.4%
6am – 12pm	4	8.7%	4	8.7%
12pm – 6pm	31	67.4%	25	60.9%
6pm – 12am	8	17.4%	15	25%

Note. Only those who completed at least one session were included in the analyses.

SB = Singing bowls. PMR = Progressive muscle relaxation.

We were interested to see if participants completed the interventions and questionnaires on the days the reminders were emailed. Table 12 shows the number and percentage of participants who completed the sessions on the day they were emailed. As shown in Table 12, most of the participants did not complete the interventions on the reminder days. Table 13 shows the number and percentage of participants who completed the questionnaires on the day they were emailed. As seen in Table 13, around half of participants did complete the questionnaires on the day they were emailed.

Table 12

Description Statistics for Participants who Started the Sessions on the Day they were Sent in the Intervention Groups from Baseline to Week 4.

Session Number	SB			PMR		
	N started session	N listened on day sent	% of Group	N started session	N listened on day sent	% of Group
1	56	25	44.6%	52	27	51.9%
2	51	7	13.7%	45	16	35.6%
3	49	9	18.4%	43	6	14.0%
4	45	8	17.8%	36	8	22.2%
5	45	5	11.1%	34	9	26.5%
6	41	7	17.1%	30	2	6.7%
7	33	3	9.1%	28	5	17.9%
8	27	4	14.8%	28	4	14.3%
9	25	4	16.0%	28	9	32.1%
10	20	1	5.0%	22	5	22.7%
11	17	0	0%	17	5	29.4%
12	11	3	27.3%	11	3	27.3%

Note. This table depicts the number and percentage of participants who completed the intervention session on the day it was emailed. All participants were included in the analysis regardless of session completion.

SB = Singing bowls, PMR = Progressive muscle relaxation

Table 13

Description Statistics for Participants who Completed Questionnaires on the day they were sent in the Intervention Groups.

Questionnaire	SB			PMR		
	N completed the questionnaire	N completed questionnaire on day it was sent	% of Group	N completed the questionnaire	N completed questionnaire on day it was sent	% of Group
T1	56	25	44.6%	52	27	51.9%
T2	44	25	56.8%	41	20	48.8%
T3	43	31	72.1%	41	27	65.9%

Note. This table depicts the number and percentage of participants who completed the questionnaires on the day it was emailed. All participants were included in the analysis regardless of session completion.

SB = Singing bowls, PMR = Progressive muscle relaxation, T1 = Baseline, T2 = Week Four, T3 = Week Eight.

Correlations

Bivariate Pearson's correlations were conducted to examine the association between change in scores on TMD, the POMS subscales, and Sleep Quality and number of sessions completed in each intervention separately. This was to determine if the number of sessions completed influenced the change in scores and what direction this was in. Table 14 shows the correlations for the SB group for baseline to week four. Table 15 shows the correlations for the PMR group for baseline to week four. Only Sleep Quality change scores and the number of sessions completed in weeks one – four in the

SB group had a significant negative correlation. This suggests that listening to more sessions was associated with greater improvements in Sleep Quality.

Table 14

Descriptive Statistics and Correlations for Session Completion and Change Scores of TMD, POMS Subscales, and Sleep Quality for the SB group for Baseline to Week Four.

Variable	N	Mean	SD	*p*
Session completion	46	6.26	4.33	-
TMD	38	-13.16	17.73	.778
Tension	38	-2.82	4.47	.415
Anger	38	-1.29	4.24	.926
Fatigue	38	-2.34	3.72	.694
Depression	38	-2.03	3.76	.588
Confusion	38	-1.42	3.31	.970
Esteem-Related Affect	38	1.58	3.48	.519
Vigour	38	1.68	4.22	.453
Sleep Quality	38	-0.21	0.53	.047*

*Significant at <.05 level.

Note. Only those who completed at least one session were included in the analyses.

TMD = Total mood disturbance.

Table 15

Descriptive Statistics and Correlations for Session Completion and Change Scores of TMD, POMS Subscales, and Sleep Quality for the PMR group for Baseline to Week Four.

Variable	N	Mean	SD	*p*
Session Completion	46	4.13	3.81	-
TMD	33	-2.85	22.64	.621
Tension	33	-1.45	4.64	.260
Anger	33	0.36	4.46	.661
Fatigue	33	-1.15	3.59	.752
Depression	33	-0.36	5.20	.848
Confusion	33	0.30	4.01	.947
Esteem-Related Affect	33	0.45	4.99	.254
Vigour	33	0.09	4.40	.278
Sleep Quality	33	-0.48	0.62	.972

*Significant at <.05 level.

Note. Only those who completed at least one session were included in the analyses. TMD = Total mood disturbance.

Correlational analyses were also conducted for each of the measures change scores for weeks five to eight and the session completion for weeks five to eight for both interventions separately. There were no significant correlations (see Table M1 in Appendix M and Table N1 in Appendix N). Bivariate Pearson's correlations were conducted for each of the measures change scores from baseline to week eight and the overall session completion for both interventions separately. There were no significant correlations (see Table O1 Appendix O and Table P1 in Appendix P).

Summary

Table 16 shows a summary of the results of the study for the SB and PMR groups. As seen in Table 16, there were significant effects for both the SB and PMR groups in TMD,

Tension, Fatigue, and Sleep Quality. There were additional significant effects for the SB group in Depression and Vigour. There were additional significant effects in the PMR group in Anger and Confusion.

Table 16

Summary of Intervention Groups Main Findings

	Singing Bowls			Progressive Muscle Relaxation		
	Overall	Week 1 - 4	Week 4 - 8	Overall	Week 1 - 4	Week 4 - 8
TMD	✓	✓		✓		
Tension	✓	✓		✓		
Anger				✓		
Fatigue	✓	✓		✓		
Depression	✓	✓				
Confusion				✓		✓
ERA						
Vigour	✓	✓				
Sleep Quality	✓	✓		✓	✓	

Note. TMD = Total mood disturbance

Chapter 4: Discussion

The current study was a parallel cohort non-comparative study. The aim of the research was to evaluate the effectiveness of quartz crystal singing bowls music, specifically the track “Tranquility”, and PMR on mood, sleep, and stress in young adults. SB music has not been widely researched but shows promise as a potential intervention that may be beneficial to individuals struggling with mild mood, stress, and sleep issues. PMR was chosen as a positive control due to the vast literature surrounding its benefits, being easy to complete, easily accessible, and a widely used relaxation technique. The study design allowed for SB and PMR interventions to be conducted at the same time without directly comparing the interventions to each other, apart from showing the comparability of the participants recruited into each group. The interventions were not compared due to SB not being a widely researched intervention for mood and sleep, especially in young adults.

Overall, the findings were positive, SB music had beneficial long-term outcomes (at eight weeks) for total mood disturbance (TMD), some POMS subscales (Tension, Depression, Fatigue, and Vigour), and Sleep Quality. SB music had beneficial acute effects for Overall Feeling, Relaxation, and Stress. PMR had long-term beneficial outcomes for TMD, some POMS subscales (Tension, Anger, Fatigue, and Confusion), and Sleep Quality. PMR had beneficial acute effects for Overall Feeling, Relaxation, and Stress.

Singing Bowls

The current study found over the eight weeks significant decreases in TMD, Tension, Fatigue, and Depression and significant increases in Vigour in the SB group. There were significant improvements in Sleep Quality in the SB group over the eight weeks. Over the first four weeks TMD, Tension, Fatigue, Depression, Vigour, and Sleep Quality showed significant improvements in the SB group. A potential explanation for some measures having a significant improvement from baseline to week four but not having further significant incremental improvements during weeks five – eight could be due to the reduction in session completion from week five to week eight. This may be due to the reminder emails being reduced to once a week during weeks five – eight rather than three times a week during the first four weeks. As well as long-term improvements, listening to the SB music showed positive acute effects in Overall Feeling, Relaxation, and Stress.

The improvement of sleep and mood subscales in the current study indicates that SB could be utilized by individuals to improve their mood and sleep. The current study builds on a previous pilot study conducted in 11 participants by Matthews et al. (2023) who found a significant reduction in Depression scores after a single in-person SB session. The current study found more positive outcomes in addition to improvement in Depression. Likewise, Goldsby et al. (2017) found significant reductions in self-reported Depression, Anxiety, and all POMS subscales as well as significant increases in Spiritual Wellbeing following a single in-person SB session. The measures were taken directly before and after the intervention. Interestingly, Goldsby et al. (2017) found those who had never experienced SB previously experienced greater reduction in Tension, Depression, and Anxiety than those who were experienced. The participants of

the current study were SB inexperienced which could have contributed to the positive results in the current study.

The SB group showed a pattern of positive acute effects in the current study highlighting that SB music may help in relaxing, de-stressing, and improving overall feeling in young adults in a short period of time. The findings were similar to Cotoia et al. (2018) who found significant reductions in Self-Reported Anxiety and Stress (as measured by physiological measures) in their study of patients awaiting surgery after a single SB session (music was delivered by headphones). Likewise, Trivedi and Saboo (2019) found a significant decrease in Stress and significant increase in relaxation (as measured by physiological measures) after a single in-person SB session. Rio-Alamos et al. (2023) also found a significant decrease in Self-Reported Anxiety and an increase in Relaxation (as indicated by physiological measures) after a single in-person SB session.

