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Original article

The effect of eight-week TRX exercises on mild and moderate posture disorders

Deniz Çakaroğlu

Department of Physical Education and Sports Siirt Universty, Siirt/Turkey - E-mail: denizceviz@hotmail.com

Summary. *Study Objectives:* This study was conducted to measure the effect of eight-week TRX exercises on mild and moderate posture disorders. *Methods:* 40 people (f: 24; m: 16), with exercise and control groups having 20 each, participated in the study. It was ensured that the exercise group performed various exercises with TRX instruments, three days a week for eight weeks. Before and after the exercise, measurements were taken from both groups with the "Scoliometer", and only the degree of curvature, shoulder, and chest circumference measurements were taken without applying any exercise program to the control group. Statistical data were obtained using frequency and percentage values in SPSS 22; the independent sample t test was applied to compare descriptive statistics, and the repeated measures ANOVA was used, whereby the level of significance was taken as 0.001 and 0.005. *Results:* A statistically significant difference was found between the pre-test and post-test scores of the male exercise-control, female exercise-control, and total study groups based on the variable of shoulder, chest, and posture degree of curvature. Compared with the Bonferroni family-wise-error control method, a significant difference was found between the male exercise group participants and the control group in shoulder measurements ($p < .0001$), and no difference was found between female groups. In comparison of female exercise and control groups based on the chest variable, the difference was found to be significant ($p < .0001$), but no statistically significant difference was observed between the male exercise and control groups and a significant difference was observed between the pre-test and post-test in the degrees of curvature of women and men (exercise-control), and the pre-test predicted the post-test in the same degree of curvature and group ($p < .0001$). *Conclusion:* Besides, TRX exercises provide positive changes in the anthropometric structure and reduce posture curvature, especially those with high degrees of curvature were found to decrease significantly.

Keywords: Posture, TRX exercise, Women, Men.

Introduction

TRX Training (Total Resistance Exercise) is strength training, a method of working against gravity, which is created with a suspension system consisting of thick woven ropes, which enables the exercise of the resistance of the exercises with its body weight (1). TRX training creates similar effects in functional mobility, strength, and balance (2). The training method with TRX is a working system that has just started to be used in Turkey. Different exercises are applied by placing hands or feet on two handles on the TRX. For the lower and upper limbs, it allows multi-joint and multi-planar exercises on unstable ground or under unstable conditions. On the other hand, it enables the movements of the belts to be applied at different loads by increasing or decreasing the ground heights and angles (3).

In exercises using TRX, three principles are used to adjust the severity of movements or difficulty levels. The first principle is the principle of "Vector Resistance" in which the resistance is reduced or increased by changing the angle of the body with the ground. The second principle is the principle of "stability-balance"

in which the stability and balance of movement are adjusted by changing the support points of the hands and feet. The last principle is the pendulum principle in which the resistance is adjusted according to the starting position under the TRX hanger or away from the hanger (4).

Stabilization exercises applied to the musculoskeletal system, stabilizing muscles around the joints and the body can become more active against unwanted movement. For this reason, the hanging exercise system training can be particularly useful for athletes in overhead sports (for example, baseball, softball, volleyball and handball players and quarterbacks in American football). For, it can increase the control of the scapula and the strength of the serratus anterior muscles. These improvements can help prevent both acute and chronic shoulder injuries (5).

Today, the gradually decreasing physical activity level affects body posture as well as different health problems (obesity, diabetes, cardiovascular, etc.) that affect people of all ages. Physiologically and biomechanically good posture is the posture that provides maximum efficiency in the body with minimum effort. Bad posture progresses with unnecessary contraction and compensation mechanisms in the muscles. These changing mechanisms trigger a spasm in the shoulder and back muscles, reduce the effectiveness of biomechanical functions, and weaken soft tissues. Although there are genetic, physiological, and psychological causes of posture disorders, long sitting at the table or in front of the computer in early childhood, using non-ergonomic tables and chairs, carrying heavy school bags and physical inactivity affect body awareness and cause bad posture (6).

The general approach to moderate and mild posture disorders that are non-structural or functional are mostly corset use or exercise applications. At this stage, people are recommended to practice exercises that refer to a practical and effective method that increases the quality of life, reduces the severity of pain, and decreases the curvature level in the spine (7). For this purpose, the effects of TRX exercises, which are exercise injuries for the muscular and skeletal system, on the degree of curvature of the posture were investigated by.

Method

Study Group

A total of 40 people (f: 24; m: 16), with exercise and control groups having 20 each, who voluntarily participated in TRX exercise, did not have any disadvantage in terms of health and did not actively participate in sports, participated in the study.

