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Research Protocol

Physiotherapy Section

Effect of Postural Exercises on Physiological and Biological Markers of Perceived Distress among Undergraduate Health Professionals Students: A Research Protocol for Randomised Controlled Trial

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ABSTRACT

Introduction: Health professional students experience high levels of Psychological Distress (PD) compared to other profession students. Persistent distress may adversely affect both psychological well-being and physiological regulation, including alterations in biological markers such as cortisol and physiological marker Heart Rate Variability (HRV). While Progressive Muscle Relaxation (PMR) is widely used for stress reduction, the potential additive benefits of physiotherapy-led postural exercises on psychological and biological markers of distress remain unexplored.

Need of the study: Posture is closely linked to emotional expression and PD, yet posture-based interventions are largely unexplored in Physiotherapy. Current management primarily relies on relaxation techniques with minimal integration of posture-focused strategies. Postural exercises are simple, safe and non invasive; there is a need to evaluate their role as interventions for improving psychological and biological markers of distress among health professions students.

Aim: To evaluate the adjunct effect of a physiotherapy-led Postural Exercise Program (PEP), in addition to PMR, on psychological and biological markers of perceived distress among undergraduate students of health professions.

Materials and Methods: A two-arm parallel randomised controlled trial will be conducted at the Department of Physiotherapy, K M Patel Institute of Physiotherapy, Bhaikaka University, Karamsad, Gujarat, India. A total of 64 undergraduate students from 1st to the final year will be recruited through advertisement-based outreach. Eligible participants will be randomised with 1:1 allocation into Group-A (postural exercises + PMR) and Group-B (PMR alone). The intervention will be administered for 10 sessions over two weeks (5 sessions/week). Outcomes, including perceived stress, anxiety, burnout, self-esteem, blood cortisol levels and HRV, will be assessed at baseline and post-intervention. Intra and intergroup comparison will be done with paired and unpaired t-test and a p-value of <0.05 will be considered statistically significant.

Keywords: Anxiety, Posture, Progressive muscle relaxation, Psychological stress

INTRODUCTION

The PD is a common mental health problem in the community [1]. Health professional students, including medical, nursing, dental and physiotherapy, experience significantly higher stress, anxiety and burnout compared to both the general population and students in other professional fields [2]. This highlights the unique pressures faced by health professional students and underscores the need for targeted support strategies to safeguard their well-being.

In the recent era, considering the higher prevalence of PD among students, the majority of schools and colleges have special cells where students can report such issues or events. However, the majority of the students do not opt for such services, considering it a social stigma [3]. This creates the need for a new intervention to manage such problems in University students.

Prolonged and repeated encounters with stressors can lead to dysregulation of the Hypothalamic-pituitary-adrenal (HPA) axis, which ultimately increases blood cortisol in response to stress as a biological marker of allostatic load [4]. Chronic stress leads to an imbalance of the autonomic nervous system, which is characterised by hyperfunction of the sympathetic system and hypofunction of the parasympathetic system, which will be best indexed by reduced HRV metrics [5].

The commonest treatment plan to manage PD includes physical activity, PMR, yoga, music, a balanced diet, establishing a routine, practising self-compassion and seeking professional help [6]. Out of which PMR is widely used by physiotherapists.

Embodiment theories of emotion assume a complex reciprocal relationship between bodily expression and the way emotional information is processed. Emotion and mental attitude profoundly affect the nervous system. Depressed and anxious individuals often demonstrate slower gait, slumped posture and less steadiness when walking compared to healthy individuals [7]. Conversely, joy, success, confidence and happiness are associated with alert, extended postures, while unhappiness, conflict and inferiority promote flexed postures [8]. If mental attitude can alter physical state, it is also possible that consciously adopting a physical attitude may influence mental well-being. This phenomenon of postural changes in anxiety and stress remains underexplored in physiotherapy. No current treatment protocols explicitly integrate posture-focused exercise programs for stress and anxiety, despite these strategies being safe, simple, non invasive and easily incorporated into daily life without harm.

