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Evaluation of Stress Indicators among Stressful Young Individuals after Relaxing Music Intervention

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Abstract **Original Research Article**

Stress is a common human experience. Excessive stress causes psychological and social health problems. Music is the combination of harmony of melody and rhythm. Pharmacological and non-pharmacological measures have been advocated to minimize the development of stress related diseases. Music listening have been associated with decrease of physiological arousal and reduction of cortisol levels. It can affect central and autonomic nervous system as well as endocrine system. This experimental study was conducted in the Department of Physiology, Chittagong Medical College, Chattagram, Bangladesh. Total 60 subjects of first year MBBS, with equal number of male and female, studying in Chittagong Medical College, were included by stratified random sampling method according to inclusion and exclusion criteria. A questionnaire along with general information about previous diseases, medical and family history were filled up by the subjects. Stress indicators- perceived stress scale (PSS) score, beck anxiety inventory (BAI), oxygen saturation (SpO2) and serum cortisol were recorded before and after 15 minutes of music intervention for 15 days. Result was compiled and compared after data collection by using SPSS-25. Paired 't'-tests were done to compare differences between pre and post-intervention values of different outcome parameters. $P < 0.05$ was considered as statistically significant. Stress indicators- perceived stress scale (PSS) score, beck anxiety inventory (BAI) and serum cortisol were significantly reduced and oxygen saturation (SpO2) was significantly increased after 15 days music intervention. This study concludes that regular listening to relaxing music causes significant reduction of stress and improvement of quality of life.

Keyword: Stress, Music Intervention, Cortisol, Anxiety, Physiological Arousal.

INTRODUCTION

Stress is a common human experience [1]. It affects the quality of life negatively [2]. Excessive stress causes psychological and social health problems. It reduces self-worth and confidence [3]. According to WHO physical or mental stress will become one of the leading cause of disability [4,5]. Chronic stress leads to higher prevalence of physical and psychological morbidity [5]. There is ample evidence of sympathetic reactions to acute stress [5]. Autonomic nervous system (ANS) maintains homeostasis to adapt with stressful situation [6]. But autonomic dysfunction can also occur in healthy individuals [6].

Many preventative initiatives, such as yoga, breathing exercise, aerobic exercises and meditation, have been advised to reduce the occurrence of stress related disorder[7]. Music has an impact on the endocrine, autonomic, and central neurological systems [7]. It reduced the levels of cortisol, epinephrine and norepinephrine by activation of parasympathetic nervous system [8]. Several studies suggest that music can be used as a therapeutic tool [9].

Music significantly contributes to improve the person's quality of life [9]. It serves as an important tool in the management of mental health disorders [10]. This study was done for evaluation of stress indicators among stressful young individuals after relaxing music intervention.

MATERIALS AND METHODS

This experimental study was done in Department of Physiology, Chittagong Medical College from January 2020 to December 2021.

Study Population

Total 60 first year medical college students of Chittagong Medical College, Bangladesh who fulfills the inclusion and exclusion criteria.

Sampling technique: Stratified random sampling method.

Selection criteria [11-13]

Inclusion criteria

1. Apparently healthy first year medical students within 18 to 21 years of both gender, willing to participate
2. Perceived stress scale (PSS) score ≥ 14

Exclusion criteria

1. Individuals below 18 year and above 21 years of age
2. Hearing difficulties
3. Perceived stress scale (PSS) score less than 14
4. Irregular students
5. Interest on only one genera of music, aversion towards music and practicing yoga, music or musical instruments
6. Known systemic and psychiatric illness or recent medication with anti-hypertensive, anti-arrythmatic, anti-diabetic, anti-epileptic, sedatives and anti-psychotic drugs.

Permission was taken from authority to perform the study. The aims, objectives and procedure of the study was explained in details to all participants. They were ensured that all information would be kept confidential and used exclusively for research. Written informed consent was provided to every students and they were allowed to leave the research at any moment. For the purpose of recording physiological parameters, 10 students were chosen each day. To record every physiological stress indicators, a total of 9 days were required. General examination was performed to assess the state of health. In order to rule out any hearing issues, the Rinne and Weber test was conducted using a tuning fork.