Data Collection

Power pull, row, squat, side squat and push-up exercises were performed with the TRX apparatus for 45 minutes (with warm-up and then cool-down exercises) three days a week for eight weeks for the exercise group. The degree of posture curvature was measured with a scoliometer. While chest circumference was measured at the level of the breasts when it was at the mid-point of the tidal volume, the pre-and-post-test measurement of shoulders was carried out by tape measure from the point where the sternum and the 2nd rib meet from the maximal protrusion of the deltoid muscle (8, 9).

Statistical Analysis

Statistical data were obtained using frequency (frequency) and percentage (%) values in SPSS 22 program; the independent sample t test was applied to compare descriptive statistics of two groups, and; the repeated measures ANOVA was used, whereby the level of significance was taken as 0.001 and 0.005.

Results

The mean age, height, and weight of the groups are shown in Table 1. The mean age of the people in the exercise group is 22.85 ± 4.80, their mean height is 168.60 ± 7.74 and their mean weight is 67.08 ± 12.48. The mean age of the individuals in the control group is 25.50 ± 5.79, the mean height is 168.40 ± 6.83 and the mean weight is 74.78 ± 20.32. Considering the general mean, it can be said that the groups are not very different from each other, and the mean age, height, and weight are close to each other.

Table 1. Mean of Age, Height, and Weight of Exercise and Control Groups

	Groups						
	Exercise		Control		General		
Variable	$\bar{X}$	S.D	$\bar{X}$	S.D	$\bar{X}$	S.D	p
Age	22.85	4.804	25.50	5.79	24.02	5.61	0.124
Height	168.60	7.748	168.40	6.83	168.50	7.21	0.931
Weight	67.08	12.48	74.78	20.32	70.93	17.10	0.157

Table 2. Main Summary Table for the repeated measures ANOVA Effect of Shoulder Circumference Dependent Variable According to Groups

Source of variance	**df**	**S.D**	**MS**	**F**	**p**	**η^2**
Men						
Shoulder Pre-tests	1	1406.746	1406.746	1480.337	0.000	0.986
Group	2	7.284	3.642	3.833	0.049	0.005
Error	13	12.354	0.950			
Women						
Shoulder Pre-tests	1	1166.518	1166.518	161.593	0.000	0.882
Group	2	4.096	2.048	0.284	0.756	0.003
Error	21	151.596	7.219			
Total						
Shoulder Pre-tests	1	4521.786	4521.786	993.715	0.000	0.962
Group	2	7.510	3.755	0.825	0.446	0.001
Error	37	168.364	4.550			

In the main summary table for the repeated measures ANOVA effect of the shoulder circumference dependent variable in men, there was a significant difference between the pretest and posttest between F (1,13 = 1480.337, p <.0001), and also between the study groups, and in women in terms of posttest F (1.21 = 161.593, p <.0001) according to the shoulder variable. However, there was no significant difference in the group variable in terms of shoulder measurement in both women and total and control groups.

A significant difference was observed between the male exercise and control groups in terms of the shoulder variable (Figure 2) and no significant difference was found between the female and total groups (Figure 1-3).

Results show that there was a significant difference between the pretest chest and posttest scores of men F (1.13 = 1693.598, p <.0001), and no statistically significant difference was observed between male exercise and control groups. There was a significant difference between both pretest-posttest and study groups in women (p <.0001). Considering the total exercise and control groups, it is understood from Table 3 that the chest measurement is significant in terms of posttest score F (1.36 = 2197.459, p <.0001). The degree of the chest and the total of the group also proved to be significant in terms of F (1.36 = 5.371, p <.0001). However, no significant difference was observed between total exercise and control groups in terms of the group variable (p = 0.125).

Figure 4 highlights that there is no significant difference between male exercise and control groups in terms of chest measurement (p = 0.178). In Figure 5, when the female exercise and control group is compared with the Bonferroni family-wise-error control method, the difference between them is significant (p = 0.000). When the Graphic showing the Binary Comparison of Total Exercise and Control Groups is examined in terms of pretest and posttest, it is observed that there is a decrease in the chest posttest measurement of the exercise group compared to the pretest measurement (Figure 6).

