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The effect of a proposed sports rehabilitation program on improving the functional efficiency of the spine in women with non-specific low back pain.

تأثير برنامج تأهيل رياضي مقترح في تحسين الكفاءة الوظيفية للعمود الفقري لدى السيدات المصابات بآلام أسفل الظهر غير المحددة.

Ala'a Abdullah Al Rawdhi [1] , **Abdul Ghani Mujahid Mutahhar** [2]

آلاء عبدالله الروضي [1] ، **عبد الغني مجاهد مطهر** [2]

[1] Sana'a University - Faculty of Physical Education - Yemen , ala'a.al-rawdhi@su.edu.ye

[2] Sana'a University - Faculty of Physical Education - Yemen , a.motaher@su.edu.ye

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Abstract:

The study aimed to identify the effect of a proposed sports rehabilitation program on improving the functional efficiency of the spine in women with non-specific low back pain. The program was implemented in conjunction with health education, using a single-group experimental approach, after conducting pre- and post-measurements. The study included a purposive sample of (10) female volunteers selected from the study community, consisting of members of the Balqis Women's Sports Club in the capital, Sana'a. The study concluded that the implementation of the proposed program had a significant positive impact on improving the functional efficiency of the spine in terms of muscle strength and range of motion. The study recommended using the proposed program as a guide in dealing with cases of non-specific low back pain.

Keywords: sports rehabilitation, functional efficiency, muscle strength, range of motion, low back pain.

ملخص: هدفت الدراسة إلى التعرف على تأثير برنامج تأهيل رياضي مقترح في تحسين الكفاءة الوظيفية للعمود الفقري لدى السيدات المصابات بآلام أسفل الظهر غير المحددة، نفذ البرنامج بمصاحبة تثقيف صحي، وباستخدام المنهج التجريبي، ذو المجموعة الواحدة، وباتباع القياسين القبلي والبعدي، لعينة عمدية مكونة من (10) متطوعات، تم اختيارهن من مجتمع الدراسة المكون من مشتركات نادي بلقيس الرياضي للسيدات بأمانة العاصمة صنعاء، خلصت الدراسة الى إن تطبيق البرنامج المقترح كان له تأثيرا ايجابيا دالاً في تحسين الكفاءة الوظيفية للعمود الفقري من حيث القوة العضلية والمدى الحركي، وأوصت بالاسترشاد بالبرنامج المقترح في التعامل مع حالات آلام اسفل الظهر غير المحددة.

Corresponding author Ala'a Abdullah Al Rawdhi -mail: ala'a.al-rawdhi@su.edu.ye

الكلمات المفتاحية: التأهيل الرياضي، الكفاءة الوظيفية، القوة العضلية، المدى الحركي، آلام اسفل الظهر..

1. Introduction to the study:

Low back pain is one of the most common reasons for medical consultations and a leading cause of disability. Occurring at similar rates in all societies, low back pain impacts quality of life and functional performance. Cases of back pain are rarely attributed to specific causes; most nonspecific pain is not associated with a specific disease. It is either acute, which is the most common, usually lasting less than three months and then resolving spontaneously, regardless of treatment. It can also be chronic, with strong psychological, social, and economic consequences due to its association with work and quality of life (Ehrlich G. E. 2003).

Nonspecific low back pain is usually treated with self-care and over-the-counter medications (Wieland L. S., et al. 2017).

Treatment should differentiate between specific and non-specific low back pain. In the case of non-specific pain, a distinction must be made between acute and chronic pain. Acute non-specific low back pain is treated with analgesics and early active movement to relieve pain and prevent it from becoming chronic. Chronic low back pain is treated with analgesics, NSAIDs, and muscle relaxants, in addition to short-term exercise programs, personalized physiotherapy, and cognitive behavioral therapy, all of which aim to ensure pain relief, maintain physical activity, and avoid permanent disability (Illés S. T. 2015).

There is a significant accumulation of knowledge and experience regarding nonspecific low back pain. Statistics indicate that the precise cause cannot be determined in 50% of cases, and it is often considered a normal life event. Treatment relies on patient education, the use of analgesics, the

discontinuation of harmful and ineffective imaging techniques, and an early return to normal activities. When recovery is delayed beyond six weeks, comprehensive multidisciplinary treatment is recommended to prevent acute pain from becoming chronic and, consequently, disability. Rushing to surgical treatment for low back pain is not recommended, except in certain special and exceptional cases (Valat J. P. 2008)

Multidisciplinary mechanical treatment for low back pain consists of several methods, the most prominent of which are: exercise, health education, manual therapy, lumbar traction, heat therapy, cryotherapy, and ultrasound (Guild D. G. 2012).