The degree of mental stress was assessed by perceived stress scale (PSS) score. The PSS score evaluates the subject's thoughts and feelings during the previous month. Levels 0–13 indicate low perceived stress; levels 14–26 indicate moderate stress and levels 27–40 indicate high levels of perceived stress. Music intervention was selected for those with PSS score ≥ 14.

Stratified random sampling was conducted using a lottery method. Initially, 78 subjects were chosen. From the initially selected 78 subjects, 18 students were excluded due to irregularities. Finally, 60 subjects were included, comprising 28 males and 32 females.

The Beck Anxiety Inventory (BAI) was conducted to evaluate anxiety levels.

Oxygen saturation was measured by pulse oximeter (BERRY pulse oximeter) by placing the appropriate prove on a finger or toe and it fits easily without being too loose or too tight. Wait for several seconds for the pulse oxymeter to record the pulse and oxygen saturation.

Every day, blood samples were taken from 20 students to measure serum cortisol prior to the music intervention. They were informed in advance via phone to come in on the designated day for sample collection. Participants were instructed not to eat or drink anything after 10 PM the night before. Data and blood samples were collected three times a week between 8:00 AM and 9:00 AM before their classes commenced. The analysis was performed using electro-chemiluminescence immunoassay (ECLIA) technology (Cobas – e 411, UK).

After collecting all baseline data, the subjects were invited to participate in a music intervention. They were instructed to bring a mobile phone that could play mp3 music. A preselected relaxing music [14]. “The Weightless” (the most relaxing song of 2011), was downloaded onto their devices [9]. Participants were asked to listen to this calming music for 15 minutes each day over a period of 15 days while seated and using personal mobile headphones [6]. The music intervention took place in the classroom from 11:05 AM to 11:20 AM during the break hour.

After completing 15 days music intervention, data regarding –PSS score, BAI score, oxygen saturation and serum cortisol at 8 to 9 am were taken again on 16th day from all subjects. All data were documented on data sheet and analyzed by SPSS-25.

RESULT

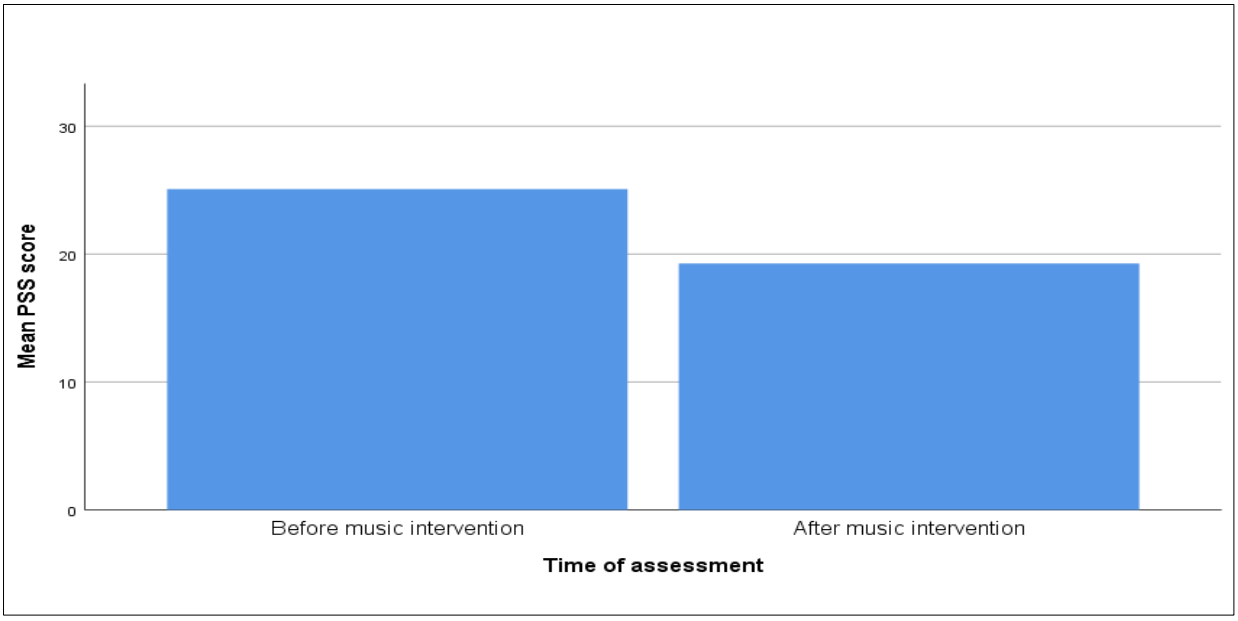

Figure 1: Comparison of pre and post intervention mean values of PSS (Perceived stress scale) score

