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The effect of park sports equipment with and without training in women with hyperlordosis and chronic low back pain

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Abstract

Background: People who use Outdoor fitness equipment in parks and gardens do not know how to use these machines and their use may cause them various types of injuries.

Aim: Outdoor fitness equipment in parks from the perspective of sports injuries cognition was evaluated for people with hyperlordosis, chronic low back pain, and healthy individuals in two groups with and without a coach and training.

Materials and Methods: In this quasi-experimental study, 30 middle-aged women with a mean and standard age deviation (48.96 ± 8.21 years) volunteered to participate in the study and were purposefully divided into two experimental groups (15 people). Controls (n = 15) were divided. There were 10 patients in each group with hyperlordosis and chronic low back pain and 5 healthy people. Pain intensity and lumbar lordosis angle were determined by VAS questionnaire and using a flexible ruler, respectively. The present study was performed for 60 minutes 3 days a week for 12 weeks.

Results: After 12 weeks of training with training, a significant decrease in pain level (*P*= 0.639, t= 0.481) was observed in the experimental group compared to the control group, but there was a significant difference in lumbar lordosis (*P*= -1.246), t= 0.235) users were not observed.

Discussion and Conclusion: The results of this study showed that working with Park Sports Equipment with the presence of a coach and proper training reduces back pain in users with chronic low back pain and develops the general health of users of these devices.

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1. Introduction

The first park sports equipment was used in 2005 in Iran. Being non-standard and possible side effects of using them have been discussed by most experts and sports medicine experts. The most users of this devices are not professional athletes and are not familiar with the correct methods of movement. Accordingly, their use may aggravate or cause musculoskeletal complications [1]. Park sports equipment is one of the most widely used components of urban furniture with general use. If it was used correctly and scientifically, it can encourage many citizens to play sports [2, 3]. These spaces provide a good opportunity for the low-income sections of society who are not able to pay for sports and entertainment [4]. Any neglected may have consequences such as acute injuries instead of health and well-being [5]. Improper location (for example, not considering the direction of sunrise and sunset), not installing the device use sign, improper arrangement, not considering the appropriate distance between devices, not specifying and separate devices for different age groups, not specifying the program exercise and minimum movements and maximum for different age groups can be harmful factors to users [6].

Many people believe that they can use these devices with any disease. Most people suffer from musculoskeletal pain and it is harmful for them to use these devices without training and awareness. Most of the fans of these equipments and interested in morning park sports are elderly people. They may suffer the most irreparable damages, specially knees and lower back [7, 8]. The devices in the parks are designed for physical fitness and are not curable at all, so people with musculoskeletal problems should not use them to cure the disease. Of course, according to experts, those who do not have a special problem with orthopedics may not be harmed, but in the meantime, some people only know that exercises are useful, so they use these devices without consulting a specialist [7, 8].

People's physical situations are completely different. Regardless of this factor and due to improper use, they may suffer some injuries of the knee, back, neck, wrist, shoulder, and elbow [9]. Another problem is that they do not have a fully controlled system in terms of speed and acceleration of parks equipments. These devices are sometimes so heavy and move so fast and the user cannot control them. Before starting these exercises, people should be checked for heart rate and blood pressure, as well as muscle and joint strength. In addition to these factors, age, gender, and even occupation should be considered. When using these devices, their speed should be quite normal, but unfortunately, many people start moving very fast from the beginning; So, the heart rate in these people goes up a lot without any preparation [10].

