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RESEARCH ARTICLE

The Effect of Six Weeks of Therapeutic Exercises and Kinesio Tape (KT) in Reducing Pain and Increasing Flexibility and Muscle Strength for People with Low Back Pain

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Abstract
Objective: This study aims to prepare therapeutic exercises that enhance the strength and elongation of ligaments and dorsal muscles, assess the impact of therapeutic exercises and Kinesio tapes (KT) in alleviating lower back pain, and evaluate the effect of therapeutic exercises and Kinesio tapes (KT) in improving flexibility and muscle strength in individuals suffering from lower back pain. **Method:** A sample of (6) injured, from Al-Kut club, (age = 30 ± 4.29 years, height = 176.6 ± 3.87 cm, mass 75.6 ± 2.71 kg) participated in the study. The participants in the experimental group (n=10) completed pre-tests and post-tests. **Results:** The results of the experimental sample show that there was a significant improvement in the mean scores for Muscular strength on the post-test compared to the pre-test. The mean score for pain decreased from (6.02 to 1.25, $p<0.005$), the mean score for the Torso force increased (flexion) from (16.17 to 51.833, (extension) 16.83 to 52.67, $p<0.005$), and the mean score for torso flexibility increased from (1.18 to 5.53, $p<0.005$). **Conclusion:** A significant finding of the study is that the therapeutic exercises employed effectively enhanced the flexibility of the torso while simultaneously restoring muscle strength. This confirms the efficacy of therapeutic exercises. Additionally, the use of Kinesio tapes appears to have a positive impact on reducing pain levels in the participants of the study

Keywords
Therapeutic Exercises, Kinesio Tape (KT), Low Back Pain

INTRODUCTION

Scientific progress, technological development, and the introduction of modern technologies have contributed to the decline in the activity of the body's vital systems and their slow functioning. Therefore, humans have become more vulnerable to many diseases and injuries due to their lifestyle (a relatively sedentary life with little movement), and among the injuries that are related to inactivity, laziness, lack of movement, and following wrong habits when Sitting or when lifting or carrying things, high effort, and poor physical fitness and body build, are injuries to the spine in general and pain in the lumbar region (lower back) in particular, as the incidence of these pains reaches one person out of every six people (Woessner et al., 2021).

The lumbar region represents weak points and movement problems for athletes and non-athletes. Given the vitality of these two regions, the occurrence of large loads and weights on them, the natural bends in them, and the occurrence of more movement activities than others in the spine, all of this leads to troubles, problems, and injuries for athletes and non-athletes. Athletes while practicing sports activities or some professions, or incorrect sitting when writing and reading, or

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misuse of modern technological devices (Bakri, 2000).

Muscle fatigue of the torso extensor muscles also plays a major role in acute and chronic low back pain (LBP). The basic physiology of fatigue is complex and not fully understood. Therefore, many physical therapists have sought to use KT because it supports damaged structures while allowing movement and at the same time may affect some of the mechanisms associated with muscle fatigue, such as blood flow and proprioception (Hasan, 2019).

Therapeutic exercises are the cornerstone of physical therapy and have positive effects on reducing pain and improving overall health, so most clinical trials have focused on studying the effects of aerobic exercise, resistance and flexibility exercises, or a combination thereof, to enhance neuromuscular control and strengthen spinal muscles, such as the multifidus and transverse abdomen, to maintain On the dynamic stability of the spine, thus reducing pain (Celenay et al., 2020).

It is worth noting that most previous studies indicated that there are positive effects left by the application of Kinesis adhesive tapes on the muscles and joints. Therefore, the researcher used them in his study in conjunction with preparing therapeutic exercises that work to quickly rehabilitate those with lower back pain and return them to practicing their normal lives while restoring their functional efficiency in the shortest time. As much time as possible to avoid complications and health problems that a person suffering from lower back pain may be exposed to (Kachanathu et al, 2014; Azab et al, 2013)

The research aims to: Preparing therapeutic exercises that strengthen and lengthen the ligaments and dorsal muscles. Identify the effect of therapeutic exercises and Kinesio tapes (KT) in reducing lower back pain. Identify the effect of therapeutic exercises and Kinesio tapes (KT) in increasing flexibility and muscle strength for people with lower back pain.

MATERIALS AND METHODS

Experimental Design

This study was based on a one-group pretest/post-test experimental design with repeated measures. When the people's injuries came to the Specialized Center for Physiotherapy and Physical Rehabilitation for the first time, their age, weight, height, BMI levels, and information about their age were recorded. Then, information was given about the core exercise practices to be applied for (6) weeks.

Participants

The participants were composed of (10) volunteers who had regularly visited the Specialized Center for Physical Therapy and Physical Rehabilitation and were experiencing lower back discomfort, aged (25-35 years). The lower back of all individuals was measured for comparison purposes. All patients underwent measurements of the affected lower back at least twice during the treatment period, pretest and posttest, and had been using Kinesio tape & rehabilitative exercise therapy as part of their rehabilitation routine for at least 8 weeks.

