ORIGINAL ARTICLE

The Effect of Suggested Physical Exercises to Reduce Wrist Joint Injuries Among Second-year Gymnastics Students

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Abstract

Background: Applying trainings and following them during sports training can help reduce the risk of wrist joint injuries and ensure the long-term health and well-being of gymnastics students. The aim of the present study was to evaluate the effectiveness of suggested physical exercises in reducing wrist joint injuries of second-year gymnastics students.

Methods: This is a quasi-experimental study with an experimental group and two pre-tests and post-tests was conducted since it is suitable with the nature of the research. Participants consisted of 36 students (age=20±1.5, weight=71.83±3.4, height=175.83±5.5). Special exercises were designed to develop the strength and range of motion to reduce wrist joint injuries. The program included 16 training sessions for a period of 8 weeks (two sessions every week). In general, the special exercises lasted for 2 months; immediately after that, the post-tests were conducted. To evaluate the effect of physical training, we used several instruments and devices. These included a dynamometer to measure the wrist strength, a goniometer to measure the range of the motion of the wrist joint, and a physician digital scale to measure the height and weight.

Results: The results showed a significant improvement in the hand wrist strength in all post-measurements compared to pre-tests. The mean scores of upward flexion strength increased from 17.69 to 19.56, downward flexion strength from 9.33 to 10.91, rightward flexion strength from 13.97 to 15.80, and leftward flexion strength from 10.13 to 12.01. In addition, the range of motion tests showed a significant improvement in all dimensional measurements, as the mean scores of flexibilities of the wrist joint increased when flexed upward from 74.94 to 78.67, flexed downward from 82.83 to 85.89, flexed to the right from 39.39 to 43.44, and flexed to the left from 29.22 to 32.78.

Conclusion: The exercises used have a positive effect on improving muscle strength and developing the range of motion of the wrist joint, which protects the joint against damage or recurrence. Therefore, the development of such physical exercises is suggested for other places and similar sports.

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Introduction

Gymnastics, as one of the most prestigious and well-known sports in the world, has attracted considerable attention in various Olympic competitions, international festivals, and sports events. In a way, this sport is considered a mother sport, and the significant progress of this sport in skill performance can be attributed to its strong scientific foundations and principles.[1, 2] As one of the basic components of physical education programs, gymnastics plays a vital role in satisfying the diverse needs of students in different age groups.[3] This course is such that it creates lifelong skills for people. Additionally, it significantly helps to develop, enhance, and improve various aspects of physical fitness.[4, 5]

Gymnastics, like any competitive sport, requires endurance and strength in the joints of the body, especially the wrists joint.[6, 7] As a vital organ, the wrist is an important focal point for many movements in the sport of gymnastics, and athletes rely on it to perform movements during training and competition. For this reason, unfortunately, this member is susceptible to various injuries, including tears, dislocations, fractures, and sprains, which are caused by falls or improper execution of skills.[6, 7] As a result, wrist joint injuries and their recurrence are common obstacles that prevent students from participating in sports, especially when using gymnastic equipment that relies heavily on hand movements.[8] Unfortunately, wrist injuries are very common among gymnastics students due to the repetitive and high-impact nature of the exercise. Previous studies show that 62% of gymnasts suffer from physical wrist injuries[9] and 89% suffer from wrist pain.[10] The types of injuries vary, but common conditions include distal radius stress injuries, scaphoid impingement syndrome, dorsal impingement, scaphoid fractures, and tears of the triangular fibro cartilaginous complex.[6, 9] Most of these injuries are chronic and are often caused by excessive use and repeated pressure on the wrist joint.[11]

The learning and training process of a gymnast is such that it requires the use of intense repetitive movements that often use the wrist as the loading area and the forces are much greater than their body weight.[12] In these cases, the wrist is often in dorsiflexion with pressure applied to ulnar and radial deviation movements. This constant stress can lead to unbearable wrist pain in young gymnasts.[1, 12, 13] Therefore, it is important that coaches and other people involved in gymnastics are educated about these concerns and prevention strategies.[14] Applying trainings and following them during sports training can help reduce the risk of wrist joint injuries and ensure the long-term health and well-being of gymnastics students.

Through their work as gymnastics instructors in the College of Physical Education and Sport Sciences, the authors of this article have witnessed an increasing number of students struggling with poor physical and skill abilities. This weakness put them at risk of various injuries, especially in the wrist joint. Wrist injuries not only affected their ability to learn and improve their physical abilities but also led to irregular attendance in class. In this regard, the aim of the present study was to evaluate the effectiveness of suggested physical exercises in reducing wrist joint injuries of second-year gymnastics students, thus improving overall performance and reducing the risk of injury.