Chronic low back pain is one of the musculoskeletal abnormalities with many socio-economic effects in many developed countries [11]. Unlike acute low back pain, chronic low back pain (CLBP) is a complex and problematic disease being associated with numerous complications and functional disorders and spontaneous recovery is rare and unlikely. Prescribing painkillers or prescribing exercise alone is not enough to control symptoms and treatthem [12]. Due to muscle weakness, mechanical pressure on the trunk may cause pain due to improper use of exercise equipment, then this pain prevents muscle activity, and if the person wants to engage

in daily physical activity, he may find problems [13]. A regular core stability exercise program is a useful treatment option to improve quality of life and reduce disability and pain in female nurses with chronic low back pain [14]. Lumbar stability exercises along with walking can be recommended for patients with chronic low back pain because relieve back pain and prevent chronic low back pain by improving muscle endurance [15]. Given the numerous negative effects associated with chronic low back pain, it has been suggested that a single approach to treating low back pain is ineffective and treatment should include a multidisciplinary approach [16]. In spinal abnormalities, lordosis is one of the most common abnormalities. Also, the most common side effects are back pain and muscle spasms, which cause spinal canal stenosis or disc herniation [17].

The amount of physiological lordosis of the lumbar region in the standing position with a flexible ruler is considered to be 40 to 60 degrees. Lumbar hyperlordosis is a term used to define an increase in lumbar lordosis and can lead to many problems for patients, including stress focusing on specific vertebral structures, lumbar pain, and disturbances in postural stability and function [18]. In previous studies, researchers have suggested that lordotic postures can increase the pressure load on the posterior vertebral structures and the stress on the intervertebral disc compared to the natural spine. Increased force concentration on a relatively small portion of the fast joint causes high stress to be concentrated on the joint tissue, which has the potential to cause low back pain symptoms [19]. Training torso and pelvic floor exercises are recommended as the simplest and most desirable way to prevent and also reduce back pain and lumbar lordosis [20].

Due to the limited research in this field in our country and the results presented, and the widespread use without knowledge of sports equipment in parks, in this study was tried to investigate the effect of park sports equipment with and without training on hyperlordosis and back pain. The question of the present study is: “Is there any difference between the effect of the presence of the instructor and training and the absence of the instructor and training on the angle of hyperlordosis and the amount of back pain in women using this equipment?”

2. Methods

The present semi-experimental and the applied study was a pre-test, post-test study with a control group. Eighty female users with a mean and standard deviation of 48.96±8.21 years who used the park sports equipment were selected as available. After completing the consent form to participate in the research and approval of the orthopedic specialist to have chronic low back pain and filling out a pain questionnaire and using a flexible ruler to measure lumbar lordosis, 45 people were eligible to enter the study. However, after the explanations of the researcher, 30 people were considered for regular cooperation during the course. Participants were then purposefully divided into experimental (n= 15) and control (n= 15) groups. Each group consisted of 10 patients with chronic low back pain and lumbar hyperlordosis (both complications together) and 5 healthy individuals (without symptoms of low back pain and musculoskeletal pain and skeletal abnormalities). Criteria for inclusion in the study were: having a history of more than 3 months of low back pain with hyperlordosis

abnormalities and confirmation of low back pain by an orthopedic specialist, in terms of pain, having moderate to less pain (number 5 and less) on a visual scale severe pain, general health and no history of surgery and specific spinal disease, sacroiliac disorders, major abdominal, pelvic and lower extremity surgeries, respiratory diseases, diabetes and cancer, and neurological diseases, pelvic fractures, and dislocations. Exclusion criteria were: absence of more than three sessions in the research program, lack of cooperation and ability to perform exercises, and severe low back pain during the training period. Visual Pain Intensity Scale (VAS) [21] was used to measure pain. Visual pain measuring instrument is the most widely used measuring instrument in the world. In addition to validity and reliability, the most important feature of this tool is its ease of use. The useful application of this tool has also been investigated for clinical studies. This instrument is a 10 cm measure left side (number zero) indicates no pain and right side number 10 indicates the most severe pain. Achieving a score of 1-3 is mild pain. On the other hand, 7-7 is moderate pain and 8-10 is severe pain (Figure 1). To measure intensity pain, the patient was asked to look at the aforementioned continuum and determine the amount of pain feeling at that moment.