One participant with a lower back (10 males; see Table 1 for participant characteristics) volunteered to participate in the study and gave written informed consent for the experimental procedures. Participants had no known history of other disorders or diseases. In addition, none of the participants had engaged in any resistance training within the past 2 months. This study was approved by the University Ethics Committee No. 32/174 and dated 20/02/2023 and was accepted with the research code number and was carried out in accordance with the recommendations of the Declaration of Helsinki.

Table 1. Group characteristics

Variables	Measuring unit	X	SD	Median	Skewness
Length	Cm	176.6	3.204	176.5	0.201
Mass	Kg	75.6	3.806	76	-0.098
Age	Year	30	2.944	30	0.000
Back injury Duratio	**Day**	18.5	3.979	18.5	0.000

Mean (X), Std. Deviations (SD)

Data Collection Tools

Form for each player to record the sequence measurements

Measuring the degree of pain (see appendix 1)

The researchers prepared a scale to measure the degree of pain that includes a set of questions and phrases intended to indicate the condition of the injured person and the degree of pain he suffers from:

This scale contains 12 statements, each statement has 6 points on a scale from (0-5), so the scale ranges from (12-60). Score 12= represents the normal condition, meaning there is no pain and no injury to the back. Score 60 = represents the highest and most severe degree of pain, meaning that the back is at its worst.

Note: The lower the points, the more the patient tends towards complete recovery, and the higher the points, the worse the condition indicates and may require surgical intervention.

Measuring the back flexibility

(https://www.physio-pedia.com/Schober_Test).

Test name: Schober Test

Purpose of the test: to measure the flexibility of the lumbar region

Initial position

The tester stands upright, the therapist stands behind him, and places two marks on the back, one of which is On the fifth lumbar vertebra and the other 10 cm above it.

Description of performance

The injured person is asked to bend forward as much as possible without bending the knees.

Recording: The distance between the two marks is measured in centimetres, and more than (10 cm) expresses the degree of flexibility of this area.

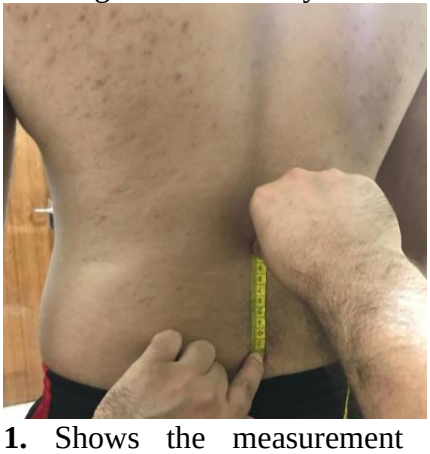

Figure 1. Shows the measurement of back flexibility

Measuring the muscle force acting on the torso (Farhat, 2007)

Measuring torso extension muscle strength

Purpose of the test: to measure the maximum strength of the muscles working on the torso.Initial position: The injured person takes a tall sitting position facing the wall or any fixed object, with the torso vertical and the feet at full extension, and the feet are fixed from the knees with a belt to prevent them from moving. The injured person wears under the shoulder area and around the chest a circular belt to which the dynamometer is attached in front of the chest and fixed to the wall or Anything fixed. Description of performance: The injured person pulls the torso forcefully backwards, and the device pointer moves equivalent to the maximum force of the muscle groups working on the torso. Recording: Three attempts, and the best reading is taken to the nearest kilometer.

Figure 2. Shows the torso extension muscle strength

Measuring torso flexor muscle strength

Purpose of the test: to measure the maximum strength of the muscles working on the torso.

Initial position

The injured person takes a sitting position, facing the wall or any fixed object, with the torso vertical and the feet at full extension. The feet are fixed at the knees with a belt to prevent them from moving. The injured person wears a circular belt under the shoulders and around the chest to which a dynamometer is attached behind the back and fixed to the wall or Anything fixed.

Description of performance

The injured person pulls the torso forcefully forward, and the device pointer moves equivalent to the maximum force of the muscle groups working on the torso.

Registration

Three attempts and the best reading is taken to the nearest kilometer.

Figure 3. Shows the strength of the torso flexors

Experimental Design

Participants were familiar with all testing and exercise protocols before starting the study. Kinesio tape applying & Rehabilitation exercises were done before and after. Therefore, the total duration of the experimental study was 8 weeks. During the rehabilitation exercises withdrawal period, the participants were asked to maintain their normal diet and physical activity levels.

Pre- measurements

Measurements and pre-tests were performed on a group of members of the experimental research sample consisting of (10) injured, at the Specialized Center for Physiotherapy and Physical Rehabilitation in Al-Kut Sports Club on Sunday corresponding to 01/03/2023.