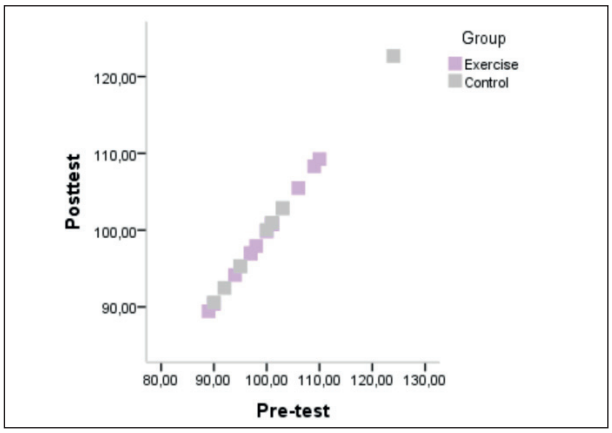

Figure 1. Female Exercise and Control Groups

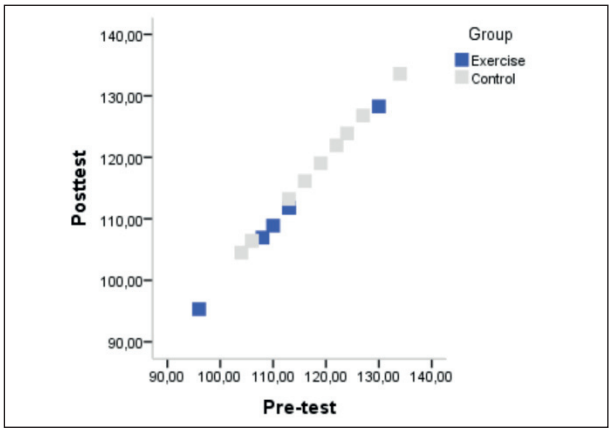

Figure 2. Male Exercise and Control Groups

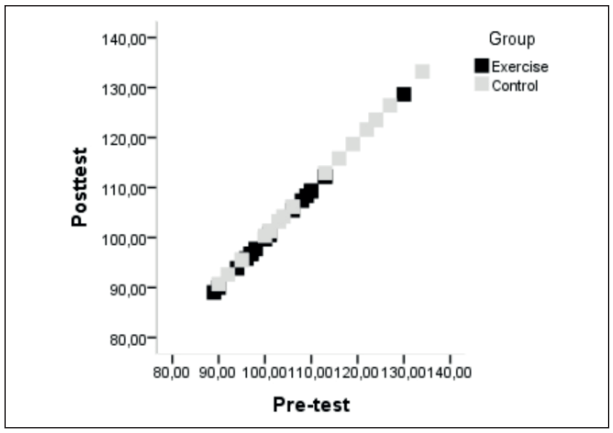

Figure 3. Total Exercise and Control Groups

Considering the main summary table for the repeated measures ANOVA effect of the Degree of Curvature according to total groups, there is a significant difference between the pre-test and post-test F (1.36 = 225.840, p <.0001) and considering the degree of curvature and group total, it is seen that the pre-test predicts the post-test F (1.36 = 13.445, p = 0.001). It is also observed that there is a significant difference between the pretest and posttest in the degree of curvature of women and men, and the pretest predicts the posttest in the same degree of curvature and group totals (p <.0001). However, there is no significant difference between the pretest and the posttest in all participants in terms of the group variable.

Table 3. Main Summary Table for the repeated measures ANOVA Effect of Chest Circumference Dependent Variable According to Groups

Source of variance	df	S.D	MS	F	p	η^2
Men						
Chest Pre-tests	1	2248.739	2248.739	1693.598	0.000	0.990
Group	2	3.484	1.742	1.312	0.303	0.001
Error	13	17.261	1.328			
Women						
Chest Pre-tests	1	1856.056	1856.056	1258.440	0.000	0.959
Group	2	46.956	23.478	15.919	0.000	0.024
Error	21	30.973	1.475			
Total						
Chest Pre-tests	1	3648.631	3648.631	2197.459	0.000	0.979
Group	2	7.307	3.654	2.200	0.125	0.001
Chest + Group	1	8.918	8.918	5.371	0.026	0.002
Error	36	59.774	1.660			

