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RESEARCH ARTICLE

The Impact of Training Program Utilizing Elastic Bands on Selected Physical and Skill Variables among Volleyball Players

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Abstract
This study aimed to explore the impact of a training program using elastic bands on selected physical and skill variables among volleyball players of Palestine Technical University – Kadoorie. Twenty male volleyball players were selected, their arithmetic average age was 20.45 years, and they were divided into two groups, (10) players for the pre-training test (control) and (10) players for the post-training test (experimental). The experimental group participated in an elastic band training program for two months**.** The data were analyzed using the statistical analysis program SPSS, and this was done by t-test to determine the differences between the pre- and post-measurements and the equivalence between the experimental and control group. The results indicated that there were statistically significant differences in the post-measurement between the experimental and control groups for selected physical and skill variables among the volleyball players, in favor of the experimental group. The percentage and p values of change in these measure variables tests were the Spiking (20.51%; p=0.011), Blocking (18.18%; p=0.001), Vertical Jump from Standstill (9.71%; p=0.033), Vertical Jump from Movement (5.37%; p=0.037), Medical Ball Throws from Overhead (2.81%; p=0.022), Medical Ball Throws from Chest (3.23%; p=0.001), and Push-Up (35.80%; p=0.001). This study concludes that elastic band training represents a promising evolution in the development of volleyball players, and is considered a comprehensive approach to improving their physical and skill attributes and enhancing their overall abilities on the court. This study recommended conducting additional research and applying elastic band training in the field of sports performance.

Keywords
Elastic Bands, Physical Variants, And Physical Skills, Ptuk Male Volleyball Game

INTRODUCTION

Improving one's physical qualities and honing one's skill sets are two of the most important objectives that athletes can pursue in the pursuit of reaching their full potential in their respective sports (Mamirzhon, 2023). A holistic approach to training is required for volleyball

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because it is a sport that is both dynamic and demanding. This type of training must address both the physical and skill-related aspects of the game (Rasuljon & Nomozbek, 2022). Within the framework of the Palestine Technical University - Kadoorie volleyball team, this paper investigates the potential influence of a suggested training regimen that involves the utilization of elastic bands on a variety of different physical and skill characteristics.

The efficacy of elastic band training in enhancing numerous volleyball-relevant physical qualities has attracted attention. Muscular strength, stamina, and fortitude are the pillars of an athlete's performance. Elastic bands can offer a unique type of resistance that challenges muscles throughout their entire range of motion, promoting balanced growth and reducing the risk of muscle imbalances (Sari et al., 2023). By replicating game-specific movements and enhancing proprioception, these bands also facilitate functional training (Tarigan et al., 2022). In addition, the bands can be tailored to meet the requirements of each individual, making them an excellent training aid for athletes of all fitness levels. This adaptability enables athletes to progressively increase their resistance, resulting in continuous strength and power gains (Nasrulloh et al., 2021). The Palestine Technical University volleyball team could considerably improve their vertical leap height, hitting power, and general agility by incorporating elastic bands into their training regimen.

Elastic band training has recently received a great deal of attention in the field of sports science due to its ability to improve a broad range of physical characteristics and skill components applicable to a variety of athletic disciplines (Ayyub et al., 2023). While the overwhelming majority of research on elastic bands has focused on contexts like strength training and rehabilitation, there is a growing interest in their application to sport-specific training, especially in dynamic sports like volleyball. This interest is fueled by the fact that elastic bands are relatively inexpensive and portable (Ibrahim, 2022). Improvement of Physical Traits Numerous studies examining the effects of elastic band exercise on an individual's physical characteristics have yielded encouraging results. The variable resistance profile of elastic bands stimulates muscles throughout the entire spectrum of motion, making them useful for developing physical strength (Yee, 2019). This unique characteristic promotes regulated muscle activation and reduces the risk of developing muscle imbalances in comparison to conventional weight training. Moreover, due to the progressive nature of elastic bands, athletes are able to continuously adapt to new challenges and increase the level of resistance they confront, resulting in ongoing strength gains (Biçer, 2021).