There are many exercises used in the rehabilitation of patients with low back pain, including spinal flexion and extension exercises, lumbar stabilization exercises, and back exercises. All of these exercises work to prevent acute and chronic low back pain, relieve pain, improve self-healing ability, strengthen abdominal muscles, increase hip and lumbar spine mobility, and stabilize the intervertebral joints (Revel M. 1995)

Degeneration of the muscles surrounding the spine, such as atrophy, fatty infiltration, structural abnormalities, or decreased activity, affects spinal mobility and is associated with acute and chronic low back pain. (Goubert, D., et al. 2017).

The lumbar vertebrae of the spine provide six levels of motion: forward and backward flexion, right and left flexion, and right and left rotation. This motion decreases markedly with age. The muscles surrounding the spine participate in the movement itself, in controlling it, and in maintaining spinal stability (Thevenon, A., & Delcambre, B. 1988)

Over the past decade, knowledge has accumulated about the effectiveness of exercise in treating low back pain. Back exercises for acute low back pain

have been shown to prevent progression from acute to chronic, and they have been shown to significantly relieve pain and prevent disability. The most important factor in achieving the desired outcome is the dosage of exercise - in terms of intensity, duration, and frequency -rather than the exercise design. (Manniche C.1993)

Back exercises that combine muscle strength, flexibility, and aerobic fitness are beneficial in rehabilitating non-specific lower back pain. Increasing the strength and flexibility of the muscles surrounding the lumbar spine, as well as the flexibility of the associated tendons and ligaments, increases spinal strength and range of motion, and relieves associated pain. (Gordon, R., & Bloxham, S. 2016).

In light of the above, it is clear that there are many indicators pointing to a strong relationship between sports rehabilitation programs and non-specific low back pain. Because these facts require further scientific research to uncover them and benefit society, the idea of this study emerged. It aims to determine the effect of a proposed sports rehabilitation program on improving spinal functional efficiency in women suffering from non-specific low back pain. The hope is that this study will contribute to improving the overall health of individuals and society, and reducing the cost of such treatment.

2. Study problem:

Bashir (Moshe, S., & Levin, M. 2005). reported that approximately 60-90% of adults experience low back pain at least once in their lives. This is particularly true for individuals who perform strenuous work, lift heavy objects, or spend long periods in static or uncomfortable positions. This pain is a major cause of occupational illness and absenteeism.

(Mirovsky Y. 2007). indicates that the United States spends approximately $20 to $50 billion annually to treat and compensate people with back pain.

Through their review of numerous scientific references and previous relevant studies, their engagement with the community, and their work in the field of sports training in women's fitness centers in the capital, Sana'a, the researchers noted that many women in the community complain of non-specific lower back pain, particularly those affiliated with women's fitness centers, who are seeking effective therapeutic exercises to alleviate and prevent this pain and reduce the cost of treatment. They also noted that most of these centers lack scientifically designed and well-thought-out sports rehabilitation programs specifically designed to treat this pain, and that much of what is offered in this regard remains characterized by randomness and the ad hoc individual efforts of those in charge of these centers.

This prompted researchers to study this problem and attempt to contribute to its solution by examining the effect of a proposed sports rehabilitation program on improving the functional efficiency of the spine in women suffering from non-specific low back pain.

3. **Study objective:**

The study aims to investigate the effect of a proposed sports rehabilitation program on improving the functional efficiency of the spine in women with non-specific low back pain.

4. **Study hypothesis:**

The study assumes the existence of statistically significant differences between the pre- and post-measurements in favor of the post-measurement regarding the effect of a proposed sports rehabilitation program on improving the functional efficiency of the spine in women suffering from non-specific low back pain, in terms of: muscle strength of the back muscles,

and the range of movement of the lumbar vertebrae in different directions (right flexion - left flexion - forward flexion - backward flexion - right rotation - left rotation).