This positions physiotherapists uniquely to develop and test posture-based protocols for stress modulation and mental health promotion.

Objectives

Primary objectives:

- To evaluate the effect of a structured PEP combined with PMR, on perceived stress among undergraduate health professional students.
- To evaluate the effect of PMR, on perceived stress among undergraduate health professional students.

Secondary Objectives:

- To compare the effect of the PEP combined with PMR vs the effect of PMR, on perceived stress among undergraduate health profession students.

Hypothesis

Null hypothesis: There will be no significant difference between PMR combined with PEP and PMR alone in improving perceived stress, anxiety, burnout, self-esteem, and physiological markers among undergraduate health professions students.

Alternate hypothesis: There will be a significant difference between PMR combined with PEP and PMR alone in improving perceived stress, anxiety, burnout, self-esteem, and physiological markers among undergraduate health professions students.

REVIEW OF LITERATURE

In recent years, the prevalence of PD among health professional University students has increased significantly. Although many Institutions have established support systems such as counselling services, their utilisation remains limited among students. This highlights the need for accessible, non stigmatising and easily implementable interventions to address PD in this population [3].

A systematic review conducted by Muhammad Khir S et al., involving 3,402 adults across 46 studies demonstrated that PMR is a highly effective evidence-based non pharmacological intervention for reducing stress, anxiety and depression. The review further highlighted that PMR shows enhanced effectiveness when combined with other interventions. Additionally, its benefits were found to be consistent across varying session durations and frequencies, indicating its flexibility and applicability in diverse settings [9].

Carney DR et al., conducted an experimental study to examine the effects of expansive (high-power) versus contractive (low-power) postures on psychological and physiological responses. The findings demonstrated that individuals adopting expansive postures exhibited increased feelings of power, reduced cortisol levels and greater risk tolerance, suggesting that body posture can influence neuroendocrine and psychological outcomes [10].

Weineck F et al., performed a comparison study between powerful and neutral poses and concluded that a single session of adopting powerful postures improves the interoceptive ability and reduces the state anxiety in University students compared to neutral poses. The result suggests that the body posture can play an important role in modulating emotional and psychological responses [11].

Laborde S et al., investigated the influence of power posing on cardiac vagal activity and reported that adopting expansive (power) postures can modulate autonomic function, particularly by influencing cardiac vagal activity as measured through HRV. The study highlights that body posture is not only associated with psychological states but also has measurable physiological effects, supporting the concept that postural modifications may contribute to stress regulation [12].

Nair S et al., conducted Randomised Control Trial (RCT) to examine the effect of slumped versus upright postures on stress responses and concluded upright posture participants reported higher self-esteem, more arousal, better mood and lower fear, compared to slumped posture participants. Notably, physiotherapy taping was used in the study as a postural support technique to facilitate maintenance of the assigned posture. These findings support the role of posture correction, including physiotherapy-based approaches, in influencing psychological well-being [13].

Wilkes C et al., investigated the impact of upright posture in individuals with depressive symptoms and found significant improvements in affect and reduced fatigue compared to usual posture [14].

These findings further support the role of posture in influencing emotional states and suggest its therapeutic potential. Despite emerging evidence, there remains a lack of structured physiotherapy-led intervention protocols integrating postural exercises with established relaxation techniques such as PMR. Furthermore, limited research has explored the combined effect of such interventions on both psychological and biological markers of distress in health professional students.

Thus, this study aims to evaluate the effect of structural exercise program with and without PMR on psychological and biological markers of perceived distress among undergraduate health profession students.