Volleyball players must also have the ability to maintain their energy levels for extended periods of time. Elastic band exercises, which emphasize eccentric and concentric muscle contractions, are intended to simulate the demands of sports that involve frequent and rapid changes in movement and direction. This training method improves muscular endurance and stamina due to the simulation of game-specific movements (Sari et al., 2023). Elastic band research has primarily focused on enhancing strength, which is essential for explosive volleyball activities such as spiking and jumping. The elastic properties of elastic bands enable athletes to generate force more rapidly, which in turn promotes rapid muscle contractions and neuromuscular adaptations. This can result in an increase in power output and vertical jump height, both of which are required for effective launching and blocking (Nasrulloh et al., 2021).

In addition to enhancing, one's physical attributes, elastic band training can enhance one's comprehensive skill set. This is an essential topic that requires additional research. Volleyball skills such as serving, striking, and blocking require exceptional timing, coordination, and precision. It is possible to incorporate elastic bands on purpose into a variety of skill-specific exercises in order to enhance these attributes. By utilizing bands during spiking exercises, for instance, players are forced to exert more effort during both the upward and downward portions of the motion. This results in stronger shocks and enhanced striking precision (Elsharnoby, 2022). Moreover, elastic band exercises provide a platform for neuromuscular adaptation, which trains muscles to contract at the appropriate moment and in perfect harmony with one another. This flexibility can result in improved coordination, agility, and overall skill execution, all of which are essential for effective volleyball performance. One of the most essential aspects of the game is its adaptability (Masel & Maciejczyk, 2022).

The psychological effects of elastic band training are a subject of increasing study. An additional area of interest is the dynamics of teamwork. Unique training techniques, such as elastic bands, can invigorate workouts. This prevents training from becoming monotonous and increases athletes' motivation. Athletes who are able to surmount the obstacles presented by elastic bands can increase their sense of accomplishment, self-confidence, and self-efficacy (Xu, 2019). In addition, elastic band training can help enhance team dynamics due to its group nature. Developing a sense of solidarity and unity among group members can be facilitated by engaging in a shared activity, overcoming obstacles together, and bearing witness to the progress of other group members. This enhanced team spirit can have a positive effect on communication, collaboration, and synergy on the playing field (Hammami et al., 2022).

Incorporation into Volleyball Practice although the potential benefits of elastic band training are evident, careful planning is required for its successful incorporation into volleyball training regimens. Several aspects, such as exercise selection, progression, and periodization, must be modified to meet the unique demands of volleyball (Sari et al., 2023). Trainers and sports scientists must collaborate to develop a comprehensive and well-balanced training program for athletes. This program should incorporate elastic band exercises as well as other training methods (Ayyub et al., 2023). The Palestine Technical University - Kadoorie volleyball team faces a multifaceted challenge in the realm of sports performance enhancement that incorporates both physical attributes and the refinement of skills. As the team seeks for optimal performance and competitive success, it must address the intricate interplay between the development of essential physical qualities and the refinement of complex skill sets. The inadequacy of the current training regimen to provide an all-encompassing solution to this problem may hinder the team's ability to reach their maximum potential on the court (Salameh & Nassar, 2023).

While the team engages in regular training sessions, the current approach may lack the diversity and specificity required to effectively target the physical attributes and skill components specific to volleyball. Absence of a customized and integrated training program may result in suboptimal gains in muscular strength, endurance, power, and agility, which are the foundations of effective performance. Moreover, the current training program may not adequately address the complexities of skill refinement, such as serving, spiking, and blocking, which require precise timing, coordination, and execution (Nassar, 2022). Additionally, it is important to consider the psychological and team cohesion components of training. A lack of novel and engaging training methods may contribute to a decline in player motivation and zeal. This may impact their confidence and perception of self-efficacy, which are crucial psychological factors that influence performance. In addition, the team's dynamics and sense of unity may not be optimal, which may hinder team spirit and collaborative efforts during matches (Salameh & Nassar, 2023).

In light of these obstacles, there is a clear need for a comprehensive and innovative training program that addresses the psychological and team cohesion aspects of performance enhancement. Such a program should include elements that cater to the specific demands of volleyball and provide a holistic approach that propels the volleyball team at Palestine Technical University - Kadoorie to peak performance. To ensure the team achieves its objectives and maintains a competitive advantage in the dynamic and demanding world of volleyball, it is essential to address these difficult obstacles.

