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## **1. Study Title**

Effects of a Customized Posture-Corrective Exercise Program on Pain, Thoracic Kyphosis, Flexibility, and Quality of Life in Healthy Adult Men: A Randomized Controlled Study

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## **2. Background and Rationale**

Postural deviations such as increased thoracic kyphosis and scapular protraction are commonly observed in modern sedentary lifestyles. These alterations may contribute to musculoskeletal discomfort, reduced flexibility, and decreased quality of life. Exercise-based interventions focusing on posture correction have been suggested as an effective approach to improve spinal alignment and musculoskeletal function. However, evidence regarding the effects of short-term customized exercise programs on thoracic posture, pain, and functional parameters in healthy individuals remains limited.

Therefore, this study aims to investigate the effects of a four-week customized posture-corrective exercise program on thoracic kyphosis, scapular posture, pain, flexibility, and quality of life in healthy adult men.

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## **3. Objectives**

### **Primary Objective**

To evaluate the effect of a customized exercise program on thoracic kyphosis angle.

### **Secondary Objectives**

To investigate the effects of the exercise program on:

- pain levels
  - scapular protraction
  - cervical anterior tilt
  - trunk flexibility
  - quality of life
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## **4. Study Design**

This study is designed as a **prospective randomized controlled trial** with two parallel groups.

Participants will be randomly assigned to:

- Exercise group

- Control group

The intervention period will last **four weeks**.

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## 5. Participants

### Inclusion Criteria

- Male participants aged 18–35 years
- Healthy individuals without diagnosed musculoskeletal disorders
- Individuals with postural deviations such as thoracic kyphosis or scapular protraction
- Voluntary participation

### Exclusion Criteria

- History of spinal surgery
  - Neurological disorders affecting posture or movement
  - Severe musculoskeletal pain
  - Participation in regular posture training within the last 6 months
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## 6. Sample Size

A total of **60 participants** will be included in the study.

Participants will be randomly assigned to two groups:

- Exercise group (n = 30)
- Control group (n = 30)

## 7. Randomization

Participants will be randomly allocated to the exercise or control group using a **computer-generated block randomization method**.

The randomization sequence will be prepared by an independent researcher. Allocation assignments will be concealed using **sequentially numbered opaque sealed envelopes**, which will be opened after baseline assessments.

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## 8. Intervention

Participants in the exercise group will receive a **customized posture-corrective exercise program**.

The program will include exercises targeting strengthening and stretching exercises. The program will be applied **twice per week for four weeks**. Each session will last approximately **30–40 minutes**. Participants in the control group will receive **no intervention** during the study period.

## 9. Outcome Measures

## Primary Outcome

Thoracic kyphosis angle measured using a **flexicurve ruler**.

## Secondary Outcomes

- Pain → **McGill–Melzack Pain Questionnaire**
- Quality of life → **SF-36**
- Scapular protraction → tape measurement method
- Cervical anterior tilt → posture assessment
- Trunk flexibility → flexibility test

All measurements will be performed:

- **before the intervention**
  - **after the 4-week intervention**
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## 10. Statistical Analysis Plan

Statistical analyses will be performed using **SPSS software (IBM SPSS Statistics)**.

### Descriptive Statistics

Mean, standard deviation, and frequency values will be calculated.

### Normality Testing

Data distribution will be evaluated using the **Shapiro–Wilk test**.

### Within-Group Comparisons

- Paired sample t-test will be used for normally distributed data.
- Wilcoxon signed-rank test will be used for non-normal data.

### Between-Group Comparisons

- Independent sample t-test will be used for normally distributed variables.
- Mann–Whitney U test will be used for non-normal variables.

The statistical significance level will be set at:

$p < 0.05$