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Effect of a rehabilitation skill program using resistance bands on biokinetic variables in volleyball players with disabilities

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ABSTRACT

To achieve high level of performance in sports games and events, all aspects, including the motor, tactical, psychological and skill performance of the players must be integrated and improved. Rubber bands play an important role in player rehabilitation to speed up muscle recovery in a good way. The aim of the study was to prepare a rehabilitation skill program using rubber bands to develop the preparation skills and biokinetic variables for volleyball players with disabilities in wheelchairs. The experimental method was used in one of its basic designs which is the design of the two equivalent groups, this due to the suitability of this design to the nature of the research problem. The research sample was chosen by a comprehensive inventory method and consisted of 18 disabled volleyball players of Babylon governorate for the 2021 season. The sample was divided into two groups, the experimental group and the control group, with 9 players for each group. A rehabilitative skill program was prepared using rubber bands on the experimental group for a period of eight weeks, with three training units per week. Data were analyzed based on arithmetic means, standard deviations and t-test. As a result, statistically significant differences were found between the pre-test and post-test of the experimental group and the control group for all study variables, in favor of the post-test for both groups ($p<0.05$). In conclusion, the rehabiliation skill program using rubber bands has a positive effect on the development of the preparation skills and biokinetic variables for volleyball players with disabilities in wheelchairs.

KEYWORDS

Rehabilitation skill program; Rubber bands; Volleyball; Disability.

1. INTRODUCTION

Those with experience and expertise have found the best scientific means and methods through research and experiments that they have carried out to develop volleyball, to increase its attractiveness and enjoyment, and to improve its performance level by working to increase the efficiency of the practitioners in terms of physical and skill aspects. The reason for this spread is the ease with which the game can be practiced under all circumstances and in all places, and the great and accelerated development which this game has undergone and is still undergoing (Hameed & Abdalkarem, 2022). Therefore, the various sciences that serve sports in general and the development of the various sports, including volleyball, shows that analysis of biokinetics is one of the important scientific methods that contribute to increase the level of performance of the skills and help to fully know the skills to be taught or trained in from a scientific point of view. Its importance lies in the fact that it is the basic skill and dominates the performance of the prepared player who uses it in the game. It organises and prepares the appropriate balls for the hitting players to score points, so that the correct and economical technical performance in performing the skill ensures the accuracy of the skill of preparation, which is presented by the importance of research, as the study of some biokinetic variables gives us the opportunity to discover the shortcomings in the technical performance of the skill preparation in order to correct them and reach the best technical performance for the prepared player in volleyball (Saleh Al-Thubaini, 2022).

Through the researcher's observation of the game of volleyball, she noticed a weakness in the accuracy of the performance of some types of preparation skills. The researcher attributes the reason for this weakness to the failure to apply the bio kinetic conditions that have to do with the correct technical performance that the player must follow, which negatively affects the accuracy of the performance of the player. So, the researcher decided to prepare a skill program and rehabilitation exercises using rubber bands in general to rehabilitate players, to speed up the recovery of muscles and joints and their functional potential and make them work well again as well as using rubber bands to develop some types of skill preparation for volleyball and some variables. The biokinetics of the skill of preparation helps to create the opportunity for coaches and players to know the accurate information of technical performance errors and then work on correcting them and avoiding their occurrence in the future (Maki et al, 2022; Taha Idrees et al, 2022).

The aim of this study was to prepare a rehabilitation skill program using rubber bands to develop the preparation skills and biomechanical variables for volleyball players with disabilities in wheelchairs. The hypothesis was that the rehabilitation skill program using rubber bands would have

a positive effect on developing the preparation skills and biomechanical variables in volleyball players with disabilities in wheelchairs.

2. METHODS

2.1. Design and participants

The experimental method was used in one of its basic designs, which is the design of the two equivalent groups, this due to the suitability of this design to the nature of the research problem. The research sample consisted of 18 disabled volleyball players in wheelchairs of Babylon governorate for the 2021 season. The study was carried out in the Babel sports hall of Babylon governorate.

Table 1 presents the results of the sample homogeneity test. As can be seen, the value of the Skewness coefficient is between ±3, indicating a moderate distribution. Table 2 summarizes the findings on the equivalence between the experimental and control groups before the intervention applied in the study. Table 2 reveals that there are no statistically significant differences between the groups with regard to all study variables ($p>0.05$). This indicates that the groups are equivalent.

