SPORT TK-EuroAmerican Journal of Sport Sciences

https://revistas.um.es/sportk Online ISSN: 2340-8812

Received: **05/12/2021.** Accepted: **01/01/2022.** Published: **31/01/2022**

Influence of dynamic training on the biomechanics and height of volleyball spike in young players

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ABSTRACT

The aim of the present study was to identify the influence of dynamic training on the biomechanics and height of volleyball spike in young players. The study was conducted in the Faculty of Physical Education and Sports Sciences gymnasium, ThiQar University. A total of six players were recruited for the study, representing Al-Furat Sports Club class A, with an experience playing of 7-9 years. Various tools and instruments were used for observation, evaluation and data collection for the study, including power measuring platform, two cameras integrated into a measuring system, a Kinovea, LockerPro and SPSS. The participants of the research group received training in the form of dynamic work using weights (of variable weight), rubber ropes (in maximum extension). This is a training method based on the auxotonic muscle contraction method. Based on the findings of the study, it was concluded that the apparent development in the level of technique of the volleyball spike is revealed due to the development of dynamic work and some biomechanical variables. The speed of run-up and take-off speed were improved due to the development of mechanical regimes caused by the use of dynamic training.

KEYWORDS

Spike; Diligent work; Anatomical contraction; Extension; Variables; Eccentric force.

1. INTRODUCTION

The spiking skill in the volleyball game is a high intensity skill in which various group of muscles undergo a high level of tension in the form of dynamic work (Dahash et al, 2022; Hameed & Abdalkarem, 2022; Marín et al, 2010). Dynamic work is one of the fundamental physical and practical abilities required for spiking technique in volleyball. Dynamic work is also considered as

the leading cause of changes in the angular and linear motions of different parts of the body. The increased mechanical load on absolute or relative muscle groups cause increase in the strength of these muscles especially during stabilization which enables them to overcome the load as a result of increased muscle extension (Jabbar, 2009).

A muscle becomes reasonably strong with the eccentric work. It increases muscle strength while expanding the muscle to its optimum length. The ability of the muscle to work is called internal muscular force or muscle tension. The eccentric muscle contraction is derived through the processes of eccentric contraction (the work and the strength of the muscle when expanding to prepare and produce a final external ability); from the point of view the moment, the centric contraction and the time of contraction (as the main phase). A muscle undergoes highest level of tension during high intensity or powerful activities like jumping and spiking.

The present study was intended to identify the effect of dynamic training on values of some biomechanical variables for the high spike in volleyball for youth. Increased ability of the muscles to work under intense activities or movement with the shortest period of time by overcoming the external and internal resistance might help player in gaining the speed of body during run up phase in the game. Hence, the linear distance travelled by the body's center of mass is strongly affected by the force of muscle contraction, and increasing the speed will positively affect other biomechanical variables (Moneim and Sobhi, 1997).

2. METHODS

The present study was conducted in the Faculty of Physical Education and Sports Sciences gymnasium, Thi-Qar University. The young players of Al-Furat Sports Club class A were selected as participants for the study. A total of six players were selected based on the eligibility criteria for the study. Various tools and equipment were used for observation, evaluation and data collection for the study which included, power measuring platform, two cameras integrated into a measuring system, a Kinovea, LockerPro and SPSS kinetic analysis programs connected to a computer. The experiment was captured using with two side cameras placed in zone 4. The power platform was also placed in zone 4.

The participants of the research group received training in the form of dynamic work using weights (of variable weight), rubber ropes (in maximum extension). This is a training method based on the auxotonic muscle contraction method. In this method, a muscle undergoes isotonic contraction, followed by isometric contraction and again isotonic type of contraction within the

anatomically and technically acceptable limits. The muscle work increases by shortening and lengthening in a cyclic manner with the help of tools and equipment used for strengthening. The rest interval was given to the participants in between the bouts of exercises depending upon the effort of the individual player. Strength training was given for the total of eight weeks, 3 sessions training units per week. Each training unit consisted of 35-45 minutes.