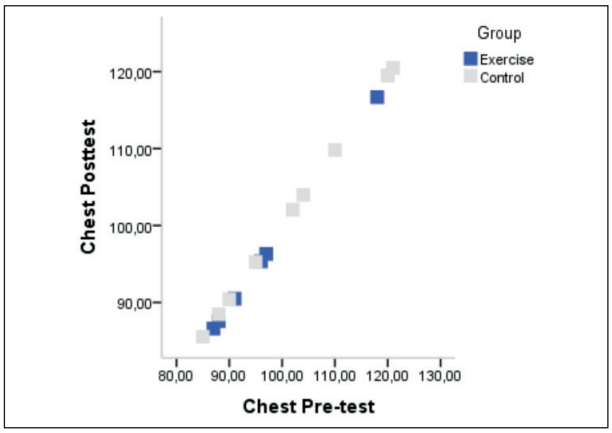

Figure 4. Male Exercise and Control Groups

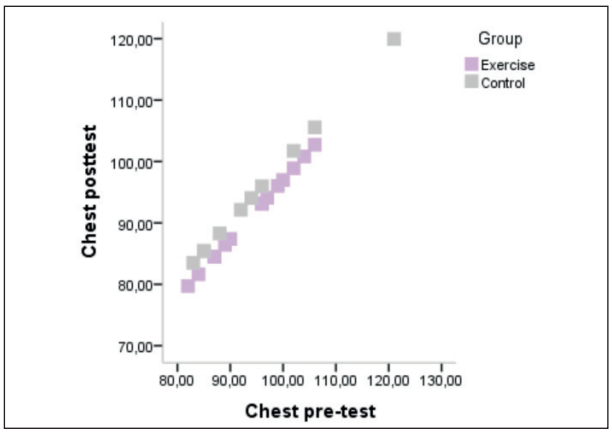

Figure 5. Female Exercise and Control Groups

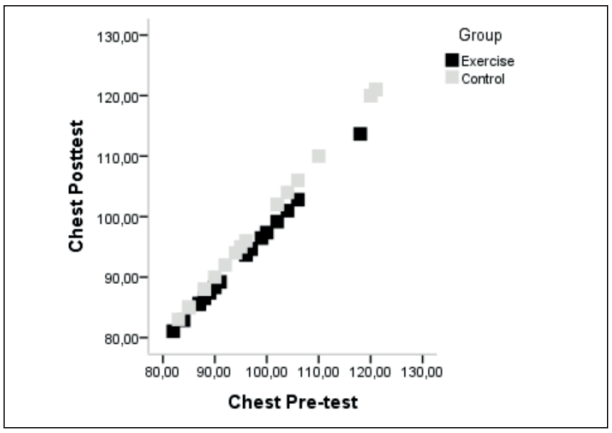

Figure 6. Total Exercise and Control Groups

When the female exercise group is analyzed in Figure 7, it is observed that the degree of curvature decreases after the second measurement, and especially the degree of curvature of those with high degrees decreases. It is seen that there is a decrease in the measurement level of the male exercise group in Figure 8. In the comparison graph between the groups, there is a significant decrease in the degree of curvature between the pretest and posttest in the exercise and control groups. When the control group and exercise group are compared, it is seen that the difference is significant (Figure 9, p <.0001).

Table 4. Main Summary Table for the repeated measures ANOVA Effect of the Degree of Curvature Dependent Variable According to Groups

Source of variance	df	S.D	MS	F	p	η^2
Men						
The Degree of Curvature Pre-tests	1	24.771	24.771	52.814	0.000	0.656
Group	2	1.773	0.887	1.891	0.193	0.047
The Degree + Male Group	1	5.532	5.532	11.794	0.005	0.146
Error	13	5.628	0.469			
Women						
The Degree of Curvature Pre-tests	1	80.108	80.108	153.835	0.000	0.854
Group	2	0.196	0.098	0.188	0.830	0.002
The Degree + Female Group	1	2.983	2.983	5.729	0.027	0.079
Error	21	10.415	0.521			
Total						
The Degree of Curvature Pre-tests	1	113.242	113.242	225.840	0.000	0.819
Group	2	0.173	0.087	0.173	0.842	0.001
The Degree + Group	1	6.742	6.742	13.445	0.001	0.048
Error	36	18.051	0.501			

