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Effectiveness of Yoga Training Combined with Healthy Lifestyle Education on Body Image Attitudes and Postural Improvement in Individuals with Postural Abnormalities and Sedentary Behaviors

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A B S T R A C T

Objective: This study aimed to determine the effectiveness of a combined yoga and healthy lifestyle education program in improving body image attitudes and postural status among individuals with postural abnormalities and sedentary behaviors.

Methods and Materials: This quasi-experimental study employed a pretest–posttest control-group design with a two-month follow-up. The statistical population consisted of women and men with postural abnormalities and sedentary behaviors who attended healthcare centers in Tehran, Iran. Using purposive sampling, 40 eligible participants with a mean age of 47.05 years were selected and randomly assigned to an experimental group (n = 20) or a control group (n = 20). The experimental group received ten weekly 60-minute yoga sessions and ten weekly 60-minute healthy lifestyle education sessions, whereas the control group received no intervention during the study period. Data were collected using the Multidimensional Body-Self Relations Questionnaire developed by Winstead and Cash (1984) and digital photogrammetric postural assessment conducted using APECS software. The data were analyzed using mixed multivariate analysis of variance with repeated measures and Bonferroni post hoc comparisons.

Findings: The results demonstrated significant effects of time and the group-by-time interaction on body image attitudes (Wilks' lambda = 0.049, F = 357.507, p < 0.001, $\eta^2 = 0.951$) and postural status (Wilks' lambda = 0.001, F = 5659.228, p < 0.001, $\eta^2 = 0.999$). Bonferroni pairwise comparisons indicated significant

improvements from pretest to posttest and from pretest to follow-up in the experimental group compared with the control group. No significant differences were observed between posttest and follow-up scores for either outcome, indicating that the intervention effects were maintained over the two-month follow-up period.

Conclusion: Yoga training combined with healthy lifestyle education appears to be an effective and sustainable intervention for improving body image attitudes and postural status in individuals with postural abnormalities and sedentary behaviors. Integrating physical, behavioral, and lifestyle-oriented components may provide a comprehensive approach to reducing the physical and psychological consequences associated with inactivity and poor posture.

Keywords: *Yoga therapy, healthy lifestyle, body image, postural status, postural abnormalities, sedentary behavior*

1. Introduction

Sedentary behavior has become an increasingly prominent feature of contemporary life because occupational duties, transportation, entertainment, and social interaction are progressively organized around prolonged sitting and screen-based activities. Sedentary behavior is not merely the absence of structured exercise; rather, it encompasses waking activities performed in a seated, reclining, or lying posture that involve very low energy expenditure. When such behaviors dominate daily routines, they may contribute to metabolic dysfunction, reduced cardiorespiratory fitness, musculoskeletal deconditioning, psychological distress, and diminished quality of life. Longitudinal evidence indicates that persistent sedentary behavior is associated with multiple adverse physical and psychological outcomes, suggesting that its health consequences accumulate over time and cannot necessarily be neutralized by occasional exercise sessions. In addition, prolonged sitting reduces opportunities for varied movement, limits activation of postural muscles, and encourages repetitive positioning of the head, shoulders, spine, pelvis, and lower extremities. These patterns may gradually impair postural control and reinforce maladaptive musculoskeletal alignment, particularly among individuals who lack sufficient physical activity to counterbalance the effects of sustained static loading (Huang et al., 2022).

Posture refers to the organization and alignment of body segments in relation to one another and to the surrounding environment during both static and dynamic activities. Optimal posture does not imply a rigid or universally identical body position; instead, it reflects the capacity to maintain functional alignment while distributing mechanical loads efficiently and adapting to changing task demands. Postural abnormalities emerge when habitual alignment places disproportionate stress on muscles, ligaments, joints, and connective tissues. Common deviations include forward head posture, lateral head tilt, shoulder asymmetry, excessive pelvic tilt, trunk deviation, abnormal spinal curvature, altered knee alignment, and excessive internal or external foot rotation. These deviations may initially be mild or asymptomatic, but their persistence can change muscle length–tension relationships, reduce joint mobility, impair proprioceptive feedback, and increase compensatory movement patterns. Over time, postural abnormalities may contribute to fatigue, pain, impaired balance, reduced functional capacity, and limitations in occupational and daily activities.

The relationship between physical inactivity and postural dysfunction is particularly important because adequate postural control depends on muscular endurance, sensory integration, balance, joint mobility, and neuromotor coordination. When individuals spend extensive periods sitting and engage in insufficient moderate-to-vigorous activity, the trunk stabilizers, scapular muscles, hip musculature, and lower-limb muscles may become weakened or inadequately recruited. At the same time, habitual computer and smartphone use can promote cervical flexion, forward translation of the head, rounded shoulders, and thoracic kyphosis. Evidence concerning dynamic postural balance also suggests that physical activity level and nutritional status are relevant to the maintenance of postural stability. Lower levels of physical activity and excess body weight may alter the mechanical demands placed on the body, reduce movement efficiency, and compromise the ability to control the center of mass during functional tasks. Consequently, interventions for sedentary individuals with postural abnormalities should address not only isolated anatomical deviations but also the broader behavioral and lifestyle conditions that sustain them (Guzmán-Muñoz et al., 2025).

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Postural abnormalities also have a psychological dimension because individuals experience and evaluate their bodies partly through appearance, movement, comfort, functionality, and social comparison. Body image is a multidimensional construct encompassing perceptions, beliefs, emotions, evaluations, and behaviors related to one's physical body. It includes satisfaction with overall appearance, evaluation of specific body areas, weight-related concerns, investment in appearance, and the degree to which the body is experienced as acceptable, functional, and worthy of care. Negative body image may involve dissatisfaction, shame, appearance anxiety, excessive monitoring, avoidance of social or physical activities, and preoccupation with perceived defects. Conversely, positive body image extends beyond the absence of dissatisfaction and includes body appreciation, acceptance, respect, functional awareness, and resistance to unrealistic appearance ideals. For individuals with visible postural deviations or movement limitations, bodily asymmetry, discomfort, reduced confidence in physical functioning, and concern about how others perceive their posture may adversely affect their body-related attitudes.