While we could not find previous research investigating SB and sleep, Bergmann et al. (2020) reported that a single in-person SB session increased subjective sleepiness after relaxing for 20 minutes. The current study is potentially one of the first to investigate the effects of SB music on sleep quality. Previous research with music listening could suggest several possible reasons for SB effect on stress, mood, and sleep. According to Dickson and Schubert (2019) the proposed reasons included music listening increasing both physiological and psychological relaxation, masking background noises, bringing joy to increase mood, being used for distraction from stressful thoughts, and increasing sleep correlated brain waves. There is evidence suggesting SB changes brain waves from agitated waves to relaxed brain waves, this is

also seen when listening to relaxing music, suggesting similar outcomes (Goldsby & Goldsby, 2020). The current study's finding of SB improving sleep quality may assist in improving mood as when sleep is good people tend to feel better.

Many of the previous studies showed more improvements across more areas of function than the current study. However, most of the previous studies delivered the SB music in-person with a professional playing them, whereas the music in the current study was a recording delivered via headphones. The current study and Cotoia et al. (2018) were the only two studies found that delivered SB via recordings and the current study was the only study found that was fully online. Both Cotoia et al. (2018) and the current study demonstrates how SB music is effective when delivered via recording. The current study builds on prior research by highlighting the potential for SB music to be delivered online making the intervention more accessible to the wider population as many individuals may be unable to access SB in-person for a variety of reasons (e.g., cost, location).

Most of the previous studies showed the acute effects of SB through a long single session whereas the current study measured both the acute and long-term (eight weeks) effects of SB. The current study is potentially the first study to measure the long-term effects of SB on mood and sleep quality outcomes. This builds on prior research by demonstrating the potential for SB to have beneficial effects after multiple uses. As seen in the current study, more significant effects occurred when listening was more frequent (weeks one – four) compared to when listening was less frequent (weeks five – eight), this could mean that if individuals continue to regularly listen to the SB music the beneficial effects could be maintained. Longitudinal music listening studies show that

the positive effects of music listening continue over the study period due to the continuous listening (Chue et al., 2018; Hausenblas et al., 2019; Linnemann et al., 2015). The current study results could suggest that SB music could have a long-term effect if SB music is regularly listened to.

Progressive Muscle Relaxation

The current study found over the eight weeks significant reductions in TMD, Tension, Anger, Fatigue, Confusion, and improvement in Sleep Quality. Over the first four weeks there was a significant improvement in Sleep Quality. Over weeks five – eight there was a significant reduction in Confusion. A potential explanation for these limited improvements during baseline and week four could be due to the high number of participants who completed only one session over the four weeks (n = 20). This could suggest more than one session is needed for a significant effect to occur. A potential explanation for the limited improvements during weeks five – eight may be due to the lower proportion of participants completing the assessments. Interestingly, while only Confusion had a significant effect, many scores improved during weeks five – eight (see Table 5). Potentially, participants were listening to PMR recordings outside the sessions due to there being many different audios available. As well as long-term improvements, completing PMR showed positive acute effects in Overall Feeling, Relaxation, and Stress.

The current study's results support the claim made by Palkar et al. (2021) that PMR will decrease muscle tension and improve mental states. Our findings of improved mood outcomes agree with previous studies. While the current study did not measure anxiety there were reductions in Tension scores. Kabakcıoğlu and Ayaz-Alkaya (2024)

found significant reductions in Depression, Anxiety, and Stress in adolescents after eight weeks of online PMR. Similarly, Gangadharan and Madani (2018) found significant reduction in Depression, Anxiety, and Stress in undergraduate nurses after five weeks of in-person PMR. The current study had greater improvements in mood outcomes than the previous studies, potentially due to the current studying having more mood subscales than the previous studies. Therefore, the current study builds on prior research by showing more areas of improvement in mood.

The current study's finding of improved Sleep Quality is supported by previous research. Liu et al. (2020) found a significant improvement in Sleep Quality and reduction in Anxiety scores after five sessions of in-person PMR. Additionally Talo and Turan (2023) found significant improvement in Depression, Sleep scores, and Quality of Life in epilepsy patients after four weeks of at home PMR. Another study found significant decreases in Stress and decreased cognitive pre sleep arousal in university students after four weeks of at home PMR (Pickett et al., 2024). Cognitive pre sleep arousal is the level of mental stimulation experienced before sleep (Gorgoni et al., 2021). These studies had greater positive outcomes in more areas of function than the current study. However, some of the studies were fully in-person and some had an in-person training/information session prior to beginning the study. The current study was fully online with no in-person sessions which could have contributed to participants not correctly performing the exercises.

The acute effects of PMR in the current study show increases in Overall Feeling and Relaxation and reduction in Stress after the sessions. These findings show that PMR can have beneficial effects in short periods of time. Tsai et al. (2021) findings of

significant increases in acute Relaxation between pre and post sessions in their school-based study support the current study. The increase in relaxation could be due to the release of tension within the body, a significant finding within the current study. Additionally, relaxation blocks inner thoughts, improves concentration, and reduces anticipatory anxiety (Palkar et al., 2021) which could also explain the acute relaxation outcomes. Interestingly, Tsai et al. (2021) also measured the effects of PMR on long-term levels of Stress using both self-reported and physiological measures, and neither showed statistically significant change. However, the participants in Tsai et al. (2021) study had low baseline stress scores.

The current study's findings build on previous research by being online and self-paced. Many of the previous studies monitored participation through being in-person or having a check-in system to ensure adherence. In previous studies if participants did not complete a certain number of sessions, they were reminded to complete them. The current study monitored session completion only and there was no penalty for participants if they did not complete a session. If participants did not complete sessions, they were not sent additional reminders. This difference between the current study and previous studies builds on prior research by demonstrating the possibility of young adults using PMR in their daily lives. While PMR has shown to be beneficial, participants do need to engage in the intervention for these effects to occur. Some of the previous studies used audio recordings that also contained river sounds which could improve outcomes, unlike in the current study where the audio recording was verbal only. Alternatively, the current study was general university students, whereas some of the previous studies had participants with high symptoms of mental distress, which could result in more positive outcomes.

Most of the previous studies measured the long-term effects of PMR whereas the current study measured the long-term and acute effects of PMR. The current study and Tsai et al. (2021) were the only two studies found who measured acute effects of PMR. While the long-term effects of PMR are widely researched, determining acute effects of PMR may be beneficial in establishing if PMR can be completed on an as needed basis. The current study's acute effects findings show the potential for individuals who are unable to commit to continuous practice being able to have beneficial outcomes after a single session. The acute effects findings support the theory of PMR decreasing body tension and improving mental states. This could be due to the experience of Tension decreasing in the body and relaxation increasing. Relaxation reduces physiological stress responses and anticipatory anxiety, increases the feeling of body control, lowers blood pressure, and improves concentration (Palkar et al., 2021).

Acceptability of the intervention

Most participants gave positive feedback on the study interventions. Out of 82 participants who completed the final questionnaire, 28 participants gave feedback. Fifteen participants gave feedback in the Bowls group, all feedback was positive. Thirteen participants gave feedback in the PMR group, 11 were positive, one was unsure of any feedback, and one was constructive. The constructive feedback made suggestions about the voice for the audio being more relaxing and clarifying when participants should send emails to the researchers. Similarly, one of the positive feedback items for PMR also suggested adding light background noise to the track to make it more relaxing. If the participants do not find the recording relaxing, they may not adhere to the intervention. This highlights how essential it is to have the right recording

to aid in adherence. The recording used in the current study was used because the speaker had a New Zealand accent, and we wanted to ensure participants would be able to understand the instructions. Additionally, participants could have become bored with both audio recordings which may have decreased adherence. Overall, many of the participants gave feedback saying the interventions were relaxing, they enjoyed it, it helped with sleep and was an escape from reality. Two participants commented that the SB helped them sleep better, with one participant commenting that they woke up feeling more refreshed than if they did not listen to it. Two participants (one in the PMR group and one in the SB group) commented that they sometimes fell asleep during the sessions.

Sixty-four participants said they would recommend this intervention to other young people, 34 in the SB group and 31 in the PMR group. One participant in the PMR group commented that their siblings were interested in doing the sessions with them. One participant said they would not recommend this intervention from the SB group; they did not provide an explanation. Two participants were unsure (one in SB, one in PMR). Many participants commented they would/have recommended the interventions to young people who are struggling with anxiety, feeling tense, stress, and sleep issues.