Table 1. Sample homogeneity

Variables	Measuring unit	Mean	Median	SD	Skewness coefficient
Age	Year	21.782	21.000	1.351	0.389
Weight	Kg	62.214	60.000	1.233	0.543
Training age	Year	6.763	6.000	1.498	0.432

Table 2. Equivalency tests results between experimental and control groups

Variables	Experimental group		Control group		T value	Level sig
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		
Angle starting ball	64.56	0.456	62.89	0.322	0.478	0.521
Speed starting ball	4.38	0.651	5.37	0.657	0.598	0.876
Time start ball	3.11	0321	4.16	0.543	0.786	0.665
The highest height of the ball above the net level	1.83	0.834	1.62	0.341	0.465	0.782
The skill of setting close to the network	14.01	0.821	12.04	0.782	0.679	0.834

2.2. Instruments and procedures

The instruments used were: Legal volleyballs (20), volleyball net with a height of (2.43 m), stopwatch (4), whistle (4), measuring tape (2), a computer (Pentium III) of the type (SAMSUNG), rubber bands (30), a Japanese-made National M7 type camera with a frequency of 25 frames per second, and a program for analyzing sports movements in a computer.

The preparation skills and biokinetic variables for volleyball players with disabilities in wheelchairs were evaluated according to the guidelines of Al-Katib & Al-Saadi (2002). The pre-tests were conducted on Thursday 10/09/2020 at the Babel Sports Hall of Babil governorate. The post-tests were conducted on 13/11/2020 at the Babel Sports Hall of Babil governorate.

The field research procedures were videography and computer-mediated analysis. For videography, the researcher used two Japanese-made National M7 video cameras with a frequency of 25 images/second to film the research sample during the main research experiment; one of the two cameras was pointed at the player. For computer-mediated analysis, the video material was converted from a videotape to a file format using the Fps16 fas 6t video in-out conversion card (MJPEG card), and then to CDs in order to facilitate the analysis steps. The movement was cut into images using the program (Make Movie – Bitmap sequence) to extract the specified variables, and these images were stored in the form of files in the computer's file folder (My document). After the sections to be analyzed have been identified, these images were transferred to the Auto Cad version 14 program, which is installed on a Pentium III (500MHz) calculator as the time, angles and displacements to be analyzed were measured. The time was extracted using the TIMER VER 3.1 program, where the start of the movement whose time is to be measured is selected by pressing the (Start Timing) button, then choosing the end of the movement to be measured by pressing the (End Timing) button, then the time of the selected movement will appear.

2.3. Biomechanical variables

The biomechanical variables were extracted during the analysis according to what was required of them, so the biokinetic variables are as follows:

- The starting angle of the ball: it is the angle between the horizontal plane and the line connecting the center of the ball at the moment of touching to another specific point of the center of the ball after its launch and it is measured from the front.

- The speed of the ball's launch: it is measured by calculating the distance between the center of the ball at the moment of touching to another specific point of the center of the ball after its launch and divided by the time of that distance, which represents the time of the ball's launch.
- Ball launch time: it is measured by calculating the time of the distance travelled by the center of the ball at the moment of touching to another specific point of the center of the ball after its launch.
- The highest height of the ball above the net level: it is the vertical distance between the center of the ball at the highest height it reaches and the upper net level.

2.4. Exercises applied

The exercises started on 12/09/2020 and ended on 11/11/2020. Training intensity was 80 - 90%. Table 3 shows the exercises used in the research.

Table 3. Exercises used in the research

Training unit	Exercises	Intensity %	Repetition	Repetition (min)
1	Handling from the top to the wall, letting the ball fall to the ground and then performing the handling.	80%	10	2 minutes
2	Handling from the top, letting the ball fall to the ground and then repeating the handling after the ball bounces.	80%	10	2 minutes
3	Handling from top to the wall from a distance of 3 m.	80%	10	2 minutes

2.5. Statistical Analysis

The Statistical Package for the Social Sciences (SPSS version 21.0) was used for data analysis. Data were analyzed based on arithmetic means, standard deviations and t-test. For the statistical differences, a significance level of 0.05 was considered statistically significant.

3. RESULTS

We used t-test analysis to find the differences between the pre and post-test of the experimental and control groups for all study variables, and also to find the differences between the two groups in the post-test. Based on the results of the t-test, a statistically significant difference was found between

the pre-test and post-test of the experimental group in relation to all study variables. The results are presented in Table 4.