The relationship between body image and posture may be reciprocal. Postural abnormalities can influence how individuals perceive their appearance and physical competence, while negative body image may encourage bodily concealment, reduced participation in exercise, and avoidance of situations that increase body awareness. A person who feels dissatisfied with body shape, alignment, or weight may adopt guarded or constricted movement patterns, avoid standing upright, or disengage from health-promoting activities. In contrast, improvements in mobility, strength, balance, and bodily comfort may enhance physical self-confidence and support a more favorable appraisal of the body. Nevertheless, an intervention focused exclusively on physical correction may not automatically transform entrenched beliefs or emotions concerning appearance. Likewise, a psychologically oriented body image intervention may not adequately correct biomechanical dysfunction. This interdependence supports the use of integrated interventions capable of simultaneously addressing postural alignment, body awareness, emotional regulation, and health behavior.

Corrective exercise and postural education are commonly used to improve musculoskeletal alignment. These interventions generally include stretching shortened tissues, strengthening inhibited muscles, retraining movement patterns, enhancing proprioception, and teaching ergonomic principles. Randomized evidence has shown that targeted postural interventions can improve clinically relevant indicators such as the craniovertebral angle among individuals with forward head posture. Postural education may increase awareness of maladaptive positioning, whereas corrective exercise may produce more direct changes in muscular balance, joint alignment, and movement control (Titcomb et al., 2023). Similarly, programs combining postural correction exercises, scapular stabilization, and related therapeutic techniques have demonstrated improvements in craniovertebral angle, scapular position, and upper-extremity function, indicating that correcting head posture may have consequences extending beyond the cervical region (Elgendy et al., 2024). Supervised corrective exercise has also been associated with changes in head and shoulder alignment, cervicothoracic muscle activation, and biomechanical muscle properties, further supporting the modifiability of habitual postural deviations through systematic training (Sarıyıldız et al., 2022).

Although corrective exercise is valuable, conventional programs may have limitations when used with sedentary adults. Some individuals experience low motivation, poor adherence, stress, fear of movement, reduced body awareness, or difficulty transferring exercises into daily routines. Programs that concentrate on one anatomical region may also overlook the interconnected nature of postural chains and the influence of breathing, stress, sleep, nutrition, and habitual movement. Moreover, highly corrective approaches can sometimes reinforce the idea that the body is defective and must be controlled, potentially conflicting with efforts to promote body acceptance. An effective intervention for individuals who simultaneously experience postural abnormalities, sedentary behavior, and unfavorable body image should therefore combine corrective movement with nonjudgmental bodily attention, progressive functional activity, and sustainable lifestyle change.

Yoga may provide such an integrative framework. As a mind–body practice, yoga combines physical postures, controlled breathing, relaxation, attentional regulation, and meditative awareness. Therapeutic yoga adapts these components to participants' health conditions and functional capacities rather than emphasizing physical performance or complex postures. Yoga postures may improve flexibility, muscular endurance, joint mobility, balance, and neuromuscular coordination, while breathing and relaxation practices may reduce excessive physiological arousal and facilitate more efficient movement. Therapeutic approaches

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to yoga also emphasize gradual progression, self-observation, energy management, and responsiveness to bodily signals. Such principles are especially relevant for sedentary individuals who may experience fatigue, stress, physical discomfort, or limited exercise tolerance. Agombar's therapeutic framework highlights the integration of gentle movement, breathing, meditation, deep relaxation, and restorative practices for reducing stress and fatigue while rebuilding a safer and more compassionate relationship with the body (Agombar, 2022).

The physical benefits of yoga may be explained through several complementary mechanisms. Yoga postures require coordinated activation of the deep trunk musculature, spinal stabilizers, shoulder girdle, pelvic muscles, and lower extremities. Repeated practice may strengthen underactive muscles, lengthen shortened tissues, improve joint range of motion, and enhance proprioceptive sensitivity. The slow transitions and sustained postures characteristic of many yoga practices provide opportunities to identify asymmetry and modify alignment under controlled conditions. Yoga may also improve balance by integrating vestibular, visual, and somatosensory information while participants shift and maintain their center of mass. Evidence from exercise research supports the therapeutic value of yoga for musculoskeletal conditions. A systematic review and meta-analysis comparing six exercise interventions for low back pain found that all evaluated exercise approaches were beneficial, with yoga demonstrating particularly strong effects, suggesting that its combination of mobility, stabilization, breathing, and attentional components may be clinically meaningful (Cheng et al., 2025). Furthermore, network meta-analytic evidence concerning mind–body exercise indicates that such practices may improve functional exercise capacity and health-related outcomes among individuals with chronic cardiopulmonary limitations, illustrating their adaptability to populations with reduced physical tolerance (Li et al., 2025).

Beyond biomechanical effects, yoga may alter the manner in which individuals attend to, interpret, and value bodily experiences. Body awareness refers to the perception of internal sensations, movement, tension, breathing, balance, and bodily position. In sedentary individuals, awareness of posture may be diminished because maladaptive positions become habitual and are maintained automatically. Yoga repeatedly directs attention toward alignment, muscular engagement, weight distribution, breath, and moment-to-moment sensation. This process may help participants recognize postural patterns before they become painful or functionally limiting. A systematic review of yoga interventions found that the available literature generally trends toward improvements in body awareness, although methodological variation and differences in measurement indicate the need for more rigorous research (Garnsey et al., 2025). Enhanced body awareness may support postural correction because individuals become better able to detect forward head displacement, shoulder elevation, pelvic asymmetry, or uneven foot loading and consciously modify these patterns during daily activities.