This study is critical for furthering our understanding of volleyball-specific athlete performance enhancement, skill development, and novel training strategies. The importance of such study is underscored by its potential to improve athlete achievement, coaching efficacy, scientific knowledge, and the sports community as a whole. By addressing numerous dimensions of athlete development, this research has the potential to increase the performance of the Palestine Technical University - Kadoorie volleyball team and inspire beneficial improvements in the field of sports training and performance enhancement.

In light of the previous discussion the study aimed to investigate the following:

The impact of a training program using elastic bands on selected physical and skill variables among volleyball players of Palestine Technical University - Kadoorie.

The impact of the conventional program on selected physical and skill variables among

volleyball players of Palestine Technical University - Kadoorie.

The differences between the experimental and control groups in terms of selected physical and skill variables among volleyball players of Palestine Technical University - Kadoorie.

MATERIALS AND METHODS

The methodology of this study was carefully planned to analyze the influence of a proposed training program utilizing elastic bands on selected physical and skill variables among volleyball players at Palestine Technical University - Kadoorie. The study attempted to provide a complete view of the intervention's impacts by using a quantitative approach.

Participants

The study's participants were all male volleyball players from Palestine Technical University - Kadoorie's team. A purposive sampling strategy was used to ensure a representative sample of athletes with various skill levels and experience. Before giving informed consent to participate, participants were informed about the study's objectives, procedures, and potential risks.

A sample of (20) players was chosen and it was divided into two groups, (10) players for the pre-training test (control) and (10) players for the post-training test (experimental).

This study followed ethical standards and received approval from the Faculty of Physical Education and Sports Sciences, Palestine Technical University - Kadoorie with reference number (2023/20 from 1.2.2023-2.4.2023). Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Data Collection Procedure

Spatial and Temporal Context

Ethical permission and informed consent were obtained from the Scientific and Ethical Committee of the Faculty of Physical Education and Sport Sciences, Palestine Technical University- Kadoorie to conduct this study. Also, written informed consent was obtained from all participants before beginning to collect data related to the study.

The research was carried out on the campus of Palestine Technical University - Kadoorie, making use of its specific sports facilities and courts. The intervention lasted from February 10, 2023 through April 10, 2023. This timeframe corresponded to the second semester of the academic year 2022/2023.

Experimental Design

The study used a pre-test and post-test design, comparing the effects of the proposed elastic band training program to a control group that followed a traditional training routine. The experimental group participated in a planned training program that included elastic band workouts aimed at certain physical qualities and volleyball skills. The control group continued with their regular exercise schedule.

Skill Variables

Spiking Test:

According to (Zhou et al., 2020) spiking can be tested using the following steps:

A few meters from the net, place the participant in the attacking position. The player begins behind the assault line (3-meter line) and approaches using the standard footwork of the team. A setter or coach delivers a set to the striking zone of a player. The player executes a spike with the objective of sending the ball over the net and into a designated location on the opponent's court. The administrator of the test documents the number of effective spikes, their accuracy, and the landing zones of the ball.

Blocking Test:

According to (Zonifa, 2020) blocking can be tested using the following steps:

Position the participant at the net so that he or she is prepared for defensive blocking actions. A coach or teammate simulates real-game situations by performing assaults (spikes) from the opposite side of the net. The player attempts to intercept and redirect the spiking ball back to the opponent's side of the court by executing blocking movements. The administrator of the test records the number of effective blocks, the accuracy of blocks (in or out of bounds), and the position of the player relative to the net.

Physical Variables

According to (Masel & Maciejczyk, 2022; Salameh & Nassar, 2023; Zhou et al., 2020; Zonifa, 2020) the following tests can be tested using the following steps:

Vertical Jump from Standstill:

Place the athlete in a predetermined starting area. Request that the athlete stand with his or her the athlete to take a preparatory step or movement (approach). During the preparatory movement, instruct the athlete to bow their knees and swing their arms behind them. On the "go" signal, the athlete extends their hips, knees, and ankles to leap as high as possible vertically.

Medical Ball Throws from Overhead Test: Assessing Upper Body Power

Place the athlete in the designated location for throwing. Request that the athlete stand with feet shoulder-width apart and the medical ball held overhead. Instruct the athlete to engage their core muscles and hurl the medical ball with a swift, powerful motion forward and upward.