Strengths and Limitations

The current study shows the benefits that can occur with the use of PMR and SB as interventions to improve mood, sleep, and stress outcomes. The study is strengthened by its delivery setting being online. The study being online allowed participants to complete the sessions in their own time and in their own space, which may have been an attractive aspect of the study to some participants. Many of the past

literature in both SB and PMR had participants completing the interventions in person. Within the university setting many participants may not have been able to complete the intervention sessions if they were in-person due to potential clashes with classes as well as many students having jobs in addition to study. The use of being online also allowed more individuals to access the interventions as the University of Waikato has campuses in two New Zealand cities (Tauranga and Hamilton); therefore, being online allowed individuals from both campuses to participate which also increased the current study's sample size. The current study had a good sample size, with 85% of the recruited participants engaging in the sessions and completing at least one set of questionnaires, and 57% completing all sets. This bolsters its potential generalizability.

The study was a longitudinal study, this allowed the study to potentially identify how participants would use it in a real-world setting. Identifying if the interventions would be continued when reminders were decreased from three to once a week allowed the study to determine if adherence would continue in a real world setting and if participants would complete sessions alone. Determining if adherence continues is important for online interventions as if adherence discontinues pathways can be constructed to ensure continued adherence to the intervention. As seen in the current study, when reminders decreased so did the listening frequency. This could have contributed to the decrease in outcomes.

The study is strengthened by having a diverse population of participants. 25% (n = 27) of the sample identified as Māori (32.6% in SB group, 21.7% in PMR group, 12.5% in Control group). Having this research conducted in New Zealand, with the many cultures and ethnicities that are within the population, is a good start to determining the

effectiveness of the interventions with a diverse population. Another strength is the focus on young adults, due to the high prevalence of mood disturbances in this population, the current research contributes to possible interventions to assist in reducing these high rates of mental disturbances.

The current study is not without its limitations. Firstly, the researchers were unable to determine if participants were engaging in the sessions correctly due to the online delivery. This could result in participants not getting the full effects of the interventions; for example, if participants were not correctly performing or just listening to the PMR exercises, they may not experience the full effect of the intervention which could contribute to the smaller number of outcomes in the current study. Secondly, due to the current study being online, the vibrations that are felt during an in-person SB session are removed. There is a theory suggesting that SB vibrations interact with the energy surrounding the body (the biofield) and when this occurs the vibrations will attune the biofield increasing wellbeing and healing processes (Goldsby & Goldsby, 2020; Seetharaman et al., 2024). Therefore, the removal of these vibrations from the current study could have impacted the results by decreasing the effects of SB. Finally, the study only used a single SB audio track with a relaxation focus, therefore it is not generalizable to all SB music. Additionally, the use of a single track of SB music and PMR verbal guidance could increase the possibility of participants becoming bored of the audios and contribute to why they reduced listening time.

Future Research

This study has the potential to pave the way forward to further research concerning SB effectiveness on mood, sleep, and stress, using online interventions.

Future research could investigate the effects of SB in a population of adolescents. Adolescents have a high rate of mental disturbance (Sutcliffe et al., 2023) and there is limited research of the effects of SB music on adolescent mental wellbeing.

The current study found beneficial outcomes in mood and sleep in young adults who participated in an eight-week intervention of either SB or PMR. The results of the current study should be interpreted with caution due to the limitations of the study. However, the current study fills an important gap in SB and PMR research by utilizing online interventions with young adults within a diverse population and highlighting the potential for development of an accessible intervention using SB. Further research is warranted in adolescents, determining the most effective form of administration of the intervention, and the SB music used.

Conclusion

In summary, the current study supports the hypothesis that SB and PMR have beneficial effects on mood, sleep, and stress outcomes in young adults. The current study provides evidence that SB and PMR online interventions over the course of eight weeks show positive effects on mood, sleep, and stress in young adults. We found SB and PMR had longitudinal benefits on Mood and Sleep Quality outcomes and acute benefits on Overall Wellbeing, Relaxation, and Stress outcomes. We believe these findings highlight the potential for SB and PMR to be a useful tool for improving mood, sleep, and stress in young adults in New Zealand.

References

Abend, R., Dan, O., Maoz, K., Raz, S., & Bar-Haim, Y. (2014). Reliability, validity and sensitivity of a computerized visual analog scale measuring state anxiety. *Journal of behavior therapy and experimental psychiatry*, *45*(4), 447-453. https://doi.org/10.1016/j.jbtep.2014.06.004

ACC. (2019). *Mental Injury Assessments for ACC* https://www.acc.co.nz/assets/provider/edb599d6ad/mental-injury-assessment-guide.pdf

ACC. (2024). *Counselling and Therapy*. https://www.acc.co.nz/im-injured/types-of-ongoing-support/counselling-therapy

Ahearn, E. P., & Carroll, B. J. (1996). Short-term variability of mood ratings in unipolar and bipolar depressed patients. *Journal of affective disorders*, *36*(3), 107-115. https://doi.org/10.1016/0165-0327(95)00066-6

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders : DSM-5* (5th ed.). American Psychiatric Association.

American Psychiatric Association. (2022). *Diagnostic and Statistical Manual of Mental Disorders Text Revision: DSM-5-TR*. American Psychicatric Association.

American Psychological Association. (2022, February 14). *What's the difference between stress and anxiety?* https://www.apa.org/topics/stress/anxiety-difference#:~:text=There's%20a%20fine%20line%20between,provide%20you%20additional%20coping%20tools.

Arroll, B., Fernando, A., Falloon, K., Warman, G., & Goodyear-Smith, F. (2011). Development, validation (diagnostic accuracy) and audit of the Auckland sleep questionnaire: A new tool for diagnosing causes of sleep disorders in primary care. *Journal of primary health care*, *3*(2), 107-113. https://doi.org/10.1071/hc11107

Ask, H., Torgersen, S., Seglem, K. B., & Waaktaar, T. (2014). Genetic and environmental causes of variation in adolescent anxiety symptoms: A multiple-rater twin study. *Journal of anxiety disorders*, *28*(4), 363-371. https://doi.org/10.1016/j.janxdis.2014.04.003

Asnaani, A., Richey, J. A., Dimaite, R., Hinton, D. E., & Hofmann, S. G. (2010). A Cross-Ethnic Comparison of Lifetime Prevalence Rates of Anxiety Disorders. *The journal of nervous and mental disease*, *198*(8), 551-555. https://doi.org/10.1097/NMD.0b013e3181ea169f

Bergmann, M., Riedinger, S., Stefani, A., Mitterling, T., Holzknecht, E., Grassmayr, P., Högl, B., & Liguori, C. (2020). Effects of singing bowl exposure on Karolinska sleepiness scale and pupillographic sleepiness test: A randomised crossover study. *PloS one*, *15*(6), e0233982-e0233982. https://doi.org/10.1371/journal.pone.0233982

BlackDeer, A. A., Patterson, A. D., Maguin, E., & Beeler-Stinn, S. (2023). Depression and anxiety among college students: Understanding the impact on grade average and differences in gender and ethnicity. *Journal of American College Health*, *71*(4), 1091-1102. https://doi.org/10.1080/07448481.2021.1920954

Buli, B. G., Larm, P., Nilsson, K., & Giannotta, F. (2023). Trends in adolescent mental health problems 2004–2020: do sex and socioeconomic status play any role? *Scandinavian journal of public health*, 14034948231165552-14034948231165552. https://doi.org/10.1177/14034948231165552

Chellew, K., Evans, P., Fornes-Vives, J., Pérez, G., & Garcia-Banda, G. (2015). The effect of progressive muscle relaxation on daily cortisol secretion. *Stress*, *18*(5), 538-544. https://doi.org/10.3109/10253890.2015.1053454

Chen, H., He, Q., Wang, M., Wang, X., Pu, C., Li, S., & Li, M. (2022). Effectiveness of CBT and its modifications for prevention of relapse/recurrence in depression: A systematic review and meta-analysis of randomized controlled trials. *Journal of affective disorders*, *319*, 469-481. https://doi.org/10.1016/j.jad.2022.09.027

Christman, E., Barone, D., Dzubay, S., Ernstmeyer, K., Green, J., Johnson-Schuh, D., Pritchard, R., Sward, M., & Tays, A. (2022). Chapter 9: Anxiety Disorders. In K. Ernstmeyer, & Christman E, (Ed.), *Nursing: Mental Health and Community Concepts*. https://www.ncbi.nlm.nih.gov/books/NBK590031/

Chue, A. E., Gunthert, K. C., Kim, R. W., Alfano, C. A., & Ruggiero, A. R. (2018). The role of sleep in adolescents' daily stress recovery: Negative affect spillover and positive affect bounce-back effects. *Journal of adolescence (London, England.)*, *66*(1), 101-111. https://doi.org/10.1016/j.adolescence.2018.05.006

Conard, N. J., Malina, M., & Münzel, S. C. (2009). New flutes document the earliest musical tradition in southwestern Germany. *Nature (London)*, *460*(7256), 737-740. https://doi.org/10.1038/nature08169

Cotoia, A., Dibello, F., Moscatelli, F., Sciusco, A., Polito, P., Modolo, A., Gallo, C., Cibelli, G., & Cinnella, G. (2018). Effects of Tibetan Music on Neuroendocrine and Autonomic Functions in Patients Waiting for Surgery: A Randomized, Controlled Study. *Anesthesiology research and practice*, *2018*, 9683780-9683788. https://doi.org/10.1155/2018/9683780