MATERIALS AND METHODS

This two-arm parallel randomised controlled trial will be conducted at the Department of Physiotherapy, K M Patel Institute of Physiotherapy, Bhaikaka University, Karamsad, Gujarat, India. Ethical approval is obtained from the Institutional Ethics Committee (Ref. No. IEC/BU/144/Faculty/05/121/2023). Due to funding-related delays in study initiation, the commencement of participant recruitment is deferred; this is formally communicated to the IEC and reviewed during six-monthly Research Advisory Committee (RAC) meetings. The study continues under ongoing institutional ethical oversight.

The study is registered with the Clinical Trials Registry of India (CTRI/2023/05/053150). Written informed consent will be obtained from all participants before enrollment. For participants aged below 18 years, parental/guardian consent along with participant assent will be obtained as per ethical guidelines. Necessary institutional permissions from the respective Deans have also been obtained before recruitment.

Inclusion criteria:

- Undergraduate students enrolled in a health professions program at Bhaikaka University (Physiotherapy, MBBS, Nursing, Medical Laboratory Technology, Allied Health).
- Aged ≥17 years.
- Able and willing to provide written informed consent.
- Not currently practicing structured PEPs or yoga.

Exclusion criteria:

- Participants who are already diagnosed case of psychiatric illness and on psychiatric medication.
- Participants with history of physical disorders and systemic illness for which they are under any standard of medical care that can limit their participation for postural exercises.
- Participants who are already doing Yoga or postural exercise

Sample size calculation: The sample size will be calculated based on the primary outcome, Perceived Stress Scale (PSS), using data from a previous randomised controlled trial [15].

$n \geq ((Z_1\text{-}\alpha/2 + Z_1\text{-}\beta)^2 \times (\sigma_1^2 + \sigma_2^2/r))/(\mu_1 - \mu_2)^2$

α=0.05 so Z1−α/2=1.96

β=0.20 so Z1−β=0.84

σ1=6.3 so σ_1^2 =39.69

σ2=5.5 so σ_2^2 =30.25 [15]

r=1 (equal group sizes)

Δ=μ1−μ2=24.05−19.35=4.7 [15]

$n \geq ((Z_1\text{-}\alpha/2 + Z_1\text{-}\beta)^2 \times (\sigma_1^2 + \sigma_2^2 / r))/(\mu_1 - \mu_2)^2$

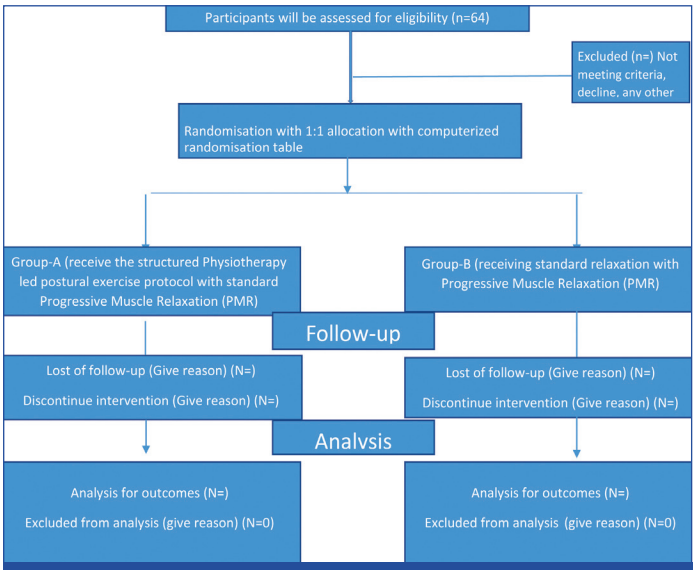
$n \geq (1.96+0.84)^2 \times (39.69+30.25/1)/(4.7)^2$

$n \geq (2.8)^2 \times (69.94)/22.09.$

$n \geq 7.84 \times 70/22.09$

$n \geq 25$

Required sample size is 25 participants per group, considering a 30% attrition rate: 32 participants per group will be recruited [Table/Fig-1].



[Table/Fig-1]: Consolidated Standards of Reporting Trials (CONSORT) flowchart.

