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The influence of ball-juggling on emotional states, blood pressure and sleep-quality among medical students during end-of-year exam preparation



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ABSTRACT

Juggling-exposure therapy has been employed in the management of anxiety and post-traumatic stress disorder. However, there is little evidence of the effectiveness of juggling-exposure in improving emotional states in subclinical conditions. This study aimed at evaluating the effect of a course of juggling on emotional states, sleep quality and blood pressure among medical students at a critical stage of their academic training.

Blood pressure, psychometric and quality of sleep assessments were performed pre- and post-examination period for two groups of students: juggling-exposed ($n = 9$) and non-juggling-exposed ($n = 11$). Juggling exposure consisted of practice-drills for one hour per week during the period spanning the student's scheduled exams. Comparisons were made between quantitative measures that were collected pre- and post-the course of juggling drills. Differences in scores and measures were expressed as percentage-change and compared between non-juggling and juggling groups.

Overall, there was a decrease in depression and anxiety scores between the pre- to post-exam periods. This decrease was statistically significant for both non-juggling and juggling groups with respect to anxiety, but only the juggling-exposed group had a significant reduction regarding depression scores. However, when calculated as percentage-change over the pre- to post-exam period, there was no significant difference in any of the parameters for either of the two groups.

Practicing juggling drills had an influence on emotional states.

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1. Introduction

Suicide rates among practicing physicians have been shown to be higher than in the general population [1]. This has alarming implications not merely from the medical profession but also for society at large. The development of serious psychological illness in this important professional group may emerge during their pre-licensing training period [2]. Indeed, it is well documented that doctors-in-training, at medical school, experience problems of psychological distress [3,4] and are at high risk for depression and suicidal ideation [5]. Although, decades of research has recognised that stress in medical school is a significant issue, there is a paucity of approaches

for preventing and treating this problem in this specific population. Complementary therapies may have an important role in treating psychological distress among medical students [6,7].

Juggling-exposure therapy may be one such approach to managing stress in this group. Training to juggle objects, such as balls or beanbags, has been shown to be effective in treating anxiety among females [8] and has also been used to treat post-traumatic stress disorder (PTSD) [9]. A report on juggling therapy among patients with PTSD suggests that attention deficit problems associated with PTSD may be addressed by juggling; as the process of focussing on juggling helps to re-train the brain and shut out irrelevant stimuli [9]. Juggling therapy may therefore have further potential in the treatment of other attention deficit disorders or may improve attention in healthy individuals. These studies suggest that the art of juggling balls has potential role in the management of stress and wellbeing among medical students. However, there is little evidence in the literature describing the effectiveness of juggling

Abbreviations: DASS-21, Depression, Anxiety and Stress Scales-21.

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therapy in improving emotional states in subclinical conditions and healthy volunteers. Reliable tools for measuring stress may be of value in this type of investigation.

Emotional states and stress induced somatic symptoms may be evaluated using the psychometric self-administered questionnaire Depression, Anxiety and Stress Scales -21 (DASS-21) in clinical and non-clinical settings [10,11]. Sleep quality may also be assessed using questionnaires, such as the Pittsburgh Sleep Quality Index (PSQI) questionnaire. Poor sleep quality has been found to have a bidirectional relationship with depression among adults [12]. More specifically poor sleep quality has been shown to be associated with high depression scores [13,14] including evaluations using the DASS-21 instrument [15]. Sleep deprivation has also been identified as a one of the stressors affecting medical trainees [16]. Changes in blood pressure and heart rate are important somatic signs linked to disturbances in emotional states. The measurement of changes in blood pressure and heart rate may be indicators of changes in emotional states [17].

The aim of this study was to evaluate the effect of a course of juggling on emotional states, sleep quality and blood pressure among medical students at a critical stage of their semester; pre- and post-exams. Differences in quantitative scores and measures were computed and expressed as percentage-change. These percentages were then compared between non-juggling and juggling groups of participants.

2. Method

2.1. Setting

This study was performed in a medical college and participants were recruited from medical students. Participants were invited to attend a briefing on the study via an electronic mail shot. Interested participants were then enrolled and self-selected themselves into either a non-juggling group or a juggling group. All participants gave signed informed consent and the investigation was approved by the local Research and Ethics Committee of the university.