3. RESULTS AND DISCUSSION

Table 1 describes the calculated value of the t-test, function under the level of significance with $p<0.05$. Significant difference was found between pre and post-test, for the benefit of the post-test. The significant findings were related to the effect of dynamic work which contributed in developing the muscle strength to a maximal level especially by doing eccentric muscle contraction. Eccentric contraction was performed by slowly lifting of the rods or pulling out the rubber ropes while maintaining the joint extension of the body parts in training when lowered to down, which increased the eccentric force (Al-Fadhli, 2010).

The correlation of this work between elasticity of muscles and the time component effectively helped in developing the ability of muscles to generate high tension under intense activity like spiking thereby preparing them to contract with high level of force at high speed. Hence, it contributed in increasing the general speed of player regardless of the run-up speed or took off speed. "The faster the run-up speed, the faster the take-off speed and, thus, the momentum of the body increases and the ball moves". It also caused an increase in the instantaneous strength of the ball due to increase in the values of the vertical force of the body (Al-Dain, 1993). "The development of the efficiency of muscle acceleration effectively contributed to the success of the main phase by ensuring that the required goal is effectively achieved and with the lowest possible muscle effort" (Moneim, 1977).

Table 1. Values of arithmetic mean, standard deviations and t-test of kinematic variables in pre and post-tests.

Variables	Unit	Pre-test		Post-test		T-value	P value	R.
		M	SD	M	SD			
Run-up speed	м/с	0.06	5.01	0.01	4.78	4.11	0.040	Sig.
Angle of ascent	Deg.	0.52	87	1.03	74	13.06	0.010	Sig.
Take-off speed	м/с	0.50	3.33	0.02	2.71	4.11	0.027	Sig.
Max. Height CMB	м.	0.02	1.53	0.01	1.37	29.793	0.000	Sig.

Table 2. Values of arithmetic mean, standard deviations and t-test of biokinetic variables in pre and post-tests.

Variables		Unit	Pre-post		Post-test		T-value	P value	R.
			M	SD	M	SD			
Contact force	Max. Force	н.	1290.20	124.54	1725.62	49.05	6.843	0.030	Sig.
	Arrival time	с.	0.045	0.002	0.018	0.001	26.745	0.007	Sig.
Absorb. Force	Max. Force	н.	902.75	50.89	1198.66	68.69	6.516	0.001	Sig.
	Arrival time	с.	0.044	0.001	0.019	0.001	9.195	0.010	Sig.
Impulse force	Max. Force	н.	2054.04	132.82	2934.97	60.97	16.234	0.020	Sig.
	Arrival time	с.	0.052	0.001	0.020	0.001	15.982	0.010	Sig.

Table 2 describes the calculated value of the t-test, function under the level of significance with $p<0.05$. Significant difference was found between pre and post-test, for the benefit of the post-test, indicating significant effect of dynamic work training on the targeted group of muscle. Dynamic muscle training helped the muscle in gaining the strength in the lengthened position by eccentric contraction. Eccentric mode of contraction caused increase in the speed of contraction, overcoming the resistance from the different parts of the body especially during the preparatory phase of the performance of the player. Hence, the muscle strength increased significantly which further increased the technical performance of the skill. The players were able to perform with the high intensity muscle work in the shortest span of time.

Training muscles by lengthening and shortening is characterized by a short period in which the muscle gets a state of rest (muscles extension). "This situation has a natural effect on the extension and as a result of which muscle tension increases. The more muscle tension, the greater the mechanical strength". Demonstrated by developing the value of the maximum contact force and absorption force, their positive role improved the maximum ultimate take-off force. In a study conducted by T.H. Hussam Ad-Deen, the authors stated that the preparatory phase in a game is crucially important for the desired outcome of the game. In case of shortening the time required for performing the movement, preference is given to the athlete who has the highest level of strength because the time of the main stages continuously decreases with the improvement of physical fitness of the athletes (Zayed, 2012).

4. CONCLUSION

Based on the findings of the study, the authors concluded that the development in the level of technique of the volleyball spike is revealed due to the development of dynamic work and some biomechanical variables. The speed of run-up and take-off speed were improved due to the development of mechanical regimes caused by the use of dynamic training. The training of dynamic work and auxotonic contraction training method also helped in the development of take-off angle in connection with the development of the moment of muscle force.

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AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

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