	Shortness of breath	At rest	During activity
0	Nothing at all	□	□
0.5	Very very slight	□	□
1	Very slight	□	□
2	Slight	X	□
3	Moderate	□	□
4	Somewhat severe	□	□
5	Severe	□	□
6		□	X
7	Very severe	□	□
8		□	□
9	Very very severe	□	□
10	Maximal	□	□

Figure 1. Visual scale vas to measure pain intensity

A flexible ruler (IDIO) made in Thailand was used to measure the lumbar curvature of the spine. This ruler is a rod with a length of 60 cm and a width of 1 cm that can be bent and smoothed and is easily formed. This tool has an accuracy of one-tenth of a degree, a reliability coefficient of 97%. To use this method, two bony signs are needed, which according to the Yodas method, should be found from the prickly appendage of the twelfth dorsal vertebra to the prickly appendage of the second sacrum [22]. The subject is asked to the least amount of coverage in the upper body, spread the legs shoulder-width apart with then bend over and place the hands on the table. Then, by touching the last ribs and extending them to the back (midline of the spine), the examiner determines the T12 vertebral appendages, then marks the lower L1 vertebra. After all, the subject will be asked to stand and the iliac thorns posterior upper of the S2 spine was marked. After finding the above beads, the marked points are marked on the ruler and the ruler is drawn on the paper without any changes.

After removing the ruler from the paper, the two points marked 12; 2S is connected to the straight line. Connected the spinous process, it is denoted by the letter L, then we measure from the deepest point of the arc and from the line L the width of the arc H (Figure 2). By placing the values in the formula, we measure the amount of lumbar curvature. Formula (1-1): θ= 4ARCTAN2H / L.

Age was calculated and recorded based on their date of birth (Figure 3).

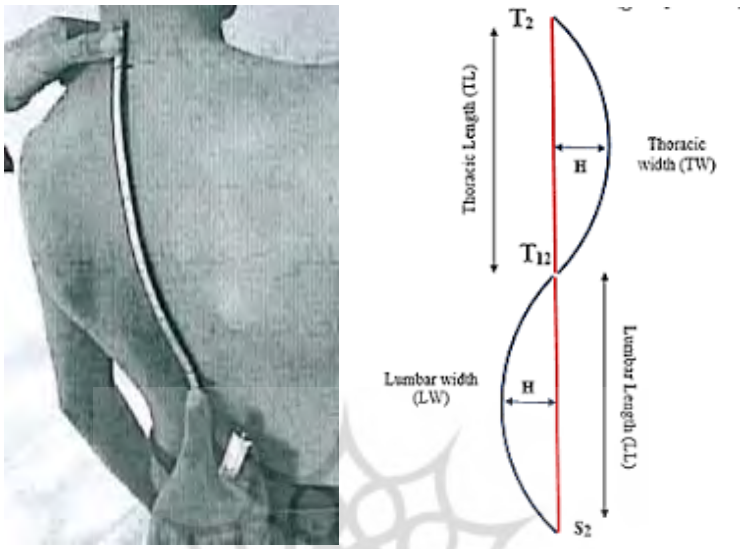

Figure 2. Drawing points of lumbar curvature: A specific point T12 to S2 is connected in a straight line and (L) is named, after the deepest point of the linear arc perpendicular to the line L is drawn; it is measured and named H.