Therapeutic exercises

The therapeutic exercises were prepared in three stages, where each stage lasted two weeks, and the total time period required to implement t20he program in practice was six weeks. The rehabilitation stages contained different exercises to suit the stage the injured person was going through, at a rate of (3) rehabilitation units per week, and the number of rehabilitation units for the injured reached over the course of Six weeks (18) rehabilitation units. The duration of the rehabilitation unit in the first stage was (45) minutes, in which various flexibility and stretching exercises were used. The first stage aimed to reduce the pain in the lumbar region and lengthen the back muscles. The number of exercises in one rehabilitation unit was... This stage ranged between (6-8) exercises. In the second stage, the time of the rehabilitation unit was (60) minutes, in which the researchers used strength and resistance exercises in which the gradual use of weights was taken into account, from easy to difficult and from simple to complex, in addition to movement exercises with Take into account the gradient load in the exercise. Resistance exercises aim to strengthen the muscles that have been weakened as a result of the injury. They also aim to improve the range of motion and the spacing of the vertebrae from each other. Resistance exercises vary, either by resisting body weight, gravity, rubber bands, or an external weight.

As for the third stage, its time became (75) minutes and aims to get rid of pain completely and restore the endurance necessary for daily performance. The focus in this stage was on special exercises to raise the level of general physical fitness and exercises for strength, resistance and stability. It is noteworthy that the rehabilitation program was applied to all individuals. The sample is individually, not collectively.

Applying medical patches

The researcher placed medical tape (KT) on the lumbar area in the lower back, in accordance with medically approved conditions, from the first day of the injury until the pain disappeared completely. The tape continued to be placed for three days, the tape was removed on the fourth day, and the process was repeated periodically until the end of the rehabilitation program. It is noteworthy that there are more than 16 colors, with no difference in the effect between one color and another (Hassan, 2018)

Steps to install Kineso adhesive strips (Al-Jawad, 2016)

First

Shaving and trimming the hair in the affected area because some men with thick hair must shave the area before fixation to increase the tape's adhesion to the skin.

Second

Clean the skin with warm water and soap, because this helps the tape stick better.

Third

Disinfect the area with disinfectant liquid, provided that the percentage is alcohol it contains more than 76% to remove pollution and dust on the skin to give the tape the opportunity to contact the skin well.

Fourth

Use a warm pillow to increase pressure on the tape adhering to the skin to increase the strength of adhesion between it and the body.

Figure 4. Shows the installation of Kinesio strips

Post-measurements

Post-measurements and tests were conducted on the group of individuals of the experimental research sample on 20/4/2023 in the same order as the pre-measurements and under the same conditions, for each patient separately.

Statistical Analysis

SPSS package program was used in the statistical analysis of our research. It was determined by the normality distribution and skewness coefficients of the data. Significance level was determined as P 0.05 and all data were presented as mean standard deviation (SD) unless stated otherwise. Independent samples t-test was used to compare the scores obtained from the measurements according to categorical variables.

RESULTS

For patients participating in rehabilitation exercises at 8 weeks, no injury was recorded at any stage of the exercises, and no adverse events (both acute and chronic) were reported for anyone doing the exercise.

Table 2. Mean scores and standard deviations of the experimental group on the Pre-Test and Post-Test for degree of pain.

Measurements	Pre-test		Post-test		Arithmetic mean of difference	T value	Improvement rate%
Degree of Pain	X	SD	X	SD	4.77	.182	83.41
	6.02	0.68	1.25	0.48			

p < (0.05), Arithmetic mean (X), Standard Deviation (SD)

The data presePnted in Table (2) clearly indicate significant differences between the pre-measurement and post-measurement in the degree of pain. The post-measurement showed a higher level of improvement, with a T value of 18.2, which exceeds the critical T value at the 0.05 level. The percentage of improvement was calculated to be 83.41%.

Table 3. Importance of the disparities between the first and final measurements in the variable of torso flexibility.

Measurements	**Pre- measurements**		**Post- measurements**		**Arithmetic mean of difference**	**T value**	**Improvement rate%**
	X	SD	X	SD			
Torso flexion force (kg)	16.17	1.94	51.833	2.14	35.663	27.64	68.80
Torso extension force (kg)	16.83	0.75	52.67	1.966	35.84	38.20	68.04
Torso flexibility (cm)	1.18	0.19	5.53	0.50	4.35	18.12	78.66

p < (0.05), Arithmetic mean (X), Standard Deviation (SD)

It is clear from Table (2) of the differences between the pre-measurement and the post-measurement in the torso flexibility variable that there are significant differences between the two measurements at the 0.05 level and in favor of the post-measurement, as the t-value reached (18.12) and this value is greater than the tabulated t-value at the 0.05 level, and the improvement percentage was 78.66.