Participants will be undergraduate students recruited from across all constituent institutes through announcements, circulars and brochure-based advertisements displayed on institutional notice boards and electronic platforms. Students who self-identify as experiencing stress, anxiety, or burnout will be invited to participate. A non probability volunteer sampling method will be used, considering ethical constraints associated with universal psychological screening of students.

To ensure balanced representation and reduce institutional variability, participants will be stratified by college in to four strata (College A, College B, College C and College D).

Within each stratum, participants will be randomised in a 1:1 allocation ratio to either: Group-A: Structured physiotherapy-led PEP combined with PMR, or Group-B: PMR alone. Randomisation will be performed using a computer-generated sequence (Sealed Envelope) with permuted variable block sizes 4 to maintain balance and reduce predictability. Allocation concealment will be ensured using Sequentially Numbered, Opaque, Sealed Envelopes (SNOSE) prepared by an independent investigator not involved in recruitment or assessment.

Study Procedure

Each participant will undergo a 2-week protocol including baseline assessment, intervention (5 sessions/week) and post-intervention assessment.

Both groups will receive Jacobson's PMR sessions daily for 15-20 minutes for 10 days (2 weeks excluding weekends). The intervention group (Group-A) receives an additional PEP immediately following PMR (total session length 15 -20 min/day [Table/Fig-2]).

PMR sequences were adopted from study done by Chaudhuri A et al., in 2019 [Table/Fig-2] [16].

Postural Exercise Program (PEP) intervention group only: This structured physiotherapy PEP has been designed to expand the role of physiotherapy in mental health and to leverage postural exercises as a modifiable determinant of PD [Table/Fig-3] [10,11,13].

This program is developed based on the evidence from the effect of upright and expansive postures to enhance stress resilience.

Components	Description	Feeling
Relax positioning	Supine or comfortable sitting	General relaxation
Start and end with breathing. Repeat breathing after each body segment relaxation session	Focus on breath, take in slow deep breath through your nose, hold and release through mouth (4- 5 breaths)	Notice the feeling of relaxation every time you breath out
Sequential tensing/ holding the muscle contraction and relaxing of muscles (face and UL)	Forehead muscle- raise your eyebrow -hold- relax	Feel the relaxation of forehead muscles
	Eye muscles- close eyes -hold - relax open your eyes	Feel the relaxation of eye muscles
	Facial and jaw muscles- clench teeth- relax	Notice relaxation of face and jaw muscles
	Neck and shoulder muscles- shrug shoulder -tighten neck- relax	Notice relaxation of shoulder and neck muscles
	Hand muscles - Squeeze your hands into fists-relax	Feel the relaxation of hand muscles
Sequential tensing and relaxing of major muscles of torso	Back muscles- arch you back -hold-relax	Notice relaxation of back muscles
	Squeeze the abdominal muscle -hold - relax	Feel the relaxation of abdominal muscles
Sequential tensing and relaxing of major muscle of lower limbs	Press both knees down against the floor-relax	Notice relaxation of knee muscles
	Push down heel against the floor - relax	Feel the relaxation of heel muscle
	Curl your toes - hold - relax	Feel the relaxation of toe muscles

[Table/Fig-2]: Progressive Muscle Relaxation (PMR) [16].

Component	Duration per session	Frequency	Progression
Warm-up: Gentle neck rotations, shoulder rolls, scapular squeezes, upper thoracic mobilisation and diaphragmatic breathing	2 minutes	5 days/ week	Include whole body exercise and increase the duration and frequency
Postural awareness: Mirror feedback session, guided cues on spinal alignment in standing: neutral pelvic, thoracic extension and chin tuck. Breathing in upright stance.	2-4 minutes	5 days/ week	Increase frequency, complexity, apply in real task
Expansive posture drill: Head, neck and spine in extension and arm/ elbow widen supported on pelvis/ clasp behind the nape of neck. Repeat in different position i.e., in supine, supine bridge, kneel sitting, upright sitting and in standing	7-9 minutes	5 days/ week	Increase hold time, frequency.
Dynamic posture integration: Carry upright posture in functional activity while walking	2-3 minutes	5 days/ week	Incorporate into work, study, walking routines.
Cool down: To promote relaxation. Focus on diaphragmatic breathing exercises.	2 minutes	5 days/ week	Progress to mindfulness integration.