5. **Study terms:**
   - **Sports rehabilitation program:** A selected set of modified physical exercises aimed at treating an injury or correcting a deviation from normal condition of a part of the body. (Raphael, and Al-Kharboutli, 1998) .
   - **Functional efficiency:** The normal function of the affected organ prior to injury. For the purposes of this study, it refers to the normal function of the spine before the loss of muscle strength surrounding it and before the range of motion of the lumbar vertebrae in various directions, as a result of aging or symptoms not attributable to a specific pathological cause. (operational definition)
   - **Muscular strength:** An individual's ability to overcome or resist external resistance. An individual's strength level can be determined through several methods, most notably by determining the number of repetitive movements per second or minute (motor frequency). (Majeed, Risan Kharbit 1997)
   - **Flexibility:** It means the range of motion of a joint or group of joints. Flexibility is measured by the maximum range between extension and flexion of the joint, and this is expressed either in degrees of angle or in a line measured in centimeters. (Abdel Fattah and Nasr El-Din, 2003)
   - **Low back pain:** Low back pain is defined as pain and discomfort localized below the ribs and above the gluteal folds, with or without leg pain. Nonspecific low back pain is defined as low back pain not attributable to a specific, known pathology, while specific low back pain

is attributable to a known pathological, morphological cause. (Vrbanić T. S. 2011).

6. **Fields of study:**
   - **Human scope:** Members of the Balqis Women's Sports Club in the capital, Sana'a.
   - **Time scope**: (9) weeks, from Saturday, October 12, 2019, to Wednesday, December 11, 2019.
   - **Spatial scope**: Balqis Women's Sports Club in the capital, Sana'a.

Second: Previous studies:

Arabic studies:

1. (Abdul Razzaq, Muhammad and Al-Zahi, Zidane 2018) (02) conducted a study entitled "The Effect of Massage and Therapeutic Exercises on the Treatment of Patients with Lumbar Spine Disease (Lower Back)". The study aimed to identify the effect of massage and therapeutic exercises on patients with lower back pain. The study sample consisted of (5) individuals suffering from lower back pain, at Rawaa Al-Hayat Center for Physiotherapy in Sabha, Libya - and their ages ranged between (40-50) years. The researchers used the single-group experimental method, and the results indicated that the applied therapeutic program had a positive effect on the study variables (forward and lateral spinal flexibility, and raising the head from a supine position).
2. (Ziyada, Mohamed, 2017) (12) conducted a study entitled "The Effect of a Rehabilitation Exercise Program on Improving the Functional Efficiency of the Spine for Workers Suffering from Low Back Pain." The study aimed to design a rehabilitation exercise program to improve the functional efficiency of the spine for workers suffering from low back pain. The researcher used the experimental method on a sample of (28) patients aged between (24) and

(40) years, with (8) survey samples and (20) primary samples. The researcher used the experimental design with a single experimental group design. The most important results were the presence of statistically significant differences between the pre- and post-measurement in favor of the post-measurement in each of: pain scale, range of trunk movement, and muscle strength: abdomen, back, and anterior thigh. The most important recommendations were to use a rehabilitation exercise program to prevent exposure to low back pain.

3. (Al-Qalyubi, Hamdi 2016) (04) conducted a study entitled "The Effectiveness of a Rehabilitation Program to Increase the Functional Efficiency of the Spine in Scoliosis Patients in Primary Education." The study aimed to identify the effect of a rehabilitation program to increase the functional efficiency of the spine in scoliosis patients. The researchers used the experimental method with a single-group design, on a deliberate sample of (10) scoliosis patients from Ali Mubarak Preparatory School for Boys in the Dekernes Educational Administration. One of the most important results was the presence of statistically significant differences between the pre- and post-measurements in back muscle strength, spinal flexibility, curvature angle, and degree of static balance. The most important recommendations were to use a rehabilitation program to increase the functional efficiency of the spine in the rehabilitation and correction of scoliosis among preparatory school students.
4. (Ismail, Ismail, et al. 2015) (08) conducted a study entitled "The Effect of a Proposed Training Program Using Therapeutic Exercises and a Magnetic Device on Some Physical Variables for Patients with Lumbar Disc Herniation." The study aimed to identify the effect of a proposed training program - using a magnetic device and therapeutic physical exercises - on some physical variables for patients with lumbar disc herniation. The study

sample was intentionally selected. The sample size was (10) individuals from lumbar disc herniation patients at Al-Zawiya Hospital in Libya. The researchers used the experimental approach. The results indicated that the rehabilitation training program using the magnetic device and therapeutic physical exercises showed an improvement in physical variables (spinal flexibility - back and leg muscle strength), and that the program contributed to reducing the degree of pain.