A paired t-test was done. There was a statistically significant mean difference between the PSS scores before and after music intervention. A statistically significant decrease of 5.82 (95% CI, 4.70 to 6.93), $p < 0.001$ was observed.

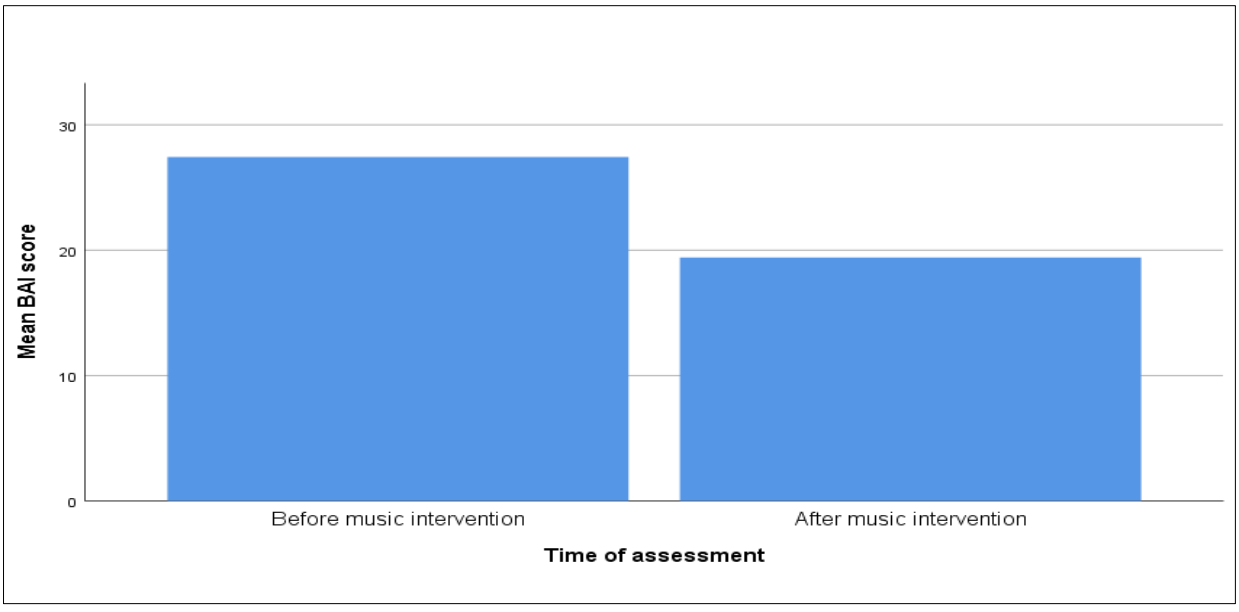

Figure 2: Comparison of pre and post intervention mean values of Beck Anxiety Inventory (BAI) score

A paired t-test was done. There was a statistically significant mean difference between the scores before and after music intervention. A statistically significant decrease of 8.02 (95% CI, 6.48 to 9.13), $p < 0.001$.