Body awareness may also mediate the psychological effects of yoga. Unlike appearance-oriented exercise, yoga can shift attention from how the body looks to how it feels and functions. Participants are encouraged to observe sensations without immediate judgment, respect individual limits, and evaluate progress according to balance, comfort, breathing, and functional capacity rather than conformity to an external appearance ideal. These processes may reduce self-objectification and appearance comparison while strengthening embodiment, body appreciation, and gratitude. A systematic review of quantitative studies in adults concluded that yoga has meaningful potential to improve body image, although variations in intervention content, population characteristics, and methodological quality require cautious interpretation (Rupani et al., 2024). The psychological value of yoga may therefore depend not only on performing postures but also on the instructional environment, language used by instructors, emphasis on noncompetition, and explicit encouragement of body acceptance.

Specific interventions provide further evidence for the relevance of yoga to positive embodiment. A brief online size-inclusive yoga program combined with body-gratitude journaling was developed to enhance positive embodiment among higher-weight college women. Its size-inclusive format challenged the assumption that yoga is appropriate only for thin, flexible, or conventionally athletic bodies and emphasized gratitude, accessibility, and respectful bodily engagement (Webb et al., 2022). Evidence from pediatric populations similarly suggests that yoga may improve body esteem and body satisfaction, particularly among young people experiencing disordered eating, although effects on weight concern, shape concern, and body surveillance have been less consistent (Bullard et al., 2025). More recently, a positive body image yoga intervention was evaluated among men and women across adulthood, addressing an important limitation of earlier research that predominantly focused on

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young women. The feasibility-oriented study supports the relevance of yoga-based positive body image work across adult age groups while also underscoring the need for controlled research evaluating its efficacy and sustainability (Dagenais et al., 2026).

The inclusion of healthy lifestyle education may strengthen and extend the effects of yoga. Lifestyle medicine is based on the premise that daily behaviors exert substantial cumulative effects on physical health, psychological well-being, and quality of life. Its central domains include physical activity, nutrition, sleep, stress management, avoidance of harmful substances, and supportive social relationships. From this perspective, postural abnormalities and sedentary behavior should not be treated as isolated conditions but as components of an interconnected behavioral pattern. Education concerning regular movement, interruption of prolonged sitting, balanced nutrition, sleep hygiene, stress regulation, and self-care may help participants transfer the benefits of structured yoga sessions into everyday life. Lifestyle education can also promote self-efficacy by providing practical strategies for modifying environmental cues, setting achievable goals, monitoring habits, and maintaining behavioral change (Rippe, 2022).

Combining yoga with healthy lifestyle education may produce synergistic effects. Yoga provides an experiential context in which participants practice movement, alignment, breathing, relaxation, and nonjudgmental awareness, whereas lifestyle education supplies cognitive and behavioral strategies for sustaining health-promoting routines outside the sessions. Improved body awareness may help individuals detect the effects of prolonged sitting, poor sleep, stress, or inadequate activity, while lifestyle knowledge may enable them to respond with specific corrective actions. Similarly, positive changes in body image may increase willingness to engage in physical activity and self-care, and postural improvement may reinforce confidence in the body's functionality. Through these reciprocal processes, a combined intervention may address both the physical-functional and psychological dimensions of sedentary postural dysfunction.

Despite growing evidence regarding corrective exercise, therapeutic yoga, positive body image, and lifestyle medicine, several gaps remain. Many postural studies focus on a single deviation such as forward head posture and evaluate narrowly defined biomechanical outcomes. Body image studies frequently emphasize adolescents, college women, or clinical eating-disorder populations, whereas research including both men and women across middle adulthood remains limited. In addition, relatively few investigations have simultaneously measured objective postural indicators and multidimensional body image attitudes. Existing yoga studies also vary considerably in duration, instructional emphasis, and outcome measurement, and many do not incorporate a structured healthy lifestyle component. Therefore, examining a combined intervention among sedentary adults with postural abnormalities may clarify whether physical alignment and psychological body-related attitudes can be improved concurrently and whether such improvements remain stable after the intervention has ended.

Accordingly, the present study aimed to determine the effectiveness of yoga training combined with healthy lifestyle education in improving body image attitudes and postural status among individuals with postural abnormalities and sedentary behaviors.

2. Methods and Materials

2.1. Study Design and Participants

The present study employed a quasi-experimental pretest–posttest control-group design with a two-month follow-up assessment. The statistical population consisted of women and men with postural abnormalities and sedentary behaviors who were referred to healthcare, rehabilitation, and counseling centers in Tehran, Iran. Participants were recruited through purposive sampling based on their eligibility for participation in the study. After the inclusion and exclusion criteria had been applied, 40 eligible individuals were enrolled and randomly assigned to either the experimental group, which received yoga training combined with healthy lifestyle education, or the control group, with 20 participants in each group. The mean age of the participants was 47.05 years. Assessments were conducted at three measurement points: before the intervention, immediately after the intervention, and two months after the completion of the intervention. The control group did not receive any psychological, educational, or physical training intervention during the study period. All participants were informed about the objectives and procedures of the study, the voluntary nature of participation, the confidentiality of their information, and their right to withdraw from the study at any stage without adverse consequences. Written informed consent was obtained before data collection.