It is clear from Table (3) regarding the differences between the pre-measurement and the post-measurement in the strength of flexion and extension of the torso that there are significant differences between the two measurements at the 0.05 level and in favor of the post-measurement, where the t-value reached (27.64) and (38.2) and this value is greater than the tabulated t-value at the 0.05 level. The improvement rate was between (68.80-68.04).

DISCUSSION

Table (2) demonstrates statistically significant disparities between the pre-and post-test in the variable degree of pain, suggesting the beneficial impact of adhesive tapes and rehabilitative exercises. The researcher's implementation of therapeutic exercises and the application of Kinesio adhesive tapes significantly contributed to the reduction of pain levels, resulting in an improvement observed in the average pain measures before and after the intervention.

The application of Kinesio adhesive strips significantly decreased pain intensity in the lower back muscles, as evidenced by a study conducted by González-Iglesias the study concluded that the use of Kinesio adhesive strips resulted in an immediate 23% reduction in pain intensity (González-Iglesiasm, 2009). This enabled the injured athlete to engage in his activities with evident ease and devoid of discomfort, so enhancing the afflicted individual's muscle capacity required for strength and flexibility training. The credit for this is attributed to the utilization of Kinesio adhesive tapes, as previously mentioned. These tapes possess the unique quality of matching the thickness and specifications of the skin. They function by lifting the skin, thereby reducing pain. Moreover, Kinesio adhesive tapes promote blood circulation, which has a beneficial impact on muscle physiology. The results align with the conclusions of previous studies conducted by Hasan & Hasan, Oliveria, Murray,, Additionally, a study by Kaya, Zinnuroglu, & Tugcu, demonstrated that the use of Kinesio adhesive strips had a notable effect in reducing pain and inflammation in the injured sample. The study shown that employing Kinesio adhesive strips is a viable alternative for addressing injuries, particularly when an immediate impact is required (Hasan and Hasan, 2022; R. Oliveria, 2005; Murray, 2000; Kaya et al, 2010).

The data presented in Table (3) indicates that there are statistically significant disparities between the pre- and post-measurements, with the post-measurement showing greater torso flexibility factors. The researcher credits the enhancement to the utilization of adhesive tapes (kt) in conjunction with rehabilitative activities. This approach effectively augments the range of motion and flexibility in the back by providing support to the back muscles. Utilizing taping techniques and incorporating flexibility and stretching exercises to enhance the flexibility and expand the range of motion of the muscles in the back. This is congruent with what was stated by (Yoshida & Kahanov, 2007; Halseth & McChesney, 2004), which asserts that the application of adhesive tapes (kt) delivers stability and support to the muscles and minimizes the degree of pain when completing various flexibility exercises. . This aligns with the findings of (Omran, 1998; Hasan & Matty, 2024), which suggest that the increase in range of motion can be attributed to the beneficial effects of stretching and standardized flexibility exercises. Additionally, this improvement is accompanied by a reduction in discomfort levels and an enhancement in muscular strength.

Table (3) demonstrates statistically significant variations between the pre- and post-measurements, favoring the post-measurement in terms of muscular strength. The researcher credits the improvement to the specific set of therapeutic exercises that were chosen, as they played a significant role in enhancing muscular strength. Additionally, the researcher applied Kinesio adhesive strips to the affected muscles, which provided crucial support and stability during rehabilitation exercises. This reduced pain in the affected limb, enabling the injured individual to perform the exercises confidently and without hesitation.

These findings align with the assertions made by (Kosra and Hassanin, 2000; Hasan, 2023; Hasan, 2018; Matty, 2021), that enhancing muscle strength results in the growth of active muscle mass, fortification of connective tissues and the skeletal system, and enhancement of body composition. Consequently, muscle strength training is recommended in various programs. Rehabilitation promotes angiogenesis, resulting in enhanced arterial blood pressure inside the muscle,

increased muscle fiber density, and heightened mitochondrial content in the muscle (Hasan & Awed, 2024).

Conclusions

The available data strongly support the use of Rehabilitation exercises that positively improve the flexibility of the torso to reach the range of motion simultaneously with the restoration of muscle strength, which confirms the effectiveness of therapeutic exercises. There appears to be a positive effect of Kinesio tapes in reducing the degree of pain in the study sample, by supporting and establishing the muscles in the lower back.

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Conflict of interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

Ethics Committee

No. 22/162 and date 02/12/2023 was accepted with the research code number and was carried out according to the recommendations of the Declaration of Helsinki

Author Contributions

Study Design, BB, LS; Data Collection, BB; Statistical Analysis, BB, LS; Data Interpretation, BB, LS; Manuscript Preparation, BB, LS; Literature Search, BB, LS. All authors have read and agreed to the published version of the manuscript.

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