5. (Faqir, Ahmed 2015) (06) conducted a study entitled "Designing a Rehabilitation Program for Some Cases of Partial Disc Herniation in the Lumbar Region." The study aimed to identify the effect of the rehabilitation program on: muscle strength of the muscles operating on both sides of the spine and hip joint, range of motion of the spine and hip joint, and severity of pain resulting from pressure on the injured discs between the vertebrae. The study sample was deliberately selected and consisted of (18) workers from the port of Hodeidah who work on cranes and winches in the port and who suffer from a disc herniation in the lumbar region. Their cases did not require surgical intervention, according to the diagnosis of the treating physician. The results indicated that the rehabilitation program had a positive impact on the injured members of the experimental group, and that the balanced development of muscle strength, joint flexibility, and muscle elongation had a significant impact on increasing the motor efficiency of the vertebrae in the lumbar region and hip joint. The rehabilitation program exercises led to greater improvement in the experimental group than in the control group in the dimensional measurements of all research variables.

Foreign Studies:

6. (Sokhanguei, Y. et al. 2017) (26) conducted a study titled "The Effect of Pilates on Chronic Non-Specific Low Back Pain and Range of Motion in Inactive

Women Aged 40–60." The study aimed to determine the effect of a Pilates exercise program on chronic non-specific low back pain and range of motion in inactive women aged 40–60. The study sample consisted of 34 women with chronic non-specific low back pain (CNLBP) who were randomly divided into two groups: a Pilates exercise program group and a control group. The Pilates group performed 10 one-hour sessions. The results showed a significant effect of Pilates on pain variables, left lateral flexion, right lateral flexion, hyperextension, and lumbar spine flexion. This low-cost, non-invasive method (Pilates) can be used in rehabilitation programs for patients with chronic non-specific low back pain.

7. (Kumar, T. et al. 2015) (19) conducted a study titled "Efficacy of Core Strengthening Exercises in Patients with Chronic Low Back Pain." The study aimed to determine the effect of core strengthening exercises on the persistence of chronic low back pain. The study sample consisted of (30) patients from the outpatient department of the National Institute of Orthopedic Disabilities. These patients were divided into two groups: based on the duration of low back pain. Patients in the first group complained of pain lasting more than twelve months, while patients in the second group complained of pain lasting three to twelve months. Both groups received the same intervention for six weeks. The study concluded that core strengthening exercises, along with lumbar flexibility and gluteus maximus strengthening, are an effective rehabilitation technique for all patients with chronic low back pain, regardless of the duration of pain (less than one year or more than one year).
8. (Mohammed, M.Y. 2012) (22) conducted a study entitled "The Effect of a Proposed Rehabilitation Program on Lower Back Pain". The study aimed to identify the effect of a rehabilitation program on those suffering from lower

back pain. The researcher used the experimental method with pre- and post-measurements for two groups: experimental and control. The research sample consisted of (22) patients aged (35-45) years who suffered from lower back pain resulting from a tear in the collateral ligaments of the lumbar spine. (10) of them were placed in the experimental group and (10) in the control group. The most important results were: improvement in the range of motion of the spine in terms of flexion and extension of the trunk, and a decrease in the thickness of fat in the back and sides of the abdomen.

9. (Hyoung, Hee-Kyoung. 2009) (17) conducted a study entitled "Effects of a Lumbar Strengthening Program in Elderly Women with Chronic Low Back Pain." The study aimed to determine the effects of a lumbar strengthening program in elderly women suffering from chronic low back pain. The research relied on an experimental approach with pre- and post-test measurements, and two groups: an experimental group consisting of (16) women, and a control group consisting of (14) women, all of whom had suffered from low back pain for at least (3) months. The strengthening program included lumbar stabilization exercises and awareness of how to manage pain in daily life, for (8) weeks. The exercises were performed (3) days a week, and education was provided on one day. The most important results were: significant improvement in pain and disability scores, flexibility, life satisfaction, and lumbar muscle strength among the sample members. The study indicated that the lumbar strengthening program would be an effective nursing intervention for elderly women suffering from low back pain.

Third: Study procedures:

1. **Study Methodology**:

   The researchers used the experimental method because it is suitable for the nature of this study, using a single-group experimental design with pre- and post-measurements.

2. **Study population:**

   The study population consisted of participants in the Balqis Women's Sports Club in the capital, Sana'a, during the fourth quarter of 2019.

3. **Study sample:**

   The study sample consisted of (10) female volunteers suffering from non-specific lower back pain, who were deliberately selected from the study community.

4. **Sample Selection Criteria:**

   Sample members were selected according to the following criteria:

   - They must be between 45 and 55 years old.
   - They must suffer from non-specific low back pain (their condition does not require surgical intervention, according to the diagnosis of the treating physician).
   - They must suffer from chronic low back pain (for 3 months or more).