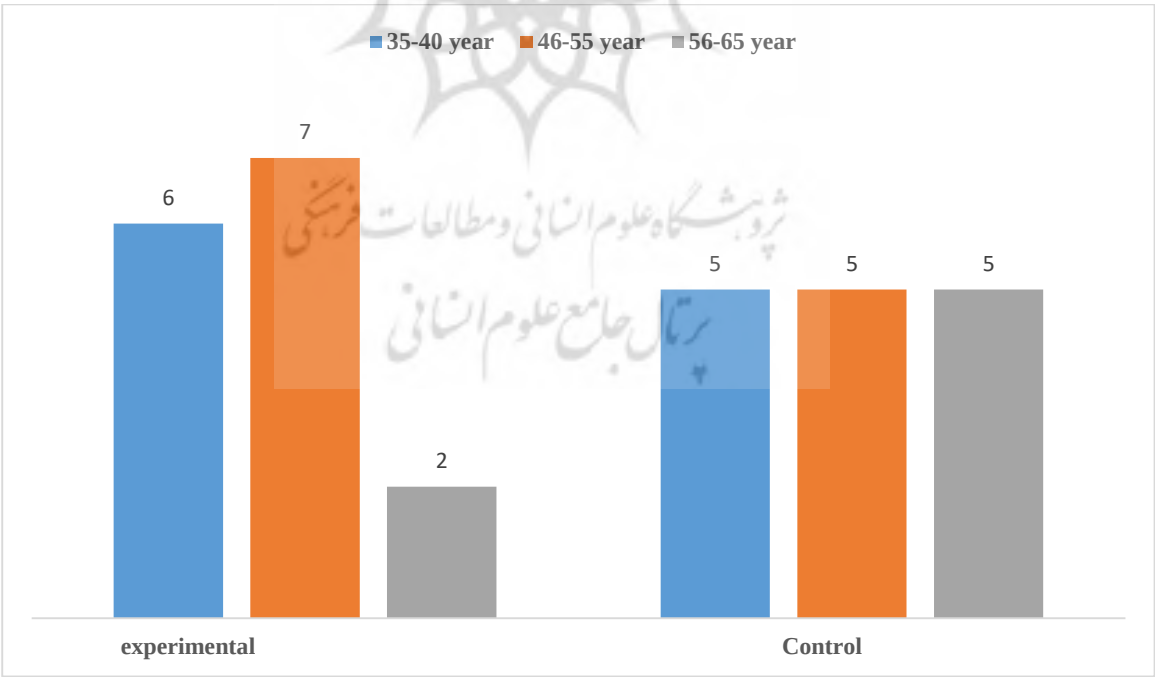

Figure 3. Frequency distribution of samples by age

To perform the training protocol, the experimental group performed warm-up

exercises for 10 min, including jogging and dynamic stretching movements, and then performed the main exercises. In the main exercises, in order to observe the principle of overload, the repetition of movements increased in each month compared to the previous month: in the first month three sets, and 10 repetitions; in the second month according to the subjects' ability 3 sets and 20 repetitions; in the third month 3 sets and 30 repetitions depending on the subjects' ability. Although some devices are prohibited for subjects with low back pain and hyperlordosis during the exercises, the movements were emphasized to do slowly and concentration. Each month, in addition to the previous month's exercises, new exercises were added. This, on the one hand, motivated the subjects and, on the other hand, maintained the principle of overload in the exercises. The progress of the exercises was at the same level for all subjects and they were advised to do the exercises as long as they did not feel pain and discomfort. If necessary, the selected exercises were adjusted for subjects who felt pain during those exercises or were unable to maintain their proper posture. In addition, if subjects felt losing control of their movements (inability to perform the exercise in the proper direction), they were advised to step back one step to reach baseline.

Observance of this led to attention to the individual differences of the subjects and their lack of pain or frustration [23]. The time of the main exercises was 20 min. In the second month, it increased 10 min. In the third month, it increased more 10 min, increased to 40 min, and 10 min of cooling exercises (including static stretching exercises) at the end. The control group used the devices according to the routine before the research for about 45-60 min without an exercise program and training and observing the warm-up steps at the beginning and cooling down at the end of the exercise, and did not receive any intervention regarding the exercise program. They were asked to maintain their daily activities that were recorded before the start of the course and not to participate in any exercise program. They were encouraged to maintain a normal course of life during the course. At the end of the course, all subjects performed all the variables of the research, in the same environment and in the same way, the pre-test-post-test design. It should be noted that both groups used the same devices (Table 1).