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2.2. *Instruments*

Multidimensional Body-Self Relations Questionnaire. Body image attitudes were assessed using the Multidimensional Body-Self Relations Questionnaire developed by Winstead and Cash in 1984. This self-report instrument contains 69 items and is designed to evaluate the cognitive, affective, evaluative, and behavioral components of an individual's attitudes toward their body and physical appearance. The questionnaire examines multiple dimensions of body image, including appearance evaluation, appearance orientation, satisfaction with specific body areas, and attitudes and concerns related to body weight. Its principal components include the Appearance Evaluation dimension, the Body Areas Satisfaction Scale, and weight-related attitude indices. Higher scores generally indicate more positive evaluations of physical appearance and greater satisfaction with the body, although the interpretation of certain dimensions depends on the direction and content of the relevant subscale. The questionnaire was administered at the pretest, posttest, and follow-up stages to determine changes in participants' perceptions, evaluations, and attitudes toward their bodies following the intervention.

Digital Photogrammetric Postural Assessment. Participants' postural status was evaluated using a noninvasive digital photogrammetry method and the APECS specialized software, an application designed for postural evaluation and corrective assessment. For this purpose, standardized digital photographs were obtained while each participant stood in a natural and relaxed position. Images were captured from the anterior, posterior, and lateral views under consistent environmental conditions, including standardized distance, camera height, participant positioning, and lighting. Anatomical landmarks were identified to facilitate quantitative analysis of postural alignment. The software was used to calculate indicators such as forward head displacement, lateral head tilt, shoulder asymmetry, pelvic tilt, trunk deviation, potential scoliosis risk, knee alignment, and foot rotation. The resulting measurements provided an objective quantitative profile of each participant's postural deviations and were used to compare postural status across the pretest, posttest, and two-month follow-up assessments.

Sedentary Behavior Questionnaire. Sedentary behavior was assessed using the Sedentary Behavior Questionnaire developed by Rosenberg and colleagues in 2010. This self-report measure evaluates the amount of time individuals spend performing common sedentary activities during typical weekdays and weekend days. The assessed activities include sitting while watching television, using a computer, reading, engaging in seated hobbies, traveling in a vehicle, and participating in other activities characterized by low energy expenditure while sitting or reclining. Participants reported the approximate duration of time spent in each sedentary activity, allowing an estimate of their overall daily sedentary behavior. In the present study, the questionnaire was primarily used to identify and verify sedentary behavior among potential participants and to monitor the level of inactivity across the study period.

2.3. *Intervention*

The experimental group participated in a combined intervention comprising ten weekly group sessions of therapeutic yoga and ten weekly group sessions of healthy lifestyle education, with each session lasting approximately 60 minutes. The yoga component was developed according to therapeutic yoga principles intended to reduce stress, enhance body awareness, improve flexibility, strengthen postural muscles, and correct maladaptive movement patterns. The sessions incorporated corrective asanas selected according to participants' physical capacities and postural needs, pranayama breathing exercises, deep relaxation techniques, and yoga nidra. The exercises progressed gradually in intensity and complexity to minimize the risk of discomfort or injury and to facilitate safe participation among individuals with sedentary lifestyles and postural abnormalities. The healthy lifestyle education component was developed based on lifestyle medicine principles and addressed major health-related behaviors, including balanced nutrition, regular physical activity, reduction of prolonged sitting, stress management, sleep hygiene, self-care, and the development of sustainable daily health routines. Participants were encouraged to apply the techniques and recommendations between sessions and to incorporate learned practices into their daily lives. The control group received no intervention during the research period and continued its usual daily routines and healthcare practices.

2.4. *Data analysis*

Data were analyzed using descriptive and inferential statistical procedures. Descriptive statistics, including means and standard deviations, were calculated to summarize body image attitudes, postural status, and sedentary behavior scores across the experimental and control groups at the

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pretest, posttest, and follow-up stages. Before conducting the primary analysis, the assumptions underlying parametric and repeated-measures analyses were examined. The Shapiro–Wilk test was used to evaluate the normality of score distributions, Levene's test was applied to assess the homogeneity of variances between the groups, Box's M test was used to examine the equality of covariance matrices, and Mauchly's test of sphericity was conducted to evaluate the equality of the variances of the differences among repeated measurements. The research hypotheses were tested using mixed multivariate analysis of variance with repeated measures, in which group represented the between-subjects factor and time represented the within-subjects factor. This analysis was used to examine the main effect of time, the main effect of group, and the group-by-time interaction for body image attitudes and postural status. When a significant time or interaction effect was identified, Bonferroni-adjusted post hoc comparisons were performed to compare mean scores between the pretest, posttest, and two-month follow-up stages while controlling for inflated Type I error resulting from multiple comparisons. All statistical tests were conducted using a significance level of 0.05.

3. Findings and Results

The participants' mean age was 46.95 ± 6.68 years in the experimental group, 47.15 ± 7.74 years in the control group, and 47.05 ± 7.13 years in the total sample. Each group consisted of 10 men and 10 women, resulting in an equal sex distribution in the total sample. Regarding educational attainment, 2 participants (10%) in the experimental group and 3 participants (15%) in the control group had completed primary or lower-secondary education. A high school diploma was reported by 15 participants (75%) in the experimental group and 13 participants (65%) in the control group. In each group, 2 or 3 participants held a bachelor's degree, whereas 1 participant (5%) in each group held a master's degree. In terms of marital status, 7 participants (35%) in the experimental group and 6 participants (30%) in the control group were married; 9 participants (45%) in the experimental group and 10 participants (50%) in the control group were single; 3 participants (15%) in each group were separated or divorced; and 1 participant (5%) in each group was widowed. Overall, the experimental and control groups demonstrated descriptively similar demographic characteristics at baseline.