[Table/Fig-3]: Physiotherapy led Postural Exercise Program (PEP) [10,11,13].

Outcome Measurements

Primary outcome: The PSS is the psychological instrument for measuring the perception of stress. It consists of 10 items rated on a 5-point Likert scale ranging from 0 (never) to 4 (very often). Items 4, 5, 7 and 8 are positively stated and will be reverse scored (0→4, 1→3, 2→2, 3→1, 4→0). The total score is obtained by summing all item scores, with a possible range of 0 to 40, where higher scores indicate greater perceived stress. For interpretation, scores will be categorised as: Low stress: 0-13, Moderate stress: 14-26 and High stress: 27-40 [17].

Secondary outcomes: Anxiety will be assessed using the State-Trait Anxiety Inventory (STAI), comprising two 20-item subscales (STAI-S and STAI-T), each scored from 20 to 80, with higher scores indicating greater anxiety. The necessary permissions/licenses will be obtained from the respective copyright holders prior to data collection [18].

Burnout will be evaluated using the Maslach Burnout Inventory (MBI), measuring emotional exhaustion, depersonalisation and personal accomplishment. Subscale scores will be interpreted as per standard guidelines. The necessary permissions/licenses will be obtained from the respective copyright holders prior to data collection [19].

Self-esteem will be assessed using the Rosenberg Self-Esteem Scale, a 10-item measure with total scores ranging from 0 to 30, where higher scores indicate greater self-esteem [20].

Physiological stress will be assessed by measuring serum cortisol levels. Blood samples will be collected under standardised conditions, preferably during morning hours (e.g., 8:00-9:00 AM), to control for diurnal variation. Cortisol levels will be analysed using standard laboratory methods such as immunoassay techniques. Higher cortisol levels will indicate increased physiological stress [21].

The HRV will be measured using a finger probe device with a 1-minute resting recording, following standardised pre-assessment instructions. Ultra-short HRV measures have demonstrated acceptable validity for research use [22].

All outcome measures will be assessed at baseline (T0 and immediately post-intervention (T1: after 2 weeks/10 sessions)

Psychological outcomes (PSS, STAI, MBI and Rosenberg Self-Esteem Scale) will be self-administered by participants under the supervision of a trained physiotherapist to ensure completeness and standard instructions.

Serum cortisol will be analysed in a certified laboratory using standard immunoassay techniques. And HRV will be recorded using a validated finger probe device and mobile application under standardised conditions.

Outcome assessment will be conducted by a trained physiotherapist; however, blinding is not feasible due to the nature of the intervention.

All data will be recorded in paper Case Record Forms (CRFs) and entered into a secured electronic database using double data entry for accuracy. Scoring will be performed according to standard guidelines and cross-checked by a second investigator. Any discrepancies will be resolved through discussion.

Incomplete responses will be minimised by checking forms at the time of collection. Missing data, if any, will be handled using appropriate statistical methods.

STATISTICAL ANALYSIS

The statistical analysis will be performed using Statistical Package for Social Sciences (SPSS) version 17.0. Data normality will be assessed using the Shapiro-Wilk test. Descriptive statistics will be presented as mean ± standard deviation and frequency (%). Baseline comparisons between groups will be conducted using independent t-test and Chi-square test, as appropriate. A paired and unpaired t-test will be used to assess the effects of group (intervention vs control) and time (baseline and post-intervention), with the group × time interaction indicating intervention effectiveness. A p-value <0.05 will be considered statistically significant.

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