Methods

Study Design and Participants

The quasi-experimental study with an experimental group and two pre-tests and post-tests was chosen according to its suitability with the nature of the research. The statistical population of the research consisted of 75 students of the second stage of the Faculty of Physical Education and Sports Sciences. The criteria for entering the study include not having strengthening exercises for the wrist, not suffering from complications and diseases related to the wrist, and having consent to participate in the study. The participants who suffered from problems in the wrist area during the interventions and participated in less than 80% of the suggested physical exercises were excluded from the research. Finally, 40 students agreed to participate in the study; 4 of them were excluded from the study, and finally the analyses were performed on 36 participants. The participants were fully explained about the research objectives. Then, if they agreed to participate in the study, a written informed consent was obtained from them. The study was approved and supervised by the ethics committee of College of Physical Education and Sport Sciences – Wasit University (No: 54.286).

Measurements

To evaluate the effect of physical training, this study used several instruments and devices. These included a dynamometer to measure the wrist strength, a goniometer to measure the range of the motion of the wrist joint and a physician digital scale to measure the height and weight.

It was done to test the strength of the wrist using a dynamometer according to the method recommended by Hasan Al-Dalawi.[15] The purpose of this test was to measure the wrist strength. As to the test specifications, the subject sat in a tall position with the dynamometer at a right angle to his body. One end of the device was attached to the hand through a belt and the other end was attached to a fixed place. The subject moved his hand according to the required ranges (bending up, bending down, bending right and

bending left) and performed the test when the signal started. Each test was attempted twice for each hand and the best result was recorded.

The method recommended by Reiman and Manske[16] was used to test the range of motion using goniometer. As to the specifications of the test, the subject sat on the floor in a tall position and fixed the device in front of his hand. Then, he moved his hand according to the required ranges (flexion up, bending down, bending to the right and bending to the left) and performed the test when the signal started. Each test was attempted twice for each hand and the best result was recorded.

Procedures

Pre-tests were conducted on December 2024. Special exercises were designed to develop the strength and range of motion to reduce wrist joint injuries. The program included 16 training sessions for a period of 8 weeks (two sessions every week). In general, the special exercises lasted for 2 months, and immediately the post-tests were conducted. The exercises were performed at a moderate intensity and frequency (75-85%). Each session lasted 60 minutes and focused on exercises to develop the wrist strength and range of motion. Details of special exercises are as follows: 1. Wrist flexion and extension: Exercises included wrist curls and reverse wrist curls using light dumbbells or resistance bands to enhance the flexion and extension strength; 2. Radial and ulnar deviation: Using resistance bands, students performed side-to-side wrist movements to strengthen the muscles responsible for radial and ulnar deviation; 3. Grip strengthening: Exercises included squeezing a hand gripper or a soft ball to improve overall grip strength; 4. Wrist stabilization: Plank variations and wrist circles were incorporated to improve the wrist stability and proprioception; and 5. Stretching exercises: Static and dynamic stretches for the wrist were performed to increase flexibility, such as wrist flexor, extensor stretches, and wrist rotations.

Statistical Methods

The data were analyzed using g IBM SPSS version 26 in Armonk, NY, USA. Shapiro-Wilk test was used to assess the normality of the data. Paired t-tests were used to determine the effect of special physical exercises. A p-value below 0.05 was deemed significant.

Results

The mean age of the participants was 20.56±0.55 years. The mean weight and height were 71.83±7.95 kg and 175.83.83±6.03, respectively. All of the participants were male.

Table 1 shows the differences in the wrist joint strength between pre-test and post-test measurements. Comparing the results of the pre-tests and post-tests showed a significant improvement (P<0.001) of 1.87, 1.58, 1.83, and 1.88 units in bend upwards, bend down, bend to the right, and bend to the left in the right hand, respectively. In addition, a significant improvement (P<0.05) of 0.99, 1.56, 2.18, and 1.54 units was observed in the left hand in upward bending, downward bending, right bending, and left bending respectively.