Table 1

Descriptive Statistics for Body Image Attitudes and Postural Indicators by Group and Measurement Stage

Variable	Group	Pretest, M (SD)	Posttest, M (SD)	Follow-up, M (SD)
Appearance evaluation	Experimental	98.80 (5.64)	113.35 (6.57)	113.05 (6.46)
	Control	99.05 (4.37)	98.90 (4.27)	98.95 (4.27)
Body Areas Satisfaction Scale	Experimental	26.25 (5.72)	35.05 (5.61)	35.00 (5.70)
	Control	26.00 (7.13)	26.00 (7.11)	26.05 (7.00)
Weight-related attitudes	Experimental	19.00 (2.67)	25.45 (2.11)	25.45 (2.30)
	Control	19.10 (3.19)	18.95 (2.96)	18.95 (2.96)
Total body image attitude	Experimental	143.40 (9.19)	173.85 (9.54)	173.55 (9.46)
	Control	144.15 (7.03)	143.85 (7.18)	143.95 (7.09)
Forward head displacement	Experimental	37.80 (5.60)	49.15 (5.79)	49.25 (5.75)
	Control	37.70 (5.63)	37.80 (5.62)	37.85 (5.60)
Head tilt	Experimental	5.70 (0.58)	4.20 (0.38)	4.24 (0.42)
	Control	5.66 (0.60)	5.64 (0.59)	5.67 (0.59)
Shoulder symmetry	Experimental	3.20 (0.30)	2.20 (0.21)	2.24 (0.27)
	Control	3.18 (0.32)	3.16 (0.33)	3.20 (0.38)
Pelvic tilt	Experimental	10.70 (1.14)	6.80 (0.99)	6.77 (1.00)
	Control	10.72 (1.15)	10.77 (1.10)	10.82 (1.04)
Trunk deviation	Experimental	5.65 (0.47)	4.11 (0.39)	4.16 (0.43)
	Control	5.69 (0.52)	5.74 (0.66)	5.78 (0.65)
Scoliosis risk	Experimental	42.05 (4.63)	30.40 (3.29)	30.30 (3.34)
	Control	42.35 (4.01)	42.45 (4.08)	42.55 (3.99)
Knee alignment	Experimental	11.91 (1.28)	7.35 (0.89)	7.39 (0.90)
	Control	12.04 (1.41)	12.10 (1.37)	12.03 (1.50)
Foot rotation	Experimental	21.80 (1.20)	14.42 (0.93)	14.45 (0.93)
	Control	21.65 (1.27)	21.75 (1.29)	21.82 (1.26)

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As presented in Table 1, the experimental and control groups had similar mean scores for body image attitudes and postural indicators at the pretest stage. Following the intervention, the experimental group demonstrated substantial improvements in all dimensions of body image. The mean total body image attitude score increased from 143.40 at pretest to 173.85 at posttest and remained almost unchanged at 173.55 during the two-month follow-up. Improvements were also observed in appearance evaluation, satisfaction with different body areas, and weight-related attitudes. In contrast, the control group demonstrated minimal changes across the three measurement stages. A similar pattern was observed for postural status. Scores for all eight postural indicators in the experimental group changed in a favorable direction from pretest to posttest and remained relatively stable during follow-up. The control group's postural scores remained approximately unchanged across the study period.

Before testing the research hypotheses, the statistical assumptions underlying mixed multivariate repeated-measures analysis of variance were examined. The Shapiro–Wilk test results were nonsignificant for body image attitudes and postural status in both groups at the 0.05 level, confirming the assumption of normality. Levene's test was also nonsignificant at the pretest, posttest, and follow-up stages, indicating that the homogeneity-of-variance assumption was satisfied. Box's M test was nonsignificant for both body image attitudes, $F = 1.053$, $p = .212$, and postural status, $F = 1.437$, $p = .165$, supporting the equality of the covariance matrices across groups. However, Mauchly's test indicated that the sphericity assumption was violated for total body image attitudes, $W = .152$, approximate $\chi^2 = 69.672$, $p < .001$. Mauchly's test was also significant for all eight postural indicators. Therefore, the Greenhouse–Geisser correction was applied when interpreting the within-subjects effects.

Table 2

Mixed Multivariate Repeated-Measures Analysis of Variance for Body Image Attitudes and Postural Status

Outcome domain	Effect	Wilks' λ	F	Hypothesis df	Error df	p	Partial η^2
Body image attitudes	Time	.049	357.507	2	37	< .001	.951
Body image attitudes	Group × Time	.048	368.572	2	37	< .001	.952
Postural status	Time	.001	5659.228	8	31	< .001	.999
Postural status	Group × Time	.020	188.747	8	31	< .001	.980

The results presented in Table 2 showed that the multivariate main effect of time on body image attitudes was statistically significant, Wilks' $\lambda = .049$, $F(2, 37) = 357.507$, $p < .001$, partial $\eta^2 = .951$. This finding indicates that body image attitude scores changed significantly across the pretest, posttest, and follow-up stages. More importantly, the group-by-time interaction was significant, Wilks' $\lambda = .048$, $F(2, 37) = 368.572$, $p < .001$, partial $\eta^2 = .952$, demonstrating that the pattern of change over time differed significantly between the experimental and control groups. After the Greenhouse–Geisser correction was applied because of the violation of sphericity, the within-subjects effect of time remained significant, $F = 702.533$, $p < .001$, partial $\eta^2 = .949$. The exceptionally large effect sizes indicated that the combined yoga and healthy lifestyle intervention accounted for a substantial proportion of the change in body image attitudes.

The multivariate analysis for the set of postural indicators also demonstrated a significant main effect of time, Wilks' $\lambda = .001$, $F(8, 31) = 5659.228$, $p < .001$, partial $\eta^2 = .999$. The group-by-time interaction was also statistically significant, Wilks' $\lambda = .020$, $F(8, 31) = 188.747$, $p < .001$, partial $\eta^2 = .980$. These findings indicate that changes in postural status differed substantially between the experimental and control groups over time. The Greenhouse–Geisser-corrected analyses showed significant effects of time and significant group-by-time interactions for all eight postural indicators at the $p < .001$ level. The partial eta-squared values ranged from .865 for shoulder symmetry to .986 for forward head displacement and foot rotation, indicating very large intervention effects across all assessed dimensions of postural status.