Cuijpers, P., Berking, M., Andersson, G., Quigley, L., Kleiboer, A., & Dobson, K. S. (2013). A Meta-Analysis of Cognitive-Behavioural Therapy for Adult Depression, Alone and in Comparison with other Treatments. *Canadian journal of psychiatry*, *58*(7), 376-385. https://doi.org/10.1177/070674371305800702

Dickson, G. T., & Schubert, E. (2019). How does music aid sleep? literature review. *Sleep medicine*, *63*, 142-150. https://doi.org/10.1016/j.sleep.2019.05.016

Drake, R. E., Green, A. I., Mueser, K. T., & Goldman, H. H. (2003). The history of community mental health treatment and rehabilitation for persons with severe mental illness. *Community mental health journal*, *39*(5), 427-440. https://doi.org/10.1023/A:1025860919277

Eisenberg, D., Gollust, S. E., Golberstein, E., & Hefner, J. L. (2007). Prevalence and Correlates of Depression, Anxiety, and Suicidality Among University Students. *American journal of orthopsychiatry*, *77*(4), 534-542. https://doi.org/10.1037/0002-9432.77.4.534

Essau, C. A. (2003). Comorbidity of anxiety disorders in adolescents. *Depression and anxiety*, *18*(1), 1-6. https://doi.org/10.1002/da.10107

Farhane-Medina, N. Z., Luque, B., Tabernero, C., & Castillo-Mayén, R. (2022). Factors associated with gender and sex differences in anxiety prevalence and comorbidity: A systematic review. *Science Progress*, *105*(4), 3685042211354. https://doi.org/10.1177/00368504221135469

Feneberg, A. C., Stijovic, A., Forbes, P. A. G., Lamm, C., Piperno, G., Pronizius, E., Silani, G., & Nater, U. M. (2023). Perceptions of Stress and Mood Associated With Listening to Music in Daily Life During the COVID-19 Lockdown. *JAMA network open*, *6*(1), 2250382-2250382. https://doi.org/10.1001/jamanetworkopen.2022.50382

Fenn, K., & Byrne, M. (2013). The key principles of cognitive behavioural therapy. *InnovAiT*, *6*(9), 579-585. https://doi.org/10.1177/1755738012471029

Field, A. P. (2013). *Discovering statistics using IBM SPSS statistics : (and sex and drugs and rock 'n' roll)* (4th ed.). Sage.

Fleming, T., Tiatia-Seath, J., Peiris-John, R., Sutcliffe, K., Archer, D., Bavin, L., Crengle, S., & Clark, T. (2020). Youth19 Rangatahi Smart Survey Initial Findings Hauora Hinengaro / Emotional and Mental Health. *The Youth19 Research Group*.

Gagné, T., Schoon, I., & Sacker, A. (2021). Trends in young adults' mental distress and its association with employment: Evidence from the Behavioral Risk Factor Surveillance System, 1993–2019. *Preventive medicine*, *150*, 106691. https://doi.org/10.1016/j.ypmed.2021.106691

Gangadharan, M. P., & Madani, M. A. H. (2018). Effectiveness of progressive muscle relaxation techniques on depression, anxiety and stress among undergraduate nursing students. *International Journal of Health Sciences and Research*, *8*(2), 155-163.

Gao, L., Curtiss, J., Liu, X., & Hofmann, S. G. (2018). Differential Treatment Mechanisms in Mindfulness Meditation and Progressive Muscle Relaxation. *Mindfulness*, *9*(4), 1268-1279. https://doi.org/10.1007/s12671-017-0869-9

Generaal, E., Timmermans, E. J., Dekkers, J. E. C., Smit, J. H., & Penninx, B. W. J. H. (2019). Not urbanization level but socioeconomic, physical and social neighbourhood characteristics are associated with presence and severity of depressive and anxiety disorders. *Psychological medicine*, *49*(1), 149-161. https://doi.org/10.1017/S0033291718000612

Gibson, S. J. (1997). The Measurement of Mood States in Older Adults. *The journals of gerontology. Series B, Psychological sciences and social sciences*, *52B*(4), P167-P174. https://doi.org/10.1093/geronb/52B.4.P167

Girgus, J. S., & Yang, K. (2015). Gender and depression. *Current opinion in psychology*, *4*, 53-60. https://doi.org/10.1016/j.copsyc.2015.01.019

Goldsby, T. L., & Goldsby, M. E. (2020). Eastern Integrative Medicine and Ancient Sound Healing Treatments for Stress: Recent Research Advances. *Integrative medicine (Encinitas, Calif.)*, *19*(6), 24-30.

Goldsby, T. L., Goldsby, M. E., McWalters, M., & Mills, P. J. (2017). Effects of Singing Bowl Sound Meditation on Mood, Tension, and Well-being: An Observational Study. *Journal of evidence-based complementary & alternative medicine*, *22*(3), 401-406. https://doi.org/10.1177/2156587216668109

Goodwin, R. D., Dierker, L. C., Wu, M., Galea, S., Hoven, C. W., & Weinberger, A. H. (2022). Trends in U.S. Depression Prevalence From 2015 to 2020: The Widening Treatment Gap.

American journal of preventive medicine, *63*(5), 726-733. https://doi.org/10.1016/j.amepre.2022.05.014

Gopichandran, L., Srivastsava, A. K., Vanamail, P., Kanniammal, C., Valli, G., Mahendra, J., & Dhandapani, M. (2021). Effectiveness of progressive muscle relaxation and deep breathing exercise on pain, disability, and sleep among patients with chronic tension-type headache a randomized control trial. *Holistic nursing practice*, 1-12. https://doi.org/10.1097/HNP.0000000000000460

Gorgoni, M., Scarpelli, S., Mangiaruga, A., Alfonsi, V., Bonsignore, M. R., Fanfulla, F., Ferini-Strambi, L., Nobili, L., Plazzi, G., De Gennaro, L., Arnaldi, D., Bonanni, E., Bonetti, G. A., Castronovo, C., Maestri, M., Garbarino, S., Guarnieri, B., Manni, R., Palagini, L., . . . Vicini, C. (2021). Pre-sleep arousal and sleep quality during the COVID-19 lockdown in Italy. *Sleep medicine*, *88*, 46-57. https://doi.org/10.1016/j.sleep.2021.10.006

Grove, J. R., & Prapavessis, H. (1992). Preliminary evidence for the reliability and validity of an abbreviated Profile of Mood States. *International Journal of Sport Psychology*, *23*, 93-109.

Hashim, H. A., Hanafi, H., & Yusof, A. (2011). The effects of progressive muscle relaxation and autogenic relaxation on young soccer players' mood states. *Asian journal of sports medicine*, *2*(2), 99-105. https://doi.org/10.5812/asjsm.34786

Hausenblas, H., Hooper, S., Hooper, D., Coyle, K., & Lynch, T. (2019). Efficacy of Wholetones 2Sleep and classical music on sleep and health behaviors of adults with insomnia symptoms: A single blind, randomized, controlled, crossover pilot trial. *Sleep science (São Paulo, SP)*, *12*(4), 302-306. https://doi.org/10.5935/1984-0063.20190091

Hennessy, S., Sachs, M., Kaplan, J., & Habibi, A. (2021). Music and mood regulation during the early stages of the COVID-19 pandemic. *PloS one*, *16*(10), e0258027-e0258027. https://doi.org/10.1371/journal.pone.0258027

Högberg, B. (2021). Educational stressors and secular trends in school stress and mental health problems in adolescents. *Social science & medicine (1982)*, *270*, 113616-113616. https://doi.org/10.1016/j.socscimed.2020.113616

Javaid, S. F., Hashim, I. J., Hashim, M. J., Stip, E., Samad, M. A., & Ahbabi, A. A. (2023). Epidemiology of anxiety disorders: global burden and sociodemographic associations. *Middle East Current Psychiatry*, *30*(1), 44. https://doi.org/https://doi.org/10.1186/s43045-023-00315-3

Kabakcıoğlu, K. N., & Ayaz-Alkaya, S. (2024). The effect of progressive muscle relaxation on stress, anxiety, and depression in adolescents: A quasi-experimental design. *Journal of pediatric nursing*, *78*, 89-96. https://doi.org/10.1016/j.pedn.2024.06.014

Kim, J., & Chatterjee, S. (2021). Financial Debt and Mental Health of Young Adults. *Financial counseling and planning*, *32*(2), 187-201. https://doi.org/10.1891/JFCP-18-00048

Landry, J. M. (2014). Physiological and Psychological Effects of a Himalayan Singing Bowl in Meditation Practice: A Quantitative Analysis. *American journal of health promotion*, *28*(5), 306-309. https://doi.org/10.4278/ajhp.121031-ARB-528

Lesage, F. X., & Berjot, S. (2011). Validity of occupational stress assessment using a visual analogue scale. *Occupational medicine (Oxford)*, *61*(6), 434-436. https://doi.org/10.1093/occmed/kqr037