5. **Normality of sample distribution:**

   The normal distribution of the sample data was confirmed according to Table No. (1) below:

Table (1) Statistical description of individuals in the basic sample of the research

(n = 10)

	Variables	Unit of measuremen	Mean	Median	Standard Deviatio	Coefficient of Skewness
1.	Age	Year	50.10	50.50	3.28	0.040-
2.	height	cm	159.80	159.50	3.42	0.192
3.	weight	kg	64.49	64.20	1.74	0.334
4.	Back muscle strength	kg	40.00	40.33	2.59	0.006
5.	Range of motion: right flexion	degree	17.00	17.00	1.56	0.000
6.	Range of motion: left flexion	degree	16.50	16.40	1.35	0.504
7.	Range of Motion: Forward	degree	45.80	45.50	2.65	0.224
8.	Range of motion: backward flexion	degree	17.60	17.50	1.26	0.544
9.	Range of motion: right rotation	degree	16.90	16.80	1.44	0.214
10.	Range of motion: Rotate left	degree	17.20	17.33	1.22	0.467-

It is clear from Table (1): that the values of the deviation coefficients for the variables under study ranged between (0.544 - 0.467): that is, they are

confined between (+3, -3), which indicates the moderation of the distribution of the study sample individuals in these variables.

6. **Study variables:**
   - Independent variable: proposed sports rehabilitation program.
   - Dependent variables: strength of the back muscles, and the range of movement of the lumbar vertebrae in different directions (flexion to the right - flexion to the left - flexion forward - flexion backward - rotation to the right - rotation to the left).
7. **Methods of collecting study data:**
   - Scientific references and previous studies.
   - Forms used in the study: Sample data collection form, expert opinion survey form.
   - Measurements used in the study: height, weight, back muscle strength, range of motion of the lumbar vertebrae in all directions, time.
8. **Devices and tools used in measurements:**

They are shown in Table No. (2) below:

Table No. (2) Devices and tools used in measurements

	Device name	The variable being measured	Unit of measurement
1.	Restameter	height	To the nearest cm.
2.	calibrated medical scale	weight	To the nearest kg.
3.	dynamometer	muscle strength	To the nearest kg.
4.	Genometer	Range of motion	By degree
5.	alarm clock	Time: Training/Rest	In a second.

9. Sports Rehabilitation Program (Proposed):

- The researchers designed the proposed sports rehabilitation program based on scientific references, previous studies, and the opinions of a group of specialized experts. The program was implemented according to the principles of gradual progression from easy to difficult, taking into account individual differences among sample members, and taking into account safety and security factors. The program included selected physical exercises designed to develop the muscular strength of the back muscles, and the range of movement of the lumbar vertebrae in all directions. It also included a training dose with an intensity of stretching that reached the point of tension or slight discomfort, such that the duration of each stretch was not less than (10) seconds for very tense muscles, and the duration gradually increased to (30-90) seconds, for a period of (45) minutes daily, with a repetition of (3) days per week for a period of (9) weeks.
- The program included, on its first day, an educational lecture and an open discussion between the researcher and the sample members for (90) minutes about non-specific lower back pain, with the aim of improving their understanding of lower back problems in terms of: that it affects a high percentage of people, and its pain is not a sign of serious damage that requires panic and fear of movement, but rather it is a temporary condition in most cases, which improves significantly during the first four to six weeks in most cases, due to early and gradual physical activity, and it usually occurs - and may recur - due to muscle strain resulting from many factors, most notably: incorrect movement, lifting heavy weights, excess body weight, stress and anxiety, vitamin D deficiency, or due to physical inactivity for long periods and the resulting

stiffness and weakness of the spine, or due to aging, and that this condition does not require rushing to perform expensive and often unnecessary surgeries, but rather requires reducing the level of unjustified anxiety about it, not resorting to bed rest, and gradually accelerating the return to normal activities, such as physical movement and exercise. Stimulating the healing process for most problems. Non-specific lower back pain.

10.Exploratory experience:

The researchers applied the exploratory experiment on a sample of (3) women from outside the study sample during the period: from 07/10/2019 until 10/09/2019 for a period of (3) consecutive days, during which the various exercises of the program were applied to the sample under study, with the aim of the following:

- Introduce research assistants to their duties.
- Identify the tools and equipment used in the experiment and how to calibrate them.
- Determine the appropriateness of the training dose.
- Identify any potential difficulties encountered in implementing the main experiment.