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Table 3

Bonferroni-Adjusted Pairwise Comparisons Across Measurement Stages

Outcome	Pretest–Posttest mean difference	p	Pretest–Follow-up mean difference	p	Posttest–Follow-up mean difference	p
Total body image attitude	−15.075	.001	−14.975	.001	0.100	1.000
Forward head displacement	−5.725	.001	−5.800	.001	−0.075	.563
Head tilt	0.760	.001	0.725	.001	−0.035	.509
Shoulder symmetry	0.507	.001	0.467	.001	−0.040	.496
Pelvic tilt	1.925	.001	1.912	.001	−0.013	1.000
Trunk deviation	0.742	.001	0.700	.001	−0.043	.498
Scoliosis risk	5.775	.001	5.775	.001	0.001	1.000
Knee alignment	2.250	.001	2.268	.001	0.018	1.000
Foot rotation	3.638	.001	3.588	.001	−0.050	.641

As shown in Table 3, the Bonferroni-adjusted comparison for total body image attitudes revealed a significant difference between pretest and posttest, mean difference = −15.075, p = .001, and between pretest and follow-up, mean difference = −14.975, p = .001. The difference between posttest and follow-up was not statistically significant, mean difference = 0.100, p = 1.000. Given the significant group-by-time interaction and the descriptive pattern presented in Table 1, these changes were primarily attributable to the improvement observed in the experimental group, whereas the control group's scores remained stable. The absence of a significant posttest-to-follow-up difference indicates that the positive effect of the intervention on body image attitudes was maintained throughout the two-month follow-up period.

The Bonferroni comparisons for postural status showed significant differences between pretest and posttest and between pretest and follow-up for all eight postural indicators, with all p values equal to .001. In contrast, none of the differences between posttest and follow-up reached statistical significance. Specifically, the posttest-to-follow-up p values ranged from .496 to 1.000, demonstrating that the postural improvements achieved immediately after the intervention were maintained during follow-up. The descriptive statistics and significant interaction effects further indicated that these improvements occurred predominantly in the experimental group, whereas the control group showed no meaningful changes in body image attitudes or postural status across the three measurement stages. Overall, the findings demonstrated that yoga training combined with healthy lifestyle education produced statistically significant, strong, and sustained improvements in both the psychological dimension of body image and the physical-functional dimension of postural status among individuals with postural abnormalities and sedentary behaviors.

4. Discussion

The present study examined the effectiveness of yoga training combined with healthy lifestyle education in improving body image attitudes and postural status among individuals with postural abnormalities and sedentary behaviors. The findings demonstrated that the intervention produced significant improvements in both outcome domains. For body image attitudes, significant effects of time and group-by-time interaction were observed, with very large effect sizes. Participants in the experimental group reported substantial improvements in appearance evaluation, satisfaction with different body areas, weight-related attitudes, and the total body image attitude score from pretest to posttest. These improvements remained stable during the two-month follow-up, as indicated by the nonsignificant difference between posttest and follow-up scores. In contrast, the control group showed no meaningful change across the three assessment stages. The intervention also significantly improved all eight postural indicators, including forward head displacement, head tilt, shoulder symmetry, pelvic tilt, trunk deviation, scoliosis risk, knee alignment, and foot rotation. The significant group-by-time interaction and very large effect sizes indicated that the observed changes were attributable primarily to the combined intervention rather than the passage of time. Furthermore, the absence of significant differences between posttest and follow-up suggested that the postural improvements were maintained for at least two months after the intervention ended.

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The improvement in body image attitudes is consistent with previous evidence indicating that yoga can promote more positive perceptions, evaluations, and experiences of the body. A systematic review of quantitative studies in adults concluded that yoga interventions generally have beneficial effects on body image, although the magnitude of improvement varies according to the characteristics of participants, intervention duration, and measures used (Rupani et al., 2024). The current study extends this body of evidence by showing that yoga, when integrated with healthy lifestyle education, can improve several dimensions of body image among both women and men with postural abnormalities and sedentary behaviors. The improvement was not limited to a general perception of appearance but also involved satisfaction with specific body areas and attitudes toward body weight. This multidimensional pattern suggests that the intervention influenced participants' broader relationship with their bodies rather than producing only a temporary improvement in appearance-related mood.

The findings also align with evidence from a pilot positive body image yoga intervention conducted among men and women across adulthood. That study emphasized the feasibility and potential psychological value of using yoga to enhance positive embodiment in diverse adult populations (Dagenais et al., 2026). The present findings provide further support for this perspective, because the experimental group included both sexes and consisted of adults whose mean age was approximately 47 years. Much of the existing body image literature has focused on adolescents, young women, college students, or individuals with eating-related concerns. Demonstrating improvement among middle-aged adults with postural dysfunction suggests that yoga-based body image interventions may also be relevant to individuals whose dissatisfaction is associated with functional limitations, visible postural deviations, physical discomfort, or prolonged inactivity rather than solely with weight or culturally prescribed appearance ideals.

One mechanism that may explain the improvement in body image attitudes is increased body awareness. Yoga requires participants to direct attention toward breathing, muscular tension, bodily alignment, balance, and internal sensations. Through repeated observation of the body during movement and stillness, participants may become more capable of identifying bodily signals without immediately evaluating them as defective or undesirable. A systematic review of changes in body awareness following yoga interventions reported an overall tendency toward improved awareness of internal and external bodily experiences (Garnsey et al., 2025). In the present intervention, corrective asanas, pranayama, deep relaxation, and yoga nidra may have enabled participants to experience their bodies as responsive, adaptable, and capable of improvement. This experiential shift may have reduced the dominance of appearance-based judgments and promoted a more functional and compassionate understanding of the body.