Lin, J., & Guo, W. (2024). The Research on Risk Factors for Adolescents' Mental Health. *Behavioral sciences*, *14*(4), 263. https://doi.org/10.3390/bs14040263

Linnemann, A., Ditzen, B., Strahler, J., Doerr, J. M., & Nater, U. M. (2015). Music listening as a means of stress reduction in daily life. *Psychoneuroendocrinology*, *60*, 82-90. https://doi.org/10.1016/j.psyneuen.2015.06.008

Linnemann, A., Wenzel, M., Grammes, J., Kubiak, T., & Nater, U. M. (2018). Music Listening and Stress in Daily Life—a Matter of Timing. *International journal of behavioral medicine*, *25*(2), 223-230. https://doi.org/10.1007/s12529-017-9697-5

Lipson, S. K., Zhou, S., Abelson, S., Heinze, J., Jirsa, M., Morigney, J., Patterson, A., Singh, M., & Eisenberg, D. (2022). Trends in college student mental health and help-seeking by race/ethnicity: Findings from the national healthy minds study, 2013–2021. *Journal of affective disorders*, *306*, 138-147. https://doi.org/10.1016/j.jad.2022.03.038

Liu, K., Chen, Y., Wu, D., Lin, R., Wang, Z., & Pan, L. (2020). Effects of progressive muscle relaxation on anxiety and sleep quality in patients with COVID-19. *Complementary therapies in clinical practice*, *39*, 101132-101132. https://doi.org/10.1016/j.ctcp.2020.101132

Lun, K. W. C., Chan, C. K., Ip, P. K. Y., Ma, S. Y. K., Tsai, W. W., Wong, C. S., Wong, C. H. T., Wong, T. W., & Yan, D. (2018). Depression and anxiety among university students in Hong Kong. *Hong Kong medical journal = Xianggang yi xue za zhi*, *24*(5), 466-472. https://doi.org/10.12809/hkmj176915

Mahmoud, J. S. R., Staten, R. T., Hall, L. A., & Lennie, T. A. (2012). The Relationship among Young Adult College Students' Depression, Anxiety, Stress, Demographics, Life Satisfaction, and Coping Styles. *Issues in mental health nursing*, *33*(3), 149-156. https://doi.org/10.3109/01612840.2011.632708

Majeed, N. M., Lua, V. Y. Q., Chong, J. S., Lew, Z., & Hartanto, A. (2021). Does Bedtime Music Listening Improve Subjective Sleep Quality and Next-Morning Well-Being in Young Adults? A Randomized Cross-Over Trial. *Psychomusicology*, *31*(3-4), 149-158. https://doi.org/10.1037/pmu0000283

Matthews, A., Phillips, M. C., Matthews, L. R., Kumar, S., Pillai, A., & Jameson, M. B. (2023). A Pilot Study Evaluating the Effects of Relaxation Music Played on Quartz Crystal Singing Bowls on Mood in Teenage Males. *J Psychiatry Behav Sci*, *6*(2), 1085.

McLean, C. P., Asnaani, A., Litz, B. T., & Hofmann, S. G. (2011). Gender differences in anxiety disorders: Prevalence, course of illness, comorbidity and burden of illness. *Journal of psychiatric research*, *45*(8), 1027-1035. https://doi.org/10.1016/j.jpsychires.2011.03.006

Mental Health Foundation. (2024). *Accessing Mental Health Services*. https://mentalhealth.org.nz/help/accessing-mental-health-services#:~:text=Accessing%20low%20cost%20mental%20health%20care%3A&text=If%20you%20are%20in%20paid,Aotearoa)%20offer%20free%20counselling%20services

Ministry of Health. (2017a). *Indicator: Provisional diagnosis of mild or greater anxiety (GAD-7)*. https://minhealthnz.shinyapps.io/nz-health-survey-2016-17-mental-health-explorer/_w_2417eaef/#!/explore-indicators

Ministry of Health. (2017b). *Indicator: Provisional diagnosis of mild or greater depression (PHQ-9)*. https://minhealthnz.shinyapps.io/nz-health-survey-2016-17-mental-health-explorer/_w_2417eaef/#!/explore-indicators

Ministry of Health. (2023). *Annual Data Explorer 2021/22: New Zealand Health Survey* https://www.health.govt.nz/publication/annual-update-key-results-2021-22-new-zealand-health-survey

Moreno-Agostino, D., Wu, Y.-T., Daskalopoulou, C., Hasan, M. T., Huisman, M., & Prina, M. (2021). Global trends in the prevalence and incidence of depression:a systematic review and meta-analysis. *Journal of affective disorders*, *281*, 235-243. https://doi.org/10.1016/j.jad.2020.12.035

Ohannessian, C. M., Milan, S., & Vannucci, A. (2017). Gender Differences in Anxiety Trajectories from Middle to Late Adolescence. *Journal of youth and adolescence*, *46*(4), 826-839. https://doi.org/10.1007/s10964-016-0619-7

Palkar, D., Panigrahi, S., Shatadal, P., & Mehta, R. (2021). Impact of Jacobson's Progressive Muscle Relaxation on Stress Levels of Exam Going MBBS Students of a Medical College in South Gujarat, India. *Journal of clinical and diagnostic research*, *15*(8), VC10-VC13. https://doi.org/10.7860/JCDR/2021/48607.15269

Panchal, S., Irani, F., & Trivedi, G. Y. (2020). Impact of Himalayan Singing Bowls Meditation Session on Mood and Heart Rate Variability. *International Journal of Psychotherapy*

Practice and Research, *1*(4), 20 - 24. https://doi.org/https://doi.org/10.14302/issn.2574-612X.ijpr-20-3213

Parodi, K. B., Holt, M. K., Green, J. G., Porche, M. V., Koenig, B., & Xuan, Z. (2022). Time trends and disparities in anxiety among adolescents, 2012–2018. *Social Psychiatry and Psychiatric Epidemiology*, *57*(1), 127-137. https://doi.org/10.1007/s00127-021-02122-9

Pegg, S., Hill, K., Argiros, A., Olatunji, B. O., & Kujawa, A. (2022). Cognitive Behavioral Therapy for Anxiety Disorders in Youth: Efficacy, Moderators, and New Advances in Predicting Outcomes. *Current psychiatry reports*, *24*(12), 853-859. https://doi.org/10.1007/s11920-022-01384-7

Petrowski, K., Albani, C., Zenger, M., Brähler, E., & Schmalbach, B. (2021). Revised Short Screening Version of the Profile of Mood States (POMS) From the German General Population. *Frontiers in psychology*, *12*, 631668-631668. https://doi.org/10.3389/fpsyg.2021.631668

Pickett, S. M., Kozak, A. T., Lanni, D. J., Warnke, A. S., Gaillard, P., & Jarrett, N. L. (2024). The comparison of brief, online mindfulness and relaxation interventions to reduce stress and improve sleep-related outcomes in college students. *Journal of American College Health*, *72*(4), 1085-1093. https://doi.org/10.1080/07448481.2022.2066979

Razali, H., Husain, R., Rahim, M., Endut, N. N., Mat, K. C., Simbak, N., & Latif, A. Z. A. (2017). Impacts of three different relaxation techniques on mood states among athletes. *Malaysian Journal of Public Health Medicine*, *2*, 49-58.

Reiss, F. (2013). Socioeconomic inequalities and mental health problems in children and adolescents: A systematic review. *Social science & medicine (1982)*, *90*, 24-31. https://doi.org/10.1016/j.socscimed.2013.04.026

Rio-Alamos, C., Montefusco-Siegmund, R., Cañete, T., Sotomayor, J., & Fernandez-Teruel, A. (2023). Acute Relaxation Response Induced by Tibetan Singing Bowl Sounds: A

Randomized Controlled Trial. *European journal of investigation in health, psychology and education*, *13*(2), 317-330. https://doi.org/10.3390/ejihpe13020024

Saarikallio, S., & Erkkilä, J. (2007). The role of music in adolescents' mood regulation. *Psychology of music*, *35*(1), 88-109. https://doi.org/10.1177/0305735607068889

Samaranayake, C. B., Arroll, B., & Fernando, A. T. (2014). Sleep disorders, depression, anxiety and satisfaction with life among young adults: A survey of university students in Auckland, New Zealand. *New Zealand medical journal*, *127*(1399), 13-22.