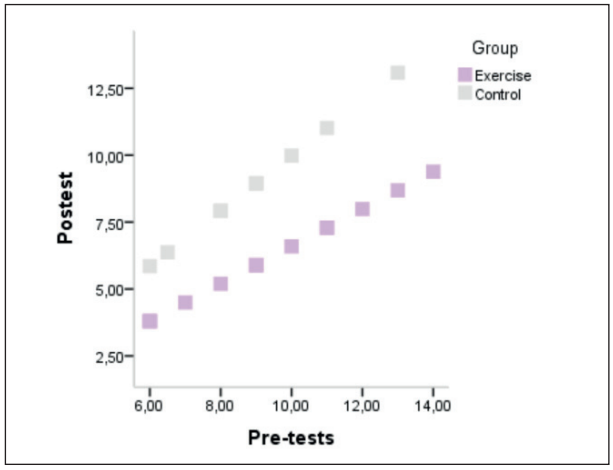

Figure 7. Female Exercise and Control Groups

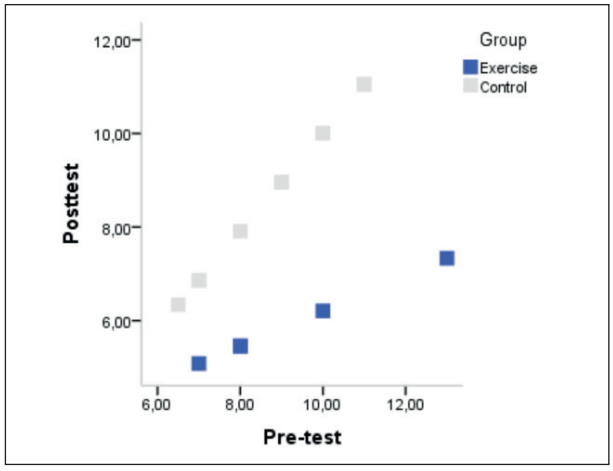

Figure 8. Male Exercise and Control Groups

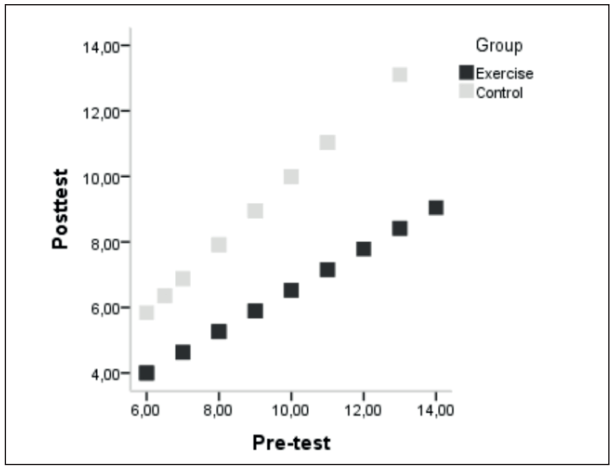

Figure 9. Total Exercise and Control Groups

Discussion and Conclusion

The aesthetic stance in terms of physical appearance has positive effects on people in physical, physiological, social, psychological, and many other aspects. In addition to posture disorders caused by factors such as genetics, etc., wrong postures obtained since the development period may cause weak back muscles and painful spinal deformations over time. Through resistance exercises with TRX, the main goal is to increase muscle strength and endurance in unbalanced body positions, to strengthen the muscles of the power zone, and to minimize the risk of disability (5). Thanks to the strengthening of the postural muscles and cooperation between certain muscles, TRX trains not only the muscles but also their antagonists, agonists, and synergists, helping improve the correct body posture (10).

Gulbani and Shevchuk used the physical rehabilitation technique for posture disorders that included TRX simulator, exercise therapy, and self-mobilization techniques for the first time in their study in which they made posture evaluation and analysis in schoolchildren aged 10-12. As a result, they found that TRX simulator exercises had positive effects such as flexing and simultaneously increasing the deep muscles of the body (11). In their study conducted with older participants, Gaedtke and Morat reported that TRX exercises had positive effects regarding mostly gaining strength compared to gait and balance improvements (12).

Pastucha et al. stated that the functional 3D training is an effective method to strengthen the postural muscles of the human body, to increase joint stability, to strengthen ligament groups, and to improve the stability and lung capacity of muscle groups, especially the back muscles (13). In another study, it was concluded that TRX suspension exercises are very effective in increasing the core region muscle strength and endurance as well as in improving static and dynamic balance, explosive force, and flexibility in healthy individuals (14). Curiţianu and Balint found in their study with those suffering idiopathic scoliosis that avoiding a more aggressive treatment even if only for six months of doing with people with idiopathic scoliosis TRX Suspension Training Exercises is clinically meaningful (15).

Numerous studies have revealed that regular physical activity and exercise provide positive improvements in anthropometric measurements. Smith et al.

stated that regular participation in TRX Suspension Training could positively alter the risk factors for many major cardiovascular diseases, including muscle fitness, body fat, and decreased waist circumference (14). Notarnicola et al. stated that CrossFit and TRX training methods led to improvements in terms of both anthropometric and aerobic resistance (16). In this study, it was observed that after the TRX exercise, decreases occurred in the shoulder area in men compared to the control group, and decreases occurred in chest measurements in women (Figure 2, 5).

In addition to such effects of TRX exercises, in this study which has been designed to determine the potential effects of TRX exercises in moderate and mild posture disorders, it has been revealed that there is a positive decrease in the degree of curvature in individuals. There are studies in the literature that examine different effects, but studies on postural disorders are limited, and similar research is recommended with young groups in this field.

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Correspondence:
Deniz Çakaroğlu
Department of Physical Education and Sports Siirt Universty, Siirt/Turkey
E-mail: denizceviz@hotmail.com