11.Basic experience:

The main experiment was implemented and pre- and post-measurements were made for the sample members as follows:

- Pre-test: The pre-test was conducted on the variables under study before the start of the training program on Thursday, October 10, 2019.
- Program implementation: The proposed sports rehabilitation program was applied to the sample members during the period from Saturday

12/10/2019 to Wednesday 11/12/2019, for a period of (9) weeks at a rate of (3) days/week.

- Post-measurement: The post-measurement of the variables under study was conducted after the completion of the program implementation on Thursday, December 12, 2019.

12.Statistical method used:

The researchers used SPSS to calculate the following statistical coefficients:

- Arithmetic mean.
- Median.
- Standard deviation.
- Skewness coefficient.
- Wilcoxon test.
- Percentage of improvement.

At a significance level of (0.05)

Fourth: Presentation and discussion of the results:

1. Show results:

The study hypothesis states that "there are statistically significant differences between the pre- and post-measurements in favor of the post-measurement regarding the effect of a proposed sports rehabilitation program on improving the functional efficiency of the spine in women suffering from non-specific low back pain in terms of: back muscle strength, and the range of motion of the lumbar vertebrae in different directions (right flexion - left flexion - forward flexion - backward flexion - right rotation - left rotation)."

To verify the validity of this hypothesis, the researchers calculated some statistical coefficients to determine each of: the significance of the differences between the pre- and post-measurements in the study sample at a

significance level of (0.05), and the percentage improvement rates between those measurements. The results of that are included in Table No. (3) below.

Table No. (3) The level of significance and the percentage of improvement for the differences between the pre- and post-measurements in the study variables

(n = 10)

Study variables	Unit of measurement	Pre-measurement			Post-measurement			Z value	Significance level	Improvement %
		arithmetic mean	Average rank	Total ranks	arithmetic mean	Average rank	Total ranks			
muscle strength	kg	40.00	.00	.00	70.00	5.50	55.00	2.805	0.05	75.00
right flexion	degree	17.00	.00	.00	26.00	5.50	55.00	2.836	0.05	52.94
left flexion	degree	16.50	.00	.00	25.00	5.50	55.00	2.848	0.04	51.52
Forward Flexion	degree	45.80	.00	.00	75.00	5.50	55.00	2.809	0.05	63.76
backward flexion	degree	17.60	.00	.00	25.70	5.50	55.00	2.842	0.04	46.02
right rotation	degree	16.90	.00	.00	25.14	5.50	55.00	2.840	0.05	48.76
Rotate left	degree	17.20	.00	.00	25.80	5.50	55.00	2.848	0.04	50.00

It is clear from Table (3) above that:

- There were statistically significant differences between the pre- and post-measurements among the sample members in all study variables, in favor of the post-measurement, as the significance level values for all study variables were equal to or less than the (0.05) level.

- The percentage of improvement between the pre- and post-measurements among the sample members in the variable of muscle strength of the back muscles reached (75%).
- The percentage of improvement between the pre- and post-measurements among the sample members in the variables of the range of motion of the lumbar spine in different directions ranged between (46.02%: 63.76%).
- The percentage improvement rates indicate a strong positive effect of the proposed sports rehabilitation program in improving the study variables (muscle strength and range of motion).

The following two figures illustrate the graphical representation of the measurement values included in Table (3) above.