The principles of therapeutic yoga may also have reduced body-related distress through stress regulation and nonjudgmental self-observation. Therapeutic yoga integrates physical postures with breathing, relaxation, and attentive awareness, thereby addressing both physical and psychological aspects of bodily experience. Agombar emphasized that yoga therapy can facilitate stress reduction, restoration of physical energy, and a more balanced relationship with bodily limitations through gradual movement, breath regulation, and deep relaxation (Agombar, 2022). Individuals with postural abnormalities may frequently experience fatigue, discomfort, self-consciousness, or dissatisfaction with their physical functioning. By participating in a structured program that emphasized gradual progress rather than competition or idealized performance, participants may have developed greater acceptance of their current condition while simultaneously gaining confidence in their ability to change it.

The present result is also compatible with evidence concerning yoga-based positive embodiment interventions. A size-inclusive yoga and body-gratitude journaling intervention was found to have potential for enhancing positive embodiment among higher-weight college women (Webb et al., 2022). Although the present study did not use journaling and involved a different age and clinical profile, both interventions emphasized bodily engagement through yoga rather than appearance-focused exercise. Yoga may be especially useful for body image because it directs attention toward what the body can do, how it moves, and how it feels. This functional orientation can weaken self-objectification, reduce habitual comparison with external appearance standards, and encourage gratitude for bodily capacities. In the present study, improvements in posture and movement may have provided concrete evidence of physical capability, thereby reinforcing more positive evaluations of appearance and body function.

The results are further supported by a systematic review of yoga as a therapeutic intervention for body image in pediatric populations. That review indicated that yoga may

improve body esteem and satisfaction, although findings concerning weight and shape concerns have not always been consistent (Bullard et al., 2025). The significant improvement in weight-related attitudes observed in the current study may be partly attributable to the addition of healthy lifestyle education. Yoga alone may improve embodiment and self-acceptance, whereas education about balanced nutrition, regular activity, sleep, and self-care may help participants reinterpret weight management as a health-oriented process rather than an appearance-driven obligation. This combination may reduce punitive or restrictive attitudes toward the body and replace them with realistic, sustainable, and health-focused behavioral goals.

The healthy lifestyle component likely contributed substantially to the observed psychological changes. Lifestyle medicine emphasizes that health is shaped by interconnected daily behaviors, including nutrition, physical activity, sleep, stress management, social functioning, and self-care (Rippe, 2022). Participants were not merely instructed to perform yoga exercises; they were also encouraged to reorganize daily routines and adopt more consistent health-promoting behaviors. Such education may increase perceived behavioral control and self-efficacy, particularly among individuals who have experienced prolonged inactivity. As participants became more active, improved sleep habits, managed stress, and reduced sedentary time, they may have experienced greater control over their health. This sense of agency can positively affect body image because the body is no longer perceived as a fixed source of dissatisfaction but as a responsive system that can be supported through regular care.

The second principal finding was the significant improvement in postural status. The intervention produced favorable changes in all assessed dimensions, and these changes were preserved during follow-up. This result is consistent with evidence showing that structured corrective and postural interventions can modify habitual musculoskeletal alignment. Titcomb and colleagues found that postural education and corrective exercise could improve the craniovertebral angle in young adults with forward head posture (Titcomb et al., 2023). Similarly, a randomized controlled trial of a head postural correction program demonstrated improvements in craniovertebral angle and scapular position, as well as changes in dominant hand grip strength (Elgendy et al., 2024). These studies support the principle that postural deviations are modifiable through repeated neuromuscular training and that changes in one postural region may influence broader functional outcomes.

The improvement in forward head displacement in the present study may be explained by the combined effects of cervical awareness, scapular stabilization, thoracic mobility, and breathing control. Sedentary individuals frequently maintain the head anterior to the trunk during computer and smartphone use. This position increases the mechanical demand on cervical extensor muscles and may be accompanied by rounded shoulders and thoracic flexion. Yoga postures that promote spinal elongation, shoulder opening, thoracic extension, and axial alignment may reduce these compensatory patterns. Slow and attentive performance also allows participants to recognize the difference between habitual and more efficient head positioning. The findings correspond with evidence that corrective exercise can improve alignment, muscle activation, and biomechanical properties among individuals with forward head posture (Sarıyıldız et al., 2022). The present study suggests that therapeutic yoga may provide a broader alternative or complement to conventional corrective exercise by incorporating postural retraining into whole-body movement.

The observed improvements in shoulder symmetry, pelvic tilt, trunk deviation, knee alignment, and foot rotation also indicate that the intervention affected the body as an integrated kinetic system. Postural abnormalities rarely occur in isolation. Pelvic malalignment may alter spinal curvature and lower-limb loading, while foot rotation and knee position can influence hip mechanics and trunk balance. Yoga involves closed- and open-chain movements, weight transfer, bilateral and unilateral postures, controlled transitions, and sustained alignment. These practices may strengthen stabilizing muscles, increase flexibility in shortened muscle groups, and improve proprioceptive control across multiple joints. As a result, the intervention may have corrected compensatory patterns throughout the kinetic chain rather than targeting only one anatomical deviation.

Improvement in postural balance may also be associated with increased physical activity and better health behavior. Research examining the relationship of nutritional status and physical activity with dynamic postural balance has indicated that active behavior and healthier physical status are relevant to balance performance (Guzmán-Muñoz et al., 2025). The healthy lifestyle education provided in the present study may have encouraged participants to interrupt prolonged sitting, increase daily movement, and practice

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learned exercises outside formal sessions. Repeated exposure to varied movement could improve lower-limb strength, sensory integration, and the ability to control the center of mass. Nutritional and sleep-related improvements may additionally support recovery and participation, although these mechanisms were not assessed directly in the present study.