In order to observe the ethical issues, the control group was warned that if they wish, after 12 weeks of the training protocol by the experimental group, they could be taught how to use it correctly for a few sessions and perform the exercises under the supervision of an instructor (Table 2).

Descriptive statistics were used to calculate the mean and standard deviation of the data. Data were analyzed by independent and paired t-test to determine within-group and between-group changes at the significant level of 5 ($P<0.05$; Table 3).

The difference between pre-test and post-test of experimental and control groups showed that changes in pain were significant between the two groups, but changes in lumbar lordosis angle were not significant (Table 4). Pain in the experimental group (chronic low back pain and hyperlordosis; $P= 0.39$) had a significant decrease compared to the control group ($P= 0.02$). The amount of lumbar pain and lordosis in healthy individuals in the control group was not significantly different from the experimental group, but healthy subjects in the control group

complained of mild joint and muscle pain in the back and shoulders.

Table 1. Devices used for experimental and control group subjects

Lift machine exercises	To strengthen the muscles of the armpits, back of the arm, and shoulder
Elliptical bike device	To strengthen heart and lung function as well as burn fat
Lat machine exercises	Strengthens the muscles of the upper body including the shoulders, arms, upper chest, and back
Chest press machine	Increases flexibility and muscle strength in the upper limbs of the chest, shoulders, and back, especially in the large pectoral muscles, back of the arm and wrist, and shoulder
Sit up bench device	To strengthen and increase the flexibility of abdominal and back muscles and burn and reduce belly and waist fat
Rotating wheel arm	Strengthening the muscles of the body in the upper torso and increasing the flexibility and mobility of the shoulder joints and muscles, rapid blood circulation in all arteries of the body and heart is appropriate. It should be noted that the movements should be done slowly and with concentration, and any rotation to the left and right should be accompanied by deep breathing.
Waist and back massager	It is used to strengthen the back, massage the back muscles and complete massage the back muscles of the body, strengthen the central nervous system, relieve fatigue and eliminate clogged blood vessels and the circulatory system [24].

Table 2. Exercise protocol table

Exercise volume	Number of repetitions	Number of sets + Aerobic time	Type of exercise	Week
First to Fourth	Lift machine exercises	3	10	3*10
	Elliptical bike devise	(5min) Aerobic		(5min) Aerobic
	Lat machine exercises	3	10	
	Chest press machine	3	10	
	Sit up bench device	3	10	
	Rotating wheel arm	3	10	
	Waist and back massager	3	10	
Fifth to Eighth	Lift machine exercises	3	20	3*20
	Elliptical bike devise	(8min) Aerobic		(8min) Aerobic
	Lat machine exercises	3	20	
	Chest press machine	3	20	
	Sit up bench device	3	20	
	Rotating wheel arm	3	20	
	Waist and back massager	3	20	
Ninth to Twelfth	Lift machine exercises	3	30	3*30
	Elliptical bike devise	(12 min) Aerobic		(12 min) Aerobic
	Lat machine exercises	3	30	
	Chest press machine	3	30	
	Sit up bench device	3	30	
	Rotating wheel arm	3	30	
	Waist and back massager	3	30	

Table 3. Descriptive information (demographic characteristics) related to the subjects

		Standard deviation	Mean
Experimental	Height (cm)	5.24	161.87
Control		7.91	169.12
Experimental	Age	4.75	28.86
Control		4.68	28.2
Experimental	Weight	7.91	69.12
Control		7.16	69.76