2.2. Juggling intervention

Participants in the juggling group performed regular juggling drills for a period of four weeks. The non-juggling group carried out no such drills over the same period. This four-week period spanned the time in which all students were tested for end of semester summative examinations as part of their academic course. All students were naïve to the juggling drills performed. The standardised juggling drills carried out consisted of procedures geared to teaching novices to juggle three balls in the 3-ball cascade motif [18,19]. Demonstrations of the drills were shown to participants and all subsequent drills were performed privately by the participants in their own homes. Participants were required to perform one hour of juggling practice a week which was split into three sessions of 20 min. A diary record was kept by the participants documenting the times of juggling practice.

2.3. Measurements

Blood pressure, heart rate, psychometric and quality of sleep assessments were performed (pre-exam) before the course of juggling drills was carried out. These measures were carried out the day before juggling drills were started. These same measurements were again performed on all participants and the end of the four week period (post-exam). Blood pressure and resting heart rate were measured in the supine position using an electronic device (Omron, Japan). All participants completed structured self-administered

questionnaires to assess emotional states and sleep quality. The short form of the Depression Anxiety Stress Scale (DASS-21) was used to assess depression, anxiety and stress [10]. This 21-item instrument simultaneously assesses three emotional states, with seven items addressing each of the three emotional states using the following cut-off scores: depression ≥ 14 , anxiety ≥ 10 and stress ≥ 19 [10]. The Pittsburgh Sleep Quality Index (PSQI) questionnaire was used to assess quality of sleep. This instrument consists of 19 items, rated on a four-point scale (0–3) and grouped into seven components (sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medications, and daytime dysfunction). The item scores in each component were summed and converted to composite scores ranging from 0 (no sleep problems) to 3 (extreme sleep problems). Global PSQI scores were calculated as the sum of the seven components scores (0–21, where higher score indicate poor sleep quality). A score of ≥ 6 on total global PSQI score is indicative of poor sleep quality [20].

2.4. Data analysis

Quantitative values were generated as measurements of emotional states, sleep quality, heart rate and blood pressure. These values were averaged and compared between the pre- and post-exam periods. These values were further compared between the non-juggling and juggling groups using the percentage-change for each measure. This percentage-change was computed by subtracting the values 'post-exams' from 'pre-exams' and then expressed as the relative to the original pre exam measurement. In addition, the frequency of individuals who were classified as depressed, anxious, and stressed, were compared between the non-juggling and juggling groups.

Paired pre and post values for all measurements were compared using Wilcoxon Signed Ranks Test comparison of medians. Percentage-changes were compared between the non-juggling and juggling groups using the Mann-Whitney U comparison of independent medians. Frequencies were analysed using Fisher's exact test. All statistical analyses were performed using SPSS (version 23, IBM Statistics, Chicago, IL). A two-tailed p -value of <0.05 was considered to be statistically significant.

3. Results

There were 11 non-juggling (all males) participants and 9 jugglers (5 females and 4 males). The median (range) age of participants was 20 (18–24) years. Median blood pressure and heart rate measures were below clinical cut-off values for hypertension.

There was no statistical difference between pre- and post-exam median values for: stress scores, sleep quality index, blood pressure and heart rate across combined non-juggling and juggling groups. In contrast, there was a statistically significant decrease in depression ($p = 0.010$) and anxiety ($p = 0.001$) scores between the pre-to post-exam periods for the combined juggling and non-juggling groups. The median (range) scores for depression were: 14 (1–36) and 6 (2–32) for pre and post scores respectively. Regarding anxiety, these were: 14 (2–36) and 6 (0–28) for pre and post median (range) scores respectively. This decrease was statistically significant for both non-juggling ($p = 0.012$) and juggling ($p = 0.042$) groups with respect to anxiety scores. Median (range) scores for the non-juggling group were; 16 (2–28) and 4 (0–28) for the pre and post juggling-exposure assessments respectively. Whilst the median (range) scores for the juggling group were; 10 (2–36) and 6 (0–22) for the pre and post juggling-exposure assessments respectively. However, with regards to depression scores, there was only a marginally significant reduction for the juggling group ($p = 0.049$) and no significant reduction for the non-

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