Table 4. The results of the pre and post-tests of the experimental group

Variables	Pre-test		Post-tests		Differences of standard deviation	T value	P value
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
Angle starting ball	64.56	0.564	67.84	0775	0.549	4.899	0.003
Speed starting ball	4.38	0.789	4.12	0.451	0.621	9.374	0.000
Time start ball	3.11	0.897	3.00	0.872	0.811	6.583	0.000
The highest height of the ball above the net level	1.83	0.431	1.90	0.845	0.673	8.421	0.002
The skill of setting close to the network	14.01	0.686	15.06	0.633	0.745	5.694	0.000

Interpreting the results, we see that for all study variables we have a statistical difference between pre-test and post-test for the experimental group ($p<0.05$), in favor of the post-test. Table 5 presents the results of the pre and post-test of the control group. Based on the t-test results, we see that there is a statistical significant difference between the pre-test and post-test of the control group in relation to all study variables ($p<0.05$), in favor of the post-test (Table 5).

Table 5. The results of the pre and post-tests of the control group

Variables	Pre-test		Post-test		Differences of Standard deviations	T value	P value
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
Angle starting ball	62.89	4.654	64.95	5.897	0.739	6.453	0.000

Speed starting ball	5.37	7.984	5.11	8.621	0.687	5.641	0.006
Time start ball	4.16	5.673	4.01	5.932	0.543	9.488	0.002
The highest height of the ball above the net level	1.62	4.367	1.71	9.654	0.723	7.945	0.00
The skill of setting close to the network	12.04	6.891	13.07	7.432	0.842	5.734	0.000

Now we present the results of the post-test between the experimental and control groups to see the differences (Table 6). As we can see from the results, there is a statistically significant difference between the experimental and the control group for all study variables ($p<0.05$).

Table 6. The results of the post-tests of the experimental and control group.

Variables	**Experimental group**		**Control group**		**T value**	**P value**
	Arithmetic mean	**Standard deviation**	**Arithmetic mean**	**Standard deviation**		
Angle starting ball	69.21	7.863	66.94	5.456	6.768	0.001
Speed starting ball	3.91	9.752	4.89	4.784	8.665	0.000
Time start ball	2.45	8.432	3.94	8.934	4.793	0.003
The highest height of the ball above the net level	2.01	6.583	1.83	7.866	7.453	0.001
The skill of setting close to the network	16.54	5.765	14.87	8.567	5.862	0.005

4. DISCUSSION

The aim of this study was to prepare a rehabilitation skill program using rubber bands to develop the preparation skills and biomechanical variables for volleyball players with disabilities in wheelchairs. Based on the results of the t-tests, statistically significant differences were found

between the pre-test and post-test of the experimental group and the control group for all study variables, in favor of the post-test.

So we see that there is a remarkable evolution in the development of the skill of preparation and biomechanical variables for volleyball players with disabilities in wheelchairs, in favor of the post-test for the experimental and control groups. Regarding to the network level, it has a great impact in developing the result that these tapes provide gradual resistances along the path of movement and then reflect it on the increase in strength in two directions: the first muscular, by increasing the muscular section, and the second neurological, by increasing the mobilization of the motor units and increasing the intensity of the loads for exercises by providing the amount of nerve impulses necessary for work (McNeely & Sandler, 2006).

The rubber bands have a positive effect on muscle strength because they provide resistance in all directions, which is positively reflected in improving muscular performance and strengthening the joint ligaments (Brody & Geigle, 2009). Also, since the role of the upper extremities is greater than the lower extremities in generating the necessary force, the effect of the force is positive (Hochmuth, 1999). The prepared player tries to bring the starting point of the ball from his hand as close as possible to the hand of the hitting player in order to surprise the blocking players of the opposing team (Muslat & Al-Hashimi, 1991). Furthermore, the levers of the body should move in the right direction, because the rapid movement of the body levers enables us to obtain the maximum effective force that serves the player to achieve the goal of the movement in the best way (Khreibet & Shalash, 1992).

5. CONCLUSIONS

In conclusion, this rehabiliation skill program using rubber bands has a positive effect on the development of the preparation skills and biokinetic variables for volleyball players with disabilities in wheelchairs. Based on the findings from this study, it is recommended that volleyball coaches focus on training players individually and intensively using special exercises, in order to take the correct technical situation for the performance as a main goal that leads to win the match. Finally, it is highly recommended to conduct other similar studies in order to investigate other variables or types of preparation skills, because they show the negative and positive aspects of the technical performance of the players.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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