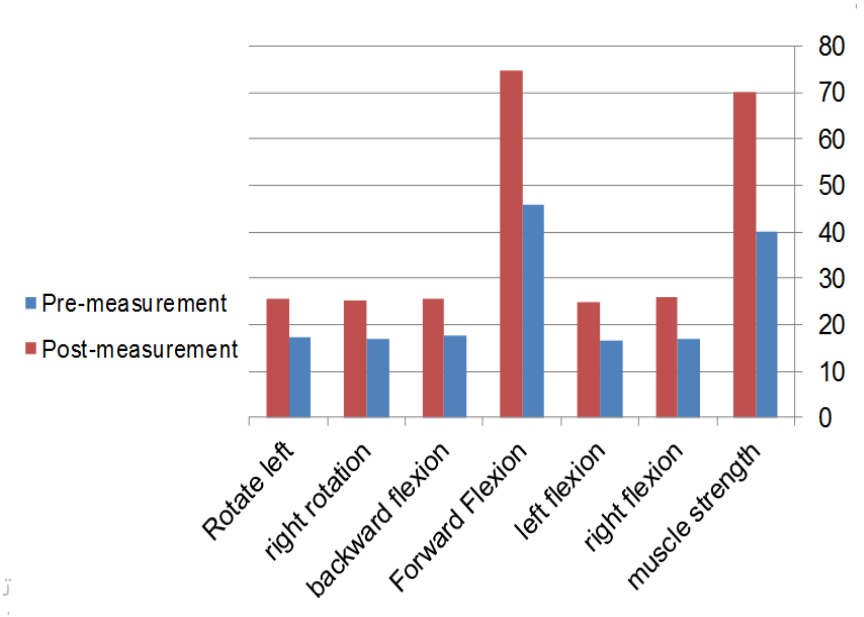
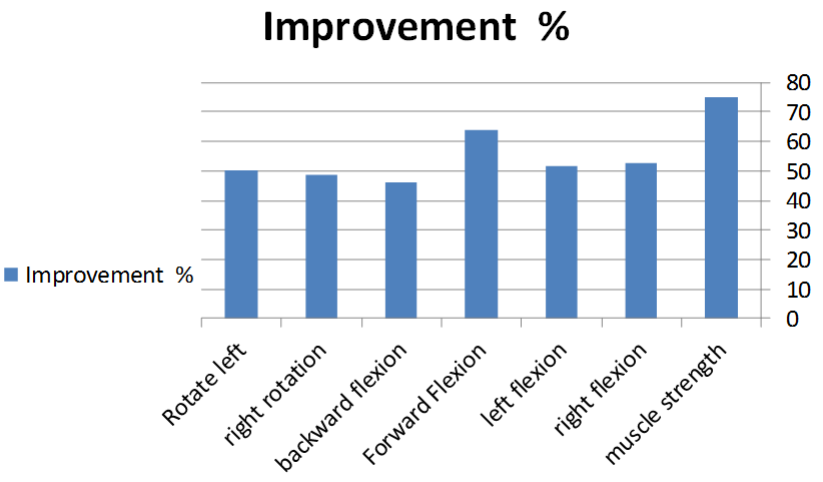


Figure (1) is a graph showing the differences between the pre- and post-measurements



. Figure (2) is a graph showing the percentage improvement rates between the pre- and post-measurements.

2. Discussion of results:

In the previous table No. (3), the result showed that there was a change in both the muscle strength of the back muscles and the range of motion of the lumbar spine in different directions in the study sample, and the percentages of change between the pre- and post-measurements in the sample members in those variables are shown; where the level of improvement in the muscle strength variable reached: (75%), while the level of improvement in the range of motion variables ranged between: (46.02%: 63.76%); which indicates the presence of a statistically significant effect of the proposed sports rehabilitation program in improving those variables.

The researchers attribute these results to the fact that the proposed sports rehabilitation program was properly and effectively designed and implemented, enabling the sample members to benefit from it in achieving this improvement. The program's exercises included appropriate exercises,

varied and balanced between strength and flexibility exercises. This is consistent with what (Alawi, Muhammad 1994) emphasized regarding the necessity of considering the connection between stretching exercises and strength exercises in physical exercises to ensure balanced development of the spine and the motor system, and avoiding developing only one aspect. The good implementation of the program also achieved many important results related to improving the functional efficiency of the spine, such as pumping moisturizing materials into the discs located between the vertebrae of the spine, which led to the flexibility of the vertebrae and improved flexibility. This is consistent with what (Helmy, Ahmed 2009) indicated, which is that movement works to pump moisturizing materials into the discs located between the vertebrae, which works to soften them, and thus the flexibility of their movement. In addition to increasing blood flow to the muscles, bones, and ligaments that operate on the spine, which increases their nutrition and strength, and improves their performance efficiency, this is consistent with what (Wetwet, Hamdi and Abdel Aziz, Ahmed 2012) argued, that physical exercise affects the joints and muscle groups involved in movement, as blood flow to the general muscles, bones, and ligaments increases, thus nourishing the muscles, increasing the thickness of muscle fibers, and consequently the size and strength of the muscles. The muscular system of the spine also develops due to the chemical changes that the program's exercises cause in the muscles and an increase in the density of blood capillaries. This is consistent with what (Al-Takriti, Wadih and Al-Hajjar Yassin 2012) argued, that physical fitness causes chemical changes in the muscles and increases the amount of (phosphocreatine, glycogen, non-nitrogenous substances, and hemoglobin), and the density of blood capillaries in the muscles, which helps the muscles work more efficiently. The