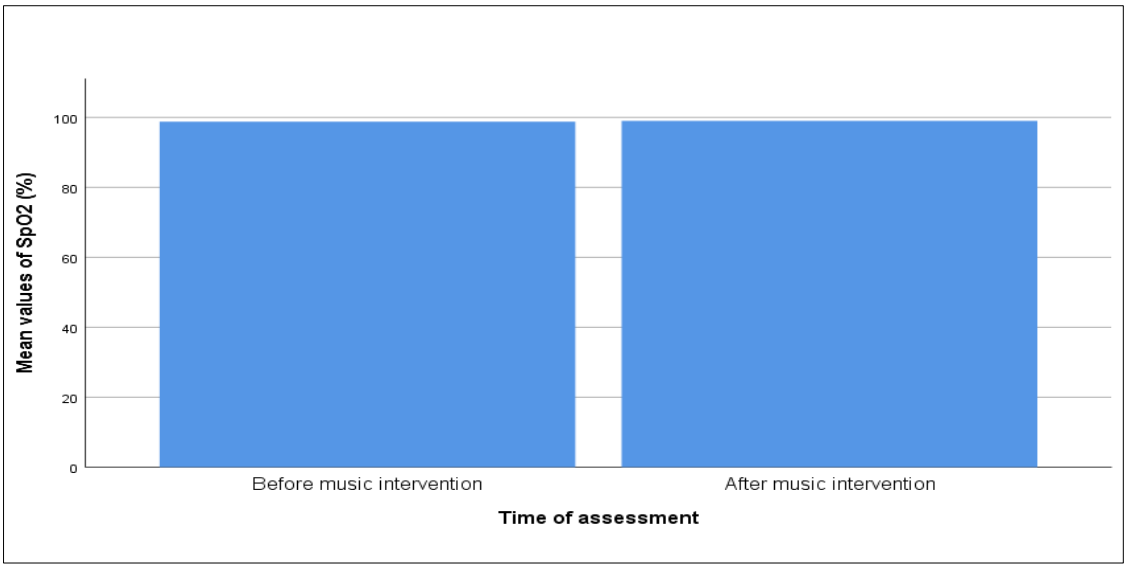

Figure 3: Comparison of pre and post intervention mean values of Pulse oxygen saturation (SpO2, %)

A paired t-test was done. There was a statistically significant mean difference between the scores before and after music intervention. A statistically significant increase of 0.22 (95% CI, 0.32 to 0.11) %, $p < 0.001$.

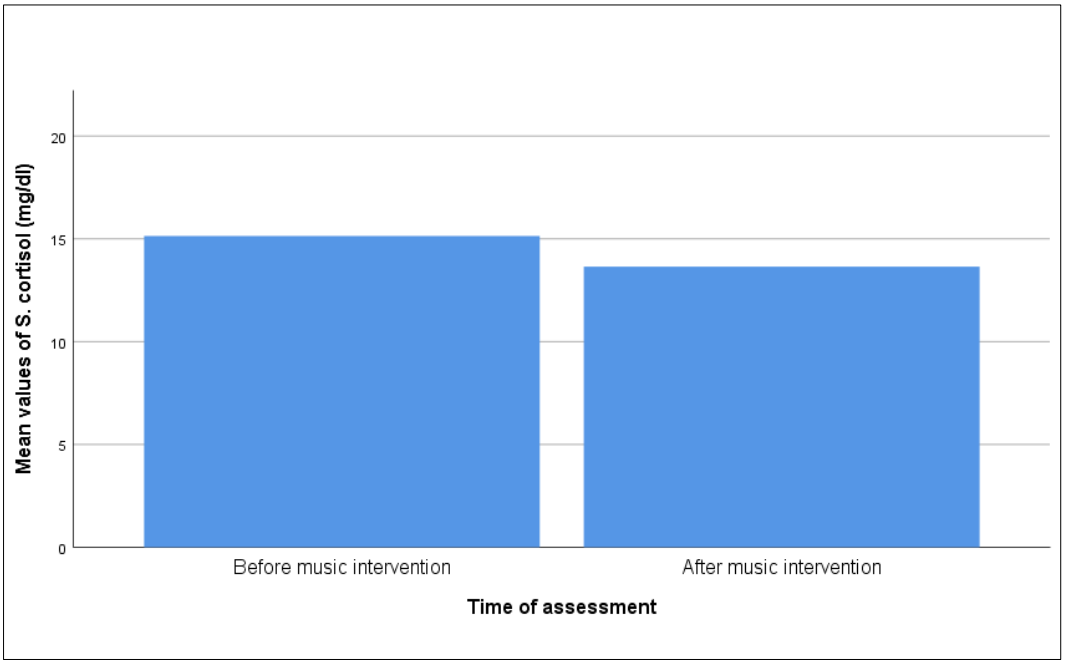

Figure 4: Comparison of pre and post intervention mean values of Serum cortisol (mg/dl)

A paired t-test was done. There was a statistically significant mean difference between the scores before and after music intervention. A statistically significant decrease of 1.49 (95% CI, 0.61 to 2.38) mg/dl, $p = 0.001$ was observed.