Särkämö, T., Tervaniemi, M., & Huotilainen, M. (2013). Music perception and cognition: development, neural basis, and rehabilitative use of music. *Wiley interdisciplinary reviews. Cognitive science*, *4*(4), 441-451. https://doi.org/10.1002/wcs.1237

Seetharaman, R., Avhad, S., & Rane, J. (2024). Exploring the healing power of singing bowls: An overview of key findings and potential benefits. *Explore (New York, N.Y.)*, *20*(1), 39-43. https://doi.org/10.1016/j.explore.2023.07.007

Silva, S. A., Silva, S. U., Ronca, D. B., Gonçalves, V. S. S., Dutra, E. S., & Carvalho, K. M. B. (2020). Common mental disorders prevalence in adolescents: A systematic review and meta-analyses. *PloS one*, *15*(4), e0232007-e0232007. https://doi.org/10.1371/journal.pone.0232007

Stanhope, J., & Weinstein, P. (2020). The human health effects of singing bowls: A systematic review. *Complementary therapies in medicine*, *51*, 102412-102412. https://doi.org/10.1016/j.ctim.2020.102412

Sutcliffe, K., Ball, J., Clark, T. C., Archer, D., Peiris-John, R., Crengle, S., & Fleming, T. (2023). Rapid and unequal decline in adolescent mental health and well-being 2012–2019: Findings from New Zealand cross-sectional surveys. *Australian and New Zealand journal of psychiatry*, *57*(2), 264-282. https://doi.org/10.1177/00048674221138503

Sutcliffe, K., Wilson, M., Clark, T. C., Crengle, S., & Fleming, T. (2024). Distinct profiles of mental health need and high need overall among New Zealand adolescents – Cluster analysis

of population survey data. *Australian and New Zealand journal of psychiatry*, *58*(8), 678-692. https://doi.org/10.1177/00048674241243262

Talo, B., & Turan, G. B. (2023). Effects of progressive muscle relaxation exercises on patients with epilepsy on level of depression, quality of sleep, and quality of life: A randomized controlled trial. *Seizure*, *105*, 29-36. https://doi.org/10.1016/j.seizure.2023.01.002

Terlizzi, E. P., & Villarroel, M. A. (2020). *Symptoms of Generalized Anxiety Disorder Among Adults: United States, 2019* (378).

Terry, P. C., Lane, A. M., Lane, H. J., & Keohane, L. (1999). Development and validation of a mood measure for adolescents. *Journal of sports sciences*, *17*(11), 861-872. https://doi.org/10.1080/026404199365425

Terwagne, D., & Bush, J. W. M. (2011). Tibetan singing bowls. *Nonlinearity*, *24*(8), R51-R66. https://doi.org/10.1088/0951-7715/24/8/R01

Thase, M. E., & Lang, S. S. (2023). *Beating the blues : new approaches to overcoming dysthymia and chronic mild depression* (1st ed.). Oxford University Press. https://doi.org/10.1093/oso/9780195159189.001.0001

Theodore, R., Bowden, N., Kokaua, J., Ruhe, T., Hobbs, M., Hetrick, S., Marek, L., Wiki, J., Milne, B., Thabrew, H., & Boden, J. (2022). Mental health inequities for Māori youth : a population-level study of mental health service data. *New Zealand medical journal*, *135*(1567), 79-90. https://doi.org/10.26635/6965.5933

Thomas, P. B., Mantey, D. S., Clendennen, S. L., & Harrell, M. B. (2024). Mental Health Status by Race, Ethnicity and Socioeconomic Status among Young Adults in Texas during COVID-19. *Journal of racial and ethnic health disparities*. https://doi.org/10.1007/s40615-024-01923-3

Time, W. S., Fakapulia, I. F., Samalia, L., & Wibowo, E. (2024). The Relationship Between Academic Stress, Sleep Quality, and Psychological Wellbeing in Pasifika and New

Zealand European Students at the University of Otago. *Journal of racial and ethnic health disparities*. https://doi.org/10.1007/s40615-024-02043-8

Trivedi, G. Y., & Saboo, B. (2019). A Comparative Study of the Impact of Himalayan Singing Bowls and Supine Silence on Stress Index and Heart Rate Variability. *Journal of Behavior Therapy and Mental Health*, *2*(1), 40 - 50. https://doi.org/https://doi.org/10.14302/issn.2474-9273.jbtm-19-3027

Tsai, M. L., Cheng, T. H., Yang, Y. K., & Wang, C. J. (2021). A school-based progressive muscle relaxation program for female adolescents: Development and the effectiveness on physiological and psychological evidence. *Healthcare 9*(10), 1319. https://doi.org/10.3390/healthcare9101319

Wilson, A., & Nicolson, M. (2020). *Mental Health in Aotearoa: Results from the 2018 Mental Health Monitor and the 2018/19 New Zealand Health Survey*. Wellington: Te Hiringa Hauora/ Health Promotion Agency.

World Health Organization. (2021). *Mental health of adolescents*. https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health

World Health Organization. (2023). *Depressive Disorder (Depression)*. https://www.who.int/news-room/fact-sheets/detail/depression

World Health Organization. (2024). *Mental Health*. https://www.who.int/health-topics/mental-health#tab=tab_1

Yoo, N., & Jang, S. H. (2023). Perceived household financial decline and physical/mental health among adolescents during the COVID-19 crisis: Focusing on gender differences. *Preventive medicine reports*, *32*, 102119-102119. https://doi.org/10.1016/j.pmedr.2023.102119

Zhao, L., Han, G., Zhao, Y., Jin, Y., Ge, T., Yang, W., Cui, R., Xu, S., & Li, B. (2020). Gender Differences in Depression: Evidence From Genetics. *Frontiers in genetics*, *11*, 562316-562316. https://doi.org/10.3389/fgene.2020.562316

Appendix A: Study Flyer

This appendix consists of the flyer used to recruit participants around the university campus.

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UNIVERSITY OF AUCKLAND
Waipapa Taumata Rau
NEW ZEALAND

The Effects of Quartz Crystal Singing Bowl Music and Guided Relaxation on Mood and Sleep in Rangatahi (young adults)

What is this study about?

- An increasing number of rangatahi (young adults) report low mood and trouble sleeping but accessing help can be challenging.
- We want to find out if listening to music played on singing bowls or guided relaxation exercises improve mood and sleep
- The study is being led by Professor Nicola Starkey, School of Psychology, University of Waikato and Associate Professor Michael Jameson, University of Auckland and has received approval from the University of Waikato Human Research Ethics Committee (HREC(Health)2024#3); humanethics@waikato.ac.nz)

Am I eligible to take part?

- You are aged between 16-25 years, have a good understanding of English, good hearing and have a mobile phone/laptop to access the internet
- You cannot take part if you already use singing bowls or guided relaxation, or are currently receiving treatment from a psychologist or psychiatrist

What am I being asked to do?

- To complete questionnaires about your mood and sleep at three time points and participate in the online intervention three times a week for four weeks (each session is approximately 10 minutes)
- You can participate in the intervention at a time and place that suits you
- As a thank you for your participation you will receive a $30 Warehouse voucher

Who can I speak with about my participation in this project?

- Email the research team on singingbowls@waikato.ac.nz for more information, or to take part.

Appendix B: Eligibility Questionnaire

This appendix consists of the eligibility questionnaire used in T1 of the study.

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Q3.1 The next few questions are to confirm that you are eligible to participate in the study. After that we will ask you to provide some information about you and answer some questions about your mood and your sleep. You can then complete the first relaxation exercise, so make sure you are somewhere comfortable and quiet and have some headphones.

Q3.2 How old are you?

- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24
- 25

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Q3.3 Do you have access to a mobile/tablet or laptop, and headphones so that you can access the intervention?

- ○ No
- ○ Yes

Q3.4 Do you use singing bowls music regularly (more than once a month)?

- ○ No
- ○ Yes

Q3.5 Do you use guided meditation regularly (more than once a month)?

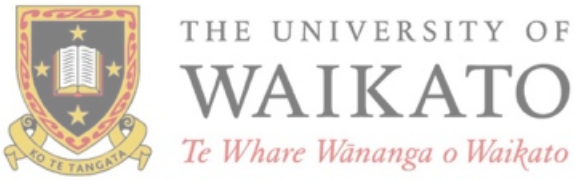
- ○ No
- ○ Yes

Q3.6 Are you currently receiving treatment from a psychologist or psychiatrist?

- ○ No
- ○ Yes

Appendix C: Demographic Questions

This appendix consists of the demographic questions that were included in T1 of the study.



Q5.1 Please provide your email address below (use the one we sent the study information to if you have several)

_____

Q5.2 Now we want to know a little bit about you... What gender do you most identify as?

- ○ Male
- ○ Female
- ○ Non-binary/third gender
- ○ Prefer to self-describe: _____
- ○ Prefer not to say

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Q5.3 What is your ethnicity? (Select all those that apply)

- [ ] New Zealand European
- [ ] Maori
- [ ] Samoan
- [ ] Cook Island Maori
- [ ] Tongan
- [ ] Niuean
- [ ] Chinese
- [ ] Indian
- [ ] Other, such as Dutch, Japanese, Tokelauan _____

Q5.4 What is your first language?

_____

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Q5.5 Please tell us a bit about your education

- ☐ Still at secondary school
- ☐ Completed secondary school
- ☐ At University/Tec
- ☐ Completed University/Tec

Q5.6 What qualifications have you completed? (tick all that apply)

- ☐ Nil
- ☐ NCEA Level 1 or equivalent
- ☐ NCEA Level 2 or equivalent
- ☐ NCEA Level 3 or equivalent
- ☐ Trade - Specify _____
- ☐ Professional - Specify _____
- ☐ Tertiary - Specify _____
- ☐ Other - Specify _____

Appendix D: Profile of Mood Scale

This appendix consists of the Profile of Mood Scale measure that was used in T1, T2, and T3 of the study as the mood measure.