Table 1: Comparison of the difference in strength of the right and left wrist joints before and after the interventions of physical exercises (n=36)

Variables		Pre-test (mean)	Post-test (mean)	*t* -value	P value
Right wrist strength	Bend upwards	17.69	19.56	13.88	0.001
	Bend down	9.33	10.91	15.905	0.001
	Bend to the right	13.97	15.80	24.45	0.001
	Bend to the left	10.13	12.01	17.630	0.001
Left wrist strength	Bend upwards	18.11	19.10	2.622	0.02
	Bend down	11.16	12.72	4.699	0.001
	Bend to the right	14.06	16.24	5.480	0.001
	Bend to the left	10.10	11.64	10.87	0.001

Table 2: Comparison of the difference in the range of motion of the right and left wrist joints before and after the interventions of physical exercises (n=36)

Variables		Pre-test (mean)	Post-test (mean)	*t* -value	P value
Right wrist flexibility	Bend upwards	74.94	78.67	6.80	0.00
	Bend down	82.83	85.89	8.57	0.00
	Bend to the right	39.39	43.44	6.29	0.00
	Bend to the left	29.22	32.78	6.61	0.00
Left wrist flexibility	Bend upwards	69.17	71.61	20.28	0.00
	Bend down	79.89	83.30	14.71	0.00
	Bend to the right	32.33	34.57	22.03	0.00
	Bend to the left	41.17	43.33	3.54	0.00

The difference in the range of motion of the wrist joint before and after the intervention is reported in Table 2. Comparing the results of the baseline and follow-up tests showed a significant increase (P<0.001) of 3.73, 3.06, 4.05, and 3.56 units in bend upwards, bend down, bend to the right, and bend to the left in the right hand, respectively. In addition, a significant increase (P<0.001) of 2.44, 3.41, 2.24, and 2.16 units was observed in the left hand in upward bending, downward bending, right bending, and left bending, respectively.

Discussion

This study aimed to investigate the effectiveness of physical exercises in reducing wrist joint injuries in second-year Iraqi gymnastics students. This is one of the first studies among student gymnasts in Iraq. Based on the obtained results, significant differences were observed in the strength and flexibility of the students' wrists. This improvement can be attributed to the training interventions used to develop the strength and range of motion of the wrist joint among the subjects in the gymnastics game.

These results are consistent with the findings that muscle strength development exercises must be accompanied by joint flexibility and muscle lengthening exercises to increase the positive effects of strength training on flexibility.[17, 18] The results show that the effective positive impact of the exercises used to develop strength has improved the muscular work of the main and working muscles in the wrist joint, which has increased the students' ability to sense movement and improve the angles of the participating body parts in a way that serves the smooth movement of the arm with fast and precise motor performance, as well as increasing interconnection and compatibility.

Motor activity is important in transferring the amount of movement from the torso to the arms via the wrist while performing movements in gymnastics. This is consistent with another study,[19] indicating that special physical exercises would raise the level of physical fitness, which helps protect students from wrist joint injury or its recurrence.[20] This is clear in the rates of development occurring in students' post-measurements in physical variables; It has been confirmed[21] that the main goal in sports that contain a skill requiring flexibility is to achieve speed in the movement of the limb farthest from the body by developing strength and flexibility between the parts (joints) of the used limb. This should be taken into consideration when choosing exercises for this type of performance because of its importance in protecting the joint from injuries or their recurrence. This is what the researchers sought to achieve through the exercises used to develop the strength and flexibility of the wrist joint. The improvement of the range of motion in sports and rehabilitation tests is due to the positive effect of physical exercises, which include various methods for developing the range of motion of joints, such as static and mobile flexibility exercises, and performing these exercises slowly.[21, 22]

Researchers believe that the selection of training exercises is based on scientific principles and in a practical, thoughtful, and codified manner; therefore, the training units included diverse and exciting physical exercises that helped them gain strength and range of motion. This is what scientific studies indicate when using diverse, precise, and purposeful exercises; in particular, they have a positive effect in preventing injuries to the wrist joint or its repetition.

Despite its strengths, this study had limitations. First, the small sample size (36 participants) limits the generalizability of the findings. Also, he studies only included male second-year gymnastics students from a single institution, which may not represent the wider population of gymnasts. Moreover, the 8-week intervention period may not be sufficient to assess the long-term effectiveness of the exercise program. Finally, the absence of a control group makes it difficult to isolate the effects of the exercise.

Conclusion

The results revealed that the exercises used had a positive effect on improving muscle strength and developing the range of motion of the wrist joint, which protects the joint against damage or recurrence. Therefore, the development of such physical exercises is suggested for other places and similar sports.

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Authors' Contribution

All authors contributed significantly to the completion of this research. Ghasaq Taher Habeeb designed the study, developed the exercise program, and wrote the manuscript. Ali Barkawi Jleeb assisted in data collection, statistical analysis, and manuscript editing. Fawziya Kathem Mohsen contributed to the literature review, methodology, and data interpretation. Ali Smoom Fartousy supervised the research, provided

critical revisions, and validated the findings. All authors reviewed and approved the final version of the manuscript.

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Conflict of Interest

None declared.

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