Table I: Comparison of stress indicators before and after music intervention

Stress indicators	Before music intervention	After music intervention	P value
Perceived stress scale score	25.08 ± 5.86	19.27 ± 5.73	$P < 0.001$
Back anxiety inventory	27.43 ± 7.68	19.42 ± 6.44	$P < 0.001$
Pulse oxygen saturation (SpO2, %)	98.77±0.43	98.98±0.13	P < 0.001
Serum cortisol (mg/dl)	15.14 ± 4.13	13.64 ± 4.70	$P = 0.001$

DISCUSSION

In the current study, the selected stress indicators—Perceived Stress Scale (PSS) score, Beck Anxiety Inventory (BAI), pulse oxygen saturation (SpO2), and serum cortisol levels—were analyzed before and after music intervention. The results indicated a significant changes from their initial values following the music intervention ($p < 0.05$) (Figures 1 to 4, Table-I).

These finding are similar with some previous studies [6,15].

The observed phenomenon may stem from impact of music on the central nervous system, autonomic nervous system, and hormonal systems. Listening to slow music leads to a decrease in sympathetic activity and lower levels of stress hormones [7]. According to Saritus *et al.*, music elicits physiological and psychological transformations in the body by influencing the limbic system [16]. Active listening of calming music can elevate oxytocin levels, which play a crucial role in human social attachment and relationships [17].

Pleasurable music perception enhance blood flow in specific brain regions of the meso-cortico-limbic system. This leads to the release of dopamine and the activation of central opioid receptors [18]. These changes influence defensive reactions to stress by reducing activity in the amygdala, hippocampus, and para-hippocampal gyrus [19].

Musical interventions can effectively lower anxiety levels and enhance feelings of well-being [20]. They also diminish negative emotions, encourage cognitive engagement, and positively influence anxiety, depression, and distorted thinking [20]. By reducing stress and encouraging relaxation, relaxing slow music interventions indirectly helps in inherent healing abilities of the body [21].

Some investigators found non-significant changes in stress biomarkers after music intervention which is dissimilar with present study [22,23].

According to Chlan LL *et al.*, this could be attributed to several stress-related factors and alterations in homeostasis triggered by various stressful events [22,23]. Trappe HJ *et al.*, suggest that the level of cortisol may be affected by selection of music and pattern of the music intervention [24].

An additional explanation could be the complexity of the sympathetic nerve's function. While enjoying music, every hormonal response plays a unique role in both excitement and relaxation [25].

The socioeconomic status of the participants may limit the applicability of the results. Further research recommended in this respect [26]. Furthermore, they advocated for the inclusion of stress-reduction programs in the educational curriculum to alleviate anxiety and enhance students' learning capabilities [26].

In the current research, the notable decrease in specific stress indicators might be attributed to decreased sympathetic activity and a reduction in stress facilitated by calming relaxing music. Participants were clearly happy and engaged while listening to the music. They appeared to be quite relaxed throughout the music session.

CONCLUSION

This study demonstrates that music intervention is effective in reducing stress and anxiety levels. The research offers an insight that music can assist in addressing mental health challenges among stressed young individuals.

Limitation

The research was conducted over a brief time frame with shorter intervention sessions each day. The sample size was limited and may not accurately reflect the entire community. No socio-demographic data was collected. Proper sitting posture was not upheld. The central sound system was not utilized. Blood and urine catecholamine levels were not assessed to observe patterns of stress and musical response.

Recommendation

Based on this research, several suggestions can be made for additional studies, including conducting a similar analysis with a larger participant pool across various age groups for an extended period. Furthermore, blood pressure, respiratory rate, and plasma glucose levels could be evaluated both prior to and following the music intervention.

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