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Q6.1 The next set of questions asks about your mood and sleep. Below is a list of words that describe feelings people have. Please select the option that best describes how you feel right now.

	Not at all (0)	A little (1)	Moderately (2)	Quite a lot (3)	Extremely (4)
Tense	○	○	○	○	○
Angry	○	○	○	○	○
Worn Out	○	○	○	○	○
Unhappy	○	○	○	○	○
Proud	○	○	○	○	○
Lively	○	○	○	○	○
Confused	○	○	○	○	○
Sad	○	○	○	○	○
Active	○	○	○	○	○
On-Edge	○	○	○	○	○
Grouchy	○	○	○	○	○
Ashamed	○	○	○	○	○

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Energetic	○	○	○	○	○
Hopeless	○	○	○	○	○
Uneasy	○	○	○	○	○
Restless	○	○	○	○	○
Unable to concentrate	○	○	○	○	○
Fatigued	○	○	○	○	○
Competent	○	○	○	○	○
Annoyed	○	○	○	○	○
Discouraged	○	○	○	○	○
Resentful	○	○	○	○	○
Nervous	○	○	○	○	○
Miserable	○	○	○	○	○
Confident	○	○	○	○	○
Bitter	○	○	○	○	○

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Exhausted	○	○	○	○	○
Anxious	○	○	○	○	○
Helpless	○	○	○	○	○
Weary	○	○	○	○	○
Satisfied	○	○	○	○	○
Bewildered	○	○	○	○	○
Furious	○	○	○	○	○
Full of pep	○	○	○	○	○
Worthless	○	○	○	○	○
Forgetful	○	○	○	○	○
Vigorous	○	○	○	○	○
Uncertain about things	○	○	○	○	○
Bushed	○	○	○	○	○
Embarrassed	○	○	○	○	○

Appendix E: Auckland Sleep Questionnaire: Current Sleep

This appendix consists of the Auckland Sleep Questionnaire: Current Sleep that was used in T1, T2, and T3 of the study to determine sleep quality.

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Q6.2 Do you have problems getting to sleep, staying asleep, poor quality sleep, or waking early such that it affects your functioning the next day - this includes feeling excessively sleepy the next day?

- ○ No
- ○ Yes

Q6.3 Does this occur 3 or more times per week?

- ○ No
- ○ Yes

Q6.4 Has it been like this for more than one week?

- ○ No
- ○ Yes

Q6.5 How long have you had this problem?

_____

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Q6.6 If yes, was there some event that caused this? (Please describe.) Were there specific reasons for your poor sleep? i.e. baby crying, sick family member, partying too late, work/school requirements?

_____

Q6.7 Do you need medication to help your sleep, mood or stress? Please select one:

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

Q6.8 What is the name of this medication(s)?

_____

Q6.9 During the past week, how would you rate your sleep quality overall? Please select one:

- ○ Very good
- ○ Fairly good
- ○ Fairly bad
- ○ Very bad

Appendix F: Visual Analogue Scales

This appendix consists of the Visual Analogue Scales that participants completed once a week for the first four weeks of the study to determine overall feeling, relaxation, and stress rates before and after listening to the sessions.

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Visual Analogue Scales with singing bowls

Q1.1 Please provide your email address (use the one we sent the study information to if you have several)

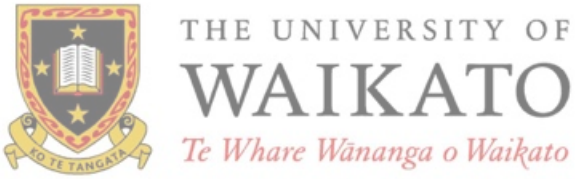
_____

Q1.2 Overall, how do you feel right now? Move the slider along the line to indicate your response.

	0 = Worst I have ever felt	100 = Best I have ever felt
	0 10 20 30 40 50 60 70 80 90 100	
How do you feel right now?		

Q1.3 How relaxed do you feel right now? Move the slider along the line to indicate your response.

	0 = Not relaxed	100 = Very relaxed
	0 10 20 30 40 50 60 70 80 90 100	
How relaxed do you feel right now?		



Q1.4 How stressed do you feel right now? Move the slider along the line to indicate your response.

	0 = Not stressed 100 = Very stressed 0 10 20 30 40 50 60 70 80 90 100
How stressed do you feel right now?	

Q2.1 Now it's time to find somewhere quiet and comfortable. Put on your headphones and press the play button when you are ready.

JS

Q2.2 https://waikato.qualtrics.com/CP/Graphic.php?IM=IM_b7tnrLJg2yRAG9g https://waikato.au1.qualtrics.com/ControlPanel/File.php?F=F_ckI5C5aTJRfgvkT Press the next button when the track has finished

Q3.1 Overall, how do you feel right now? Move the slider along the line to indicate your response.

	0 = Worst I have ever felt 100 = Best I have ever felt 0 10 20 30 40 50 60 70 80 90 100
How do you feel right now?	

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Q3.2 How relaxed do you feel right now? Move the slider along the line to indicate your response.

0 = Not relaxed 100 = Very relaxed

	0	10	20	30	40	50	60	70	80	90	100
How relaxed do you feel right now?											

Q3.3 How stressed do you feel right now? Move the slider along the line to indicate your response.

0 = Not stressed 100 = Very stressed

	0	10	20	30	40	50	60	70	80	90	100
How stressed do you feel right now?											

Appendix G: Feedback Questions

This appendix consists of feedback questions that were included in T3 that participants could complete to provide feedback and if they would recommend the intervention to other young people.

Q14 Do you have any feedback on the intervention? What did you think about it? Did you like it?

_____

Q15 Would you recommend the intervention to other rangatahi/young people?

_____

Q13 Thank you for answering the questions. You've now completed the study. Over the next few days you will receive an email with links to the progressive muscle relaxation and singing bowls tracks so you can use them whenever you like

Appendix H: Information Sheet

This appendix consists of the information sheet that was included in T1.

The Effects of Quartz Crystal Singing Bowl Music and Guided Relaxation on Mood and Sleep in Rangatahi (Young Adults)

Participant Information Sheet

What is this study about?

The number of people reporting poor mental wellbeing is increasing, with rates exceeding 25% of the population. Rates of psychological distress in young people (aged 15-24 years) are rapidly increasing but many cannot access professional help. Meditation and mindfulness are effective but require a lot of practice, so other treatment options are needed.

Music and sound (sound healing) have been used for centuries to aid relaxation and improve mood, and studies have shown that listening to music improves mood and aids relaxation. We want to compare the effectiveness of quartz crystal singing bowl music with guided relaxation on mood, stress and sleep in rangatahi.

The study is being led by Professor Nicola Starkey, School of Psychology, University of Waikato, Associate Professor Michael Jameson, Waikato Clinical School, University of Auckland with the assistance of a Masters student, Kellianne Hamilton and two Honours students, Annelise Bech and Alice Wilson. Jacqueline Woodland is our Māori advisor and Dawn Willix-Payne is providing the clinical psychology support.

Am I eligible to take part?

- You are eligible to take part in this study if you are aged 16 – 25 years of age, have a good understanding of English, good hearing and have a mobile phone/laptop to access the internet
- You cannot take part if you already use singing bowls or guided relaxation (because we won't know if the interventions we are testing are effective), or are currently receiving treatment from a psychologist or psychiatrist (because we do not want to interfere with your ongoing treatment)

What am I being asked to do?

If you agree to take part in this study, we will ask you to answer some questions about you, your mood, and how well you are sleeping. You will then be given a link to access the online intervention (singing bowl music or guided relaxation). We would like you to complete the intervention three times a week for four weeks (each session takes 10 minutes) whenever is convenient for you. We will keep track of how often you complete the intervention and send you reminders. Occasionally we will ask you to complete ratings of your mood at the beginning and end of one of the intervention sessions.

After four weeks we will ask you to complete the mood and sleep questionnaires again and give you free access to the intervention for another four weeks (you can use it as much as you like). We will

then ask you to complete the mood and sleep questionnaires again, and ask you for feedback on the study. You will then be given free access to both the singing bowl music and guided relaxation so you can continue to use it if you wish.

As an acknowledgment of your contribution to the research, first-year Psychology students enrolling in the study through IPRP can obtain up to 10% course credit for participating. Your participation is voluntary (your choice).

What will happen to my information?

Four weeks after you complete the final questionnaire we will download the data from Qualtrics and remove any identifying information (ie it will be anonymised) and the data will be stored on a server in a password-protected file at the University of Waikato. We will send an electronic summary of our findings to the participants who have indicated they would like to receive this information. The study findings will be written up for publication as a journal article and included as part of one Masters thesis and two Honours theses.