Table 4. Paired t-test in experimental and control groups

			Average	Standard deviation	Significance level
Lumbar lordosis angle	Experimental	Pre-exam	40.00	3.50	0.363
		Post-test	39.06	2.98	
	Control	Pre-exam	40.53	2.13	0.060
		Post-test	40.13	2.89	
The amount of pain	Experimental	Pre-exam	3.78	0.46	0.010
		Post-test	3.40	0.88	
	Control	Pre-exam	3.53	0.62	0.035
		Post-test	3.76	0.60	
Lumbar lordosis angle (chronic low back pain and hyperlordosis)	Experimental	Pre-exam	40.20	3.48	0.095
		Post-test	38.40	2.45	
	Control	Pre-exam	41.20	2.29	0.085
		Post-test	40.60	2.98	
Pain rate (chronic low back pain and hyperlordosis)	Experimental	Pre-exam	3.83	0.52	0.039
		Post-test	3.22	0.67	
	Control	Pre-exam	3.52	0.59	0.020
		Post-test	3.95	0.59	
Lumbar lordosis angle (healthy)	Experimental	Pre-exam	39.60	3.91	0.740
		Post-test	40.40	3.78	
	Control	Pre-exam	39.20	0.83	0.974
		Post-test	39.20	2.77	
Pain rate (healthy)	Experimental	Pre-exam	3.75	1.22	0.924
		Post-test	3.70	0.32	
	Control	Pre-exam	3.40	0.21	0.790
		Post-test	3.55	0.33	

According to t-test, the significance level of this test for the variable of pain after the study period in the experimental group (chronic low back pain and hyperlordosis and healthy; P= 0.015) and control (chronic low back pain and hyperlordosis and healthy; P= 0.010) has a significant difference (Table 5). Pain was significantly reduced in the experimental group (chronic low back pain and hyperlordosis) compared to the control group (chronic low back pain and hyperlordosis). There was no significant difference in lordosis angle between the experimental group (P= 0.235) and the control group (P= 0.398). The rate of lumbar pain and lordosis in healthy individuals in the control group was not significantly different from the experimental group, but healthy subjects in the control group at the end of the study complained of mild joint and muscle pain in the back and shoulders.

3. Discussion

The aim of this study was to investigate the effect of park sports equipment (with and without the presence of a coach and training) on hyperlordosis and chronic back pain in women. Therefore, the results of low back pain and hyperlordosis were evaluated in these two groups. Given the limited research in this area, it was not possible to conclude and compare the results with similar studies. Therefore, reports on all findings are presented with caution. The goal of exercise is to build muscle strength, endurance, soft tissue flexibility and reduce body fat, so all things in the light of maintaining the principles and rules and proper training will lead to a reduction in muscle-joint pain [11].

Table 5. Independent t-test in two groups of chronic low back pain and hyperlordosis and healthy

			Average	Standard deviation	Amount of t	Significance level
Lumbar lordosis angle (before)	Experimental	Chronic low back pain and hyperlordosis	40.20	3.48	0.302	0.767
		Healthy	39.60	3.91		
	Control	Chronic low back pain and hyperlordosis	41.20	2.29	-1.854	0.086
		Healthy	39.20	0.83		
Pain rate (before)	Experimental	Chronic low back pain and hyperlordosis	3.82	0.67	-1.090	0.296
		Healthy	3.75	1.22		
	Control	Chronic low back pain and hyperlordosis	3.52	0.59	1.772	0.100
		Healthy	3.40	0.48		
Lumbar lordosis angle (after)	Experimental	Chronic low back pain and hyperlordosis	38.40	2.45	-1.246	0.235
		Healthy	40.40	3.78		
	Control	Chronic low back pain and hyperlordosis	40.60	2.98	0.874	0.398
		Healthy	39.20	2.77		
Pain rate (after)	Experimental	Chronic low back pain and hyperlordosis	3.22	0.52	0.481	0.015
		Healthy	3.70	0.32		
	Control	Chronic low back pain and hyperlordosis	3.95	0.59	-0.070	0.010
		Healthy	3.55	0.75		

The results of this study showed the effect of the presence of a coach and training on users when using park sports equipment and reducing the amount of pain in people with chronic low back pain and no effect on reducing the angle of their hyperlordosis. Since not all equipment is suitable for users to do, the instructor's guidance in using and not using and determining the intensity of training is very important [25]. The mentioned results were indirectly in line with the results of the present study in terms of the effect of training used in park sports equipment.