The findings are also understandable in light of the harmful effects of prolonged sedentary behavior. A systematic review of longitudinal studies showed that sedentary behaviors are associated with a range of adverse health outcomes in young adults (Huang et al., 2022). Although the participants in the present study were older on average, prolonged sitting may similarly contribute to muscular deconditioning, limited joint mobility, and reduced postural endurance. The intervention addressed this problem through two complementary pathways: yoga provided structured physical activation, while lifestyle education encouraged participants to reduce and interrupt sedentary periods during daily life. This combination may explain why improvements were observed across several postural regions and remained stable during the follow-up period.

The effectiveness of yoga for musculoskeletal outcomes is supported by broader exercise research. A systematic review and meta-analysis comparing six exercise interventions for low back pain found that exercise-based approaches were generally effective and that yoga represented a valuable intervention for pain and functional improvement (Cheng et al., 2025). Although low back pain was not the primary outcome in the present study, the mechanisms underlying improvement—enhanced trunk stability, flexibility, movement control, and relaxation—are directly relevant to postural correction. Yoga may reduce excessive muscular tension while strengthening postural muscles, allowing participants to adopt more efficient alignment with less effort. The breathing component may also improve rib-cage mobility and coordination between the diaphragm, abdominal muscles, and spinal stabilizers.

Evidence from mind–body exercise studies further supports the functional benefits of this type of intervention. A network meta-analysis reported that mind–body exercises can improve exercise capacity and related outcomes among individuals with chronic cardiopulmonary dyspnea (Li et al., 2025). This evidence is relevant because sedentary adults may have reduced physical tolerance and may find high-intensity exercise difficult to initiate or maintain. Yoga can be adapted to different functional levels and may therefore provide sufficient physical stimulus without imposing excessive physiological demands. The gradual and modifiable nature of the intervention may have enhanced adherence and allowed participants to achieve repeated successful experiences, which are essential for both physical improvement and psychological confidence.

The maintenance of improvements at the two-month follow-up is an important finding. The nonsignificant differences between posttest and follow-up for body image and all postural indicators suggest that participants retained the benefits after supervised sessions ended. This stability may have resulted from the educational component, which aimed to translate session-based learning into daily routines. Participants were encouraged to continue yoga practices, manage sitting time, improve sleep and nutrition, and engage in self-care. The combination of experiential learning and behavioral education may therefore have facilitated internalization of the intervention. Moreover, improved body awareness could help participants recognize and correct poor posture during daily tasks, while more positive body attitudes could increase motivation to continue physical activity. These reciprocal psychological and physical changes may explain the durability of the outcomes.

5. Conclusion

Overall, the results suggest that body image and posture should not be treated as unrelated outcomes. Postural improvement may enhance satisfaction with appearance, physical competence, and bodily functionality, whereas more positive body attitudes may increase willingness to move, practice self-care, and maintain corrective behaviors. The intervention appears to have created a reinforcing cycle in which improved movement and alignment supported positive embodiment, and positive embodiment encouraged continued engagement in health-promoting behavior. The combined yoga and healthy lifestyle program therefore represents a comprehensive approach that addresses the psychological, behavioral, and biomechanical consequences of sedentary living.

6. Limitations & Suggestions

This study had several limitations. The sample was relatively small and was selected purposively from healthcare and counseling centers in Tehran, which may limit the generalizability of the findings to other populations, geographical regions, age groups, or individuals with different levels of postural dysfunction. Although participants were randomly assigned to the experimental and

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control groups, the quasi-experimental design did not provide the same degree of control as a large randomized clinical trial. Body image and sedentary behavior were assessed through self-report measures and may therefore have been influenced by recall error or social desirability. The control group did not receive an active comparison intervention, making it difficult to separate the specific effects of yoga and lifestyle education from attention, group participation, and expectancy effects. In addition, the intervention combined two components, so the independent contribution of yoga and healthy lifestyle education could not be determined. The two-month follow-up period was also relatively short, and intervention adherence outside supervised sessions was not objectively monitored.

Future studies should recruit larger and more diverse samples and employ multicenter randomized controlled designs to improve statistical power and external validity. Researchers could compare yoga alone, lifestyle education alone, their combined application, and an active control condition to determine the specific and additive effects of each component. Longer follow-up periods of six months or one year would clarify whether the improvements remain stable over time. Future investigations should also use objective measures of sedentary time and physical activity, such as accelerometers, and assess adherence to home-based yoga practice. Examining possible mediators, including body awareness, self-compassion, stress reduction, physical self-efficacy, muscular endurance, flexibility, and balance, could explain how the intervention produces change. Additional studies may also investigate whether age, sex, baseline postural severity, body mass index, pain, and initial body dissatisfaction moderate treatment effectiveness.

Healthcare providers, physiotherapists, exercise specialists, psychologists, and lifestyle counselors may consider incorporating adapted yoga and healthy lifestyle education into programs for sedentary individuals with postural abnormalities. Interventions should be delivered by trained professionals and adjusted according to participants' physical limitations, medical conditions, and baseline fitness. Sessions should emphasize safe alignment, gradual progression, noncompetitive participation, breathing, relaxation, and respect for individual bodily capacities. Lifestyle education should provide practical strategies for interrupting prolonged sitting, increasing daily movement, improving sleep and nutrition, managing stress, and establishing sustainable self-care routines. Periodic follow-up sessions, home-practice materials, and adherence monitoring may help participants maintain improvements after the formal intervention has ended.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. The study protocol was approved by the relevant institutional ethics committee under the ethical approval code IR.PNU.REC.1405.001.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed in this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

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