This research project has been approved by the Human Research Ethics Committee (Health) at the University of Waikato as HREC(Health)2024#03. Any questions or concerns about the ethical conduct of this research may be sent to the Secretary of the Committee, email humanethics@waikato.ac.nz, postal address, Human Research Ethics Committee (Health), University of Waikato, Te Whare Wananga o Waikato, Private Bag 3105, Hamilton 3240.

What are the possible benefits and risks of this study?

Taking part in this study will take some of your time. There are no known risks caused by this study, and we hope you find the interventions enjoyable. There is no guarantee that you will benefit directly from being involved in this study, but the results obtained from your participation will help us understand if singing bowl music or guided relaxation improves mood and sleep in rangatahi.

What can I expect from the researchers?

If you decide to participate in this project, the researchers will respect your right to:

- ask any questions of the researchers about the study at any time during participation;
- decline to answer any particular questions or carry out any of the tasks;
- withdraw from the study up to four weeks after completing the final questionnaire;
- provide information on the understanding that it is confidential to the researchers. It will not be possible to identify you in any articles produced from the study;
- be given an electronic summary of the findings

Who can I speak with about my participation in this project?

If you, or anyone you know is interested in taking part in this research, or have any questions please email singingbowls@waikato.ac.nz for more information.

Appendix I: Consent Form

This appendix consists of the consent form that was included in T1.

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Consent Form

Q2.1 **Please tick to indicate you consent to the following:**

	Yes
I have read, and I understand, the Participant Information Sheet	○
I have been given sufficient time to consider whether or not to participate in this study	○
I am satisfied with the answers I have been given regarding the study	○
I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study within 4 weeks of the final questionnaire	○
I understand that my participation in this study is confidential and that no material which could identify me personally, will be used in any reports on this study.	○
I know who to contact if I have any questions about the study in general.	○
I understand my responsibilities as a study participant.	○

Q2.2 I wish to receive a summary of the results from the study

○ Yes

○ No

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Q2.3 yes, please provide your name and email address so we can send a summary of the results

_____

Q2.4 I hereby consent to take part in this study. By writing your name and clicking the next button you give consent to participate in this study.

_____

Appendix J:

Table J1

TMD, POMS Subscales, Sleep Quality: Baseline Independent Samples t-test for the Intervention Groups.

Variable	SB N = 32		PMR N = 30				
	Mean	SD	Mean	SD	t(60)	*p*	Cohen's d
TMD	113.94	21.10	108.27	22.56	1.02	.310	0.260
Tension	8.47	5.78	7.70	5.07	0.56	.581	0.141
Anger	3.44	3.68	2.83	3.76	0.64	.525	0.162
Fatigue	8.09	3.74	6.90	4.00	1.21	.230	0.308
Depression	5.53	5.69	4.47	5.02	0.78	.439	0.198
Confusion	6.09	3.42	6.03	4.40	0.06	.952	0.015
Esteem-Related Affect	12.84	3.31	13.77	4.03	-0.99	.327	-0.251
Vigour	4.84	3.32	5.90	3.38	-1.24	.219	-0.315
Sleep Quality	2.53	.57	2.60	.68	-0.44	.665	-0.111

*Significant at <.05 level

Note. Only participants who completed the intervention and all questionnaires were included in the analysis.

SB = Singing bowls

PMR = Progressive muscle relaxation

TMD = Total mood disturbance

Appendix K:

Table K1

TMD, POMS Subscales, Sleep Quality: Baseline Independent Samples t-test for SB Group.

Variable	Completed Minimum 1 Session N= 46		Completed 0 Sessions N = 10				
	Mean	SD	Mean	SD	t(54)	*p*	Cohen's d
TMD	118.28	26.52	114.0	22.71	-0.47	.638	-0.165
Tension	8.89	6.06	7.10	6.57	-0.84	.408	-0.291
Anger	3.93	4.35	4.0	6.09	0.04	.968	0.014
Fatigue	8.87	4.52	8.90	4.38	0.02	.985	0.007
Depression	6.48	6.84	4.60	4.38	-0.83	.411	-0.289
Confusion	6.93	4.32	5.90	4.14	-0.69	.493	-0.241
Esteem-Related Affect	12.28	4.17	11.60	2.27	-0.50	.619	-0.174
Vigour	4.54	3.86	4.90	3.78	0.27	.791	0.093
Sleep Quality	2.50	0.55	2.80	0.79	1.45	.154	0.504

*Significant at <.05 level.

Note. This table depicts the independent samples t-test analysis comparing baseline measures of participants who completed a minimum of 1 session and participants who did not complete any sessions in the singing bowls (SB) group.

TMD = Total mood disturbance

Appendix L:

Table L1

TMD, POMS Subscales, Sleep Quality: Baseline Independent Samples t-test for the PMR Group.

Variable	Completed Minimum 1 Session N= 46		Completed 0 Sessions N = 6				
	Mean	SD	Mean	SD	t(50)	*p*	Cohen's d
TMD	115.22	25.61	103.0	30.36	1.30	.198	0.566
Tension	9.11	5.49	9.83	6.37	0.30	.766	0.130
Anger	4.35	5.20	6.50	6.16	0.94	.354	0.406
Fatigue	7.85	4.46	9.67	4.63	0.94	.354	0.406
Depression	6.46	6.06	11.50	8.24	1.84	.072	0.799
Confusion	6.72	4.69	6.0	5.22	-0.35	.729	-0.151
Esteem-Related Affect	13.22	4.02	9.50	2.95	-2.18	.034*	-0.946
Vigour	6.04	4.02	4.0	2.45	-1.21	.232	-0.525
Sleep Quality	2.61	0.68	2.67	0.52	0.20	.842	0.087

*Significant at <.05 level.

Note. This table depicts the independent samples t-test analysis comparing baseline measures of participants who completed a minimum of 1 session and participants who did not complete any sessions in the Progressive muscle relaxation (PMR) group.

TMD = Total mood disturbance

Appendix M:

Table M1

Descriptive Statistics and Correlations for Session Completion and Change Scores of TMD, POMS Subscales, and Sleep Quality for the SB Group for Week 4 to Week 8.

Variable	n	Mean	SD	*p*
Session Completion	46	1.72	2.59	-
TMD	32	2.09	16.68	.977
Tension	32	-0.25	4.06	.886
Anger	32	0.16	3.34	.371
Fatigue	32	0.59	3.44	.195
Depression	32	0	4.08	.416
Confusion	32	-0.03	3.10	.747
Esteem-Related Affect	32	-0.81	3.46	.660
Vigour	32	-0.81	3.89	.658
Sleep Quality	32	-0.25	0.72	.108

*Significant at <.05 level.

Note. TMD = Total mood disturbance

Appendix N:

Table N1

Descriptive Statistics and Correlations for Session Completion and Change Scores of TMD, POMS Subscales, and Sleep Quality for the PMR Group for Week 4 to Week 8.

Variable	n	Mean	SD	*p*
Session Completion	46	0.96	1.91	-
TMD	30	-9.10	22.86	.556
Tension	30	-1.70	3.79	.474
Anger	30	-1.90	4.45	.639
Fatigue	30	-0.37	4.18	.453
Depression	30	-2.07	5.71	.856
Confusion	30	-2.20	3.46	.353
Esteem-Related Affect	30	0.27	4.08	.703
Vigour	30	0.60	3.37	.067
Sleep Quality	30	-0.03	0.61	.544

*Significant at <.05 level.

Note. TMD = Total mood disturbance

Appendix O:

Table O1

Descriptive Statistics and Correlations for Session Completion and Change Scores of TMD, POMS Subscales, and Sleep Quality for the SB Group for Baseline to Week 8.

Variable	n	Mean	SD	*p*
Session Completion	46	7.98	6.31	-
TMD	35	-9.57	22.82	.551
Tension	35	-2.54	5.82	.919
Anger	35	-0.46	4.41	.274
Fatigue	35	-1.89	4.66	.474
Depression	35	-1.66	5.21	.288
Confusion	35	-1.14	4.10	.953
Esteem-Related Affect	35	0.66	3.97	.262
Vigour	35	1.23	3.75	.712
Sleep Quality	35	-0.54	0.74	.754

*Significant at <.05 level.

Note. TMD = Total mood disturbance

Appendix P:

Table P1

Descriptive Statistics and Correlations for Session Completion and Change Scores of TMD, POMS Subscales, and Sleep Quality for the PMR Group for Baseline to Week 8.

Variable	n	Mean	SD	*p*
Session Completion	46	5.09	5.41	-
TMD	35	-11.94	25.25	.862
Tension	35	-3.40	5.19	.602
Anger	35	-0.97	3.70	.822
Fatigue	35	-1.51	4.47	.587
Depression	35	-2.06	5.35	.643
Confusion	35	-1.74	3.83	.581
Esteem-Related Affect	35	1.29	5.08	.450
Vigour	35	0.97	3.54	.810
Sleep Quality	35	-0.59	0.78	.959

*Significant at <.05 level.

Note. TMD = Total mood disturbance