In the present study, a decrease in pain was observed in the users of the experimental group after 12 weeks of exercise, which is consistent with the results of research Tahsin et al. (2016) [26], Mohammadi et al. (2011) [27], Doğru et al. (2015) [28]. The importance of warming up and cooling down, supervised exercise and choosing the right time for exercise were considered important and significant. These cases reduce the amount of harm in users [29, 30, 31].

Chow et al. (2015) examined the effect of a course of strengthening and stabilizing

exercises to improve low back pain dysfunction and concluded that these exercises can be effective in improving the functional dysfunction of subjects [32].

Ko et al. (2018) entitled the effect of lumbar stabilization exercises on functional disability and lumbar lordosis angle in patients with chronic low back pain concluded that strengthening the lumbar muscles and lumbar muscle tension is effective in reducing pain in people with chronic low back pain, but lordosis angle is not changed the waist [30].

In the explanation of the present study, it can be stated that the interaction between pain and muscle strength or the interaction between these two factors is involved in the mechanism of low back pain and its development; This means that these two phenomena put a person in a vicious cycle and cause chronic disease. Strengthening the muscles of the upper body (back, abdomen) and muscle stretching, especially thigh flexors and lumbar extensions can be an important reason in reducing back pain in subjects with chronic low back pain. Also, increasing endurance (aerobic) and strength in the extensor and flexor muscles is one of the reasons for reducing pain and better performance in patients with chronic low back pain. However, the results of the present study showed that the protocol of the present study did not show an effect in reducing the lumbar hyperlordosis angle of the subjects, which is indirectly in line with the results of the study.

Mehdizadeh (2013) stated that stretching exercises on shortened muscles did not cause a significant change in lumbar lordosis angle and stabilization exercises and strengthening the central muscle trunk had no effect on reducing lumbar lordosis angle [33]. Explaining this result, it can be said that it is probably due to the limited time of the training protocol and also the limited use of some devices in the subjects due to their low back pain. Research results may change over a longer period of time. Lumbar hyperlordosis is usually accompanied by deep extensor weakness muscles of lumbar and abdominal, a feeling of tightness in the pelvic and tensor muscles, and latissimus dorsi, hip flexors, especially the iliopsoas. Another possible reason is the limitation and lack of variety of devices to further strengthen these muscles and proper stretching in people with more back pain. However, to further explain this, more research is needed by spending more time in different age groups and different genders to be able to express a definite conclusion about the effect of exercise with park sports equipment on lumbar lordosis. The limitations of the present study are the inaccuracy and focus of the subjects on the muscles used in training, in addition, the lack of control over their daily activities of life.

4. Conclusion

The results of this study showed a significant effect of the presence of the instructor and training in the use of park exercise machines in promoting the health of users who exercise with these devices without awareness (who sometimes cause serious musculoskeletal injuries). When people use the warm up before working with the sport equipment's and the training by trainer to work with the sport equipment's and at the end of the exercises, they use the cooling down of the muscles, especially the stretching movements. The back pain of people improved and healthy people did not complain of joint pain. but there was no change in the reduction of lordosis angle in these people. In the control group, people without trainer before using

the training, without warm up and cooling down at the end of exercise, they complained of increased back pain. There was no change in the angle of lordosis in this group and a number of healthy people complained of joint-muscle pain, especially low back pain and shoulder pain during exercise. According to the results of previous research and the present study and the widespread use of sports equipment in parks, the importance of proper exercise and training in strengthening and endurance muscles has become clearer and can improve many chronic pains and improve people's general health.

Conflict of interest

The authors declared no conflicts of interest.

Authors' contributions

All authors contributed to the original idea, study design.

Ethical considerations

The author has completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc.

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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