researchers also attribute the improvement resulting from this study to the effectiveness of the health education—accompanied by rehabilitation exercises—which the researcher conducted for the sample members with the aim of improving their understanding of low back problems and explaining what they should and should not do about them. In this regard, (Rauck, R. L., et al. 1998) indicate that primary health care providers should focus on pain management, improving activity, and promoting a deeper understanding of chronic low back pain. (Udermann, B. E., et al. 2004) indicate that the book "Treat Your Own Back" may be very effective in helping readers relieve their low back pain, reduce the frequency of its attacks, or even eliminate it. All of this is consistent with many previous Arab and foreign studies: similar and related, including: the studies of (Abdul Razzaq, Muhammad and Al-Zahi, Zidane 2018)), (Ismail, Ismail et al. 2015) which agreed with the results of our study regarding the existence of an effective positive effect of rehabilitation exercises in improving the variables of functional efficiency of the spine (muscular strength of the back muscles and the range of motion of the lumbar vertebrae in all directions), and differed with them in terms of the additional independent variable participating in rehabilitation exercises in causing this improvement. The study of (Abdul Razzaq, Muhammad and Al-Zahi, Zidane 2018)) attributed this improvement to the combined effect of rehabilitation exercises and the accompanying therapeutic massage, and the study of (Ismail, Ismail et al. 2015) attributed this improvement to the combined effect of rehabilitation exercises and the accompanying magnetic device, while our study attributed this improvement to the combined effect of rehabilitation exercises and the accompanying health education, and the results of our study agreed with the results of the study of (Ziyada, Mohamed, 2017) regarding the existence of

The effective positive effect of rehabilitation exercises in improving muscle strength and range of motion, and it differed with it in terms of the study sample, as the study sample at (Ziyada, Mohamed, 2017) was about all those suffering from lower back pain, and did not differentiate between those suffering from non-specific lower back pain, which has no known anatomical pathological cause, and those suffering from specific lower back pain resulting from specific causes such as disc damage, spinal fractures, or other causes that require surgical intervention and not rehabilitation exercises, as stated in that study. As for the study sample in our study, it was only about those suffering from non-specific lower back pain, meaning those suffering from pain not associated with a known disease such as fractures, damage to the intervertebral discs, etc., as the pain of fractures and damage to the intervertebral discs inevitably requires surgical and drug interventions, not rehabilitation exercises. The results of our study were also consistent with the results of the studies of: (Al-Qalyubi, Hamdi 2016), (Faqir, Ahmed 2015), (Mohammed, M.Y. 2012) regarding the existence of an effective positive effect of rehabilitation exercises in improving muscle strength and range of motion, and differed from them in terms of the type of injury among the study sample members. Although the injuries in these various studies were located in the lower back, the type of injury differed from one study to another: The study of (Al-Qalyubi, Hamdi 2016) was on those with lateral curvature of the spine. The study of (Faqir, Ahmed 2015) was on those with partial herniated disc in the lumbar region of the spine, and the study of (Mohammed, M.Y. 2012) was on those with torn collateral ligaments of the lumbar vertebrae. As for our study, it was on those with non-specific lower back pain. The results of our study were also consistent with the results of the study of (Hyoung, Hee-Kyoung. 2009) regarding the existence of an effective

positive impact of rehabilitation exercises in improving muscle strength and range of motion, and differed with it in terms of that study containing two additional dependent variables, namely: degrees of pain and disability, and the level of satisfaction with life, whose level of improvement was measured by the rehabilitation exercises applied to the sample individuals in addition to measuring the basic variables of the study, which are muscle strength and range of motion of the spine, as for our study, its dependent variables were limited to muscle strength of the back muscles and range of motion of the lumbar vertebrae in different directions. Without others. According to what is stated in the research plan.

Fifth: Conclusions and recommendations:

1. **Conclusions:**

In light of the previous results, the researchers concluded that the application of the proposed sports rehabilitation program had a significant positive effect in improving the functional efficiency of the spine in sample members suffering from non-specific lower back pain, through improving the muscular strength of the back muscles, and improving the range of motion of the lumbar vertebrae in all directions, in sample members.

2. **Recommendations:**

In light of the above conclusion, the researchers recommend the following:

- The proposed sports rehabilitation program should be used as a guide for treating non-specific lower back pain, particularly cases reported to women's fitness centers.
- Conduct educational seminars and lectures to raise awareness about non-specific lower back pain, the risk of its exacerbation, and how to deal with it. Attention should be paid to spreading health awareness regarding

proper posture when standing, walking, sitting, running, and lifting heavy objects.

- Conduct further similar studies on other non-specific injuries that individuals may be exposed to, and which sports rehabilitation programs can help reduce the severity and impact of.

the reviewer:

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