Medical Ball Throws from Chest Test: Evaluating Upper Body Explosiveness

Place the athlete in the designated location for throwing. Request that the athlete hold the medical ball with elbows bent and arms near to the body at chest level. Instruct the athlete to engage their core muscles and hurl the medical ball with a swift, powerful motion.

Push-Up Test: Evaluating Upper Body Strength and Endurance

Place the individual on the exercise mat in a prone position. Instruct the person to position their palms slightly wider than shoulder-width apart and in alignment with their chest. The feet should be near together or approximately hip-width apart, and the body should form a straight line from the head to the heels. Instruct the individual to lower their body until their chest is near to the mat by bending their elbows. The individual then pushes themselves up to the beginning position.

Statistical analysis

ankles shoulder-width apart. Tell the athlete to straighten their knees and swing their arms behind them. On the "go" signal, the athlete extends their hips, knees, and ankles to leap as high as possible vertically.

Vertical Jump from Movement

Place the athlete in a predetermined starting area. Before executing the vertical leap, instruct

Quantitative data collecting includes employing approved techniques to measure specified physical and skill variables. Pre-test measures were taken prior to the intervention, and post-test measurements were taken at the conclusion of the training period. Statistical analysis of the data was performed, checked, coded, and entered into the statistical program Statistical Package for the Social Sciences (SPSS) (version 24, IBM, USA). Where data related to physical and skill training (Spiking, Blocking, Vertical Jump from Standstill, Vertical Jump from Movement, Medical Ball Throws from Overhead, Medical Ball Throws from Chest, Push-Up) were analyzed and processed for the pre and post-tests. This data was analyzed using descriptive statistics (arithmetic mean, standard deviation, skewness, coefficient of torsion). In this context, using the (Independent Samples t-test) and (Paired Samples t-test) the data obtained were analyzed to determine the differences in the pre-and post-measurements and the ratio between the experimental and control groups, thus determining statistical significance on priority at $\alpha \leq 0.05$.

Study Sample Characteristics

Data was collected regarding the characteristics of the participating players, which were as follows: age, weight, and height. The number of participants reached 20 volleyball players, whose ages ranged between 18 and 23 years. While the weights of the participating players reached (57-99) kg, and their heights ranged between 180 and 200 cm, as shown in Table 1. The participants also underwent a set of physical and skill training, which is shown in Table 2.

Table 1. The characteristics of the study sample according to the variables of age, height, and body weight. (N = 20)

Variable	Measuring Unit	Arithmetic Mean	Standard Deviation	Skewness
Age	Year	20.45	1.432	-0.426
Weight	Kg	77.45	11.161	0.255
height	cm	1.8630	0.0515	1.205

It is evident from Table 1. That the results of skewness indicate that it is close to zero. These results indicate the achievement of homogeneity between the members of the study sample and their subjection to a normal equilibrium distribution, where the values of the torsion coefficient of the age, weight and height variables came between (-3 and +3).Therefore, the study sample individuals were randomly divided into two groups, the first group (experimental) is trained using the proposed training program with Elastic bands, the second controlled group is trained in the traditional (normal) method, and the arithmetic average for the ages of the study sample is (20.45 years) and that the average weight of the students in the study sample is (77.45 kg) and that their average height is equal to (186.3 cm).

Table 2. The arithmetic means, standard deviations, the lowest and largest value and the torsion coefficient of the variables (age, weight, height) and the physical and skill variables of male volleyball players (n = 20)

Variable	Measurement Unit	Lowest Value	Largest Value	Arithmetic Mean	Standard Deviation	Coefficient of Torsion
Age	Year	18	23	20.45	1.432	-0.490
Weight	kg	57	99	77.45	11.161	-0.216
Height	cm	180	200	186.3	5.151	-0.490
Spiking	Degree	5	13	8.55	2.038	0.466
Blocking	Frequency	5	8	6.35	0.745	0.082
Vertical Jump from Standstill	cm	37	57	51.60	4.358	0.103
Vertical Jump from Movement	cm	61	73	66.70	4.219	-1.387
Medical Ball Throws from Overhead	MTR	5.76	6.30	5.9845	0.14749	-0.002
Medical Ball Throws from Chest	MTR	4.96	5.45	5.1585	0.11833	0.760
Push-Up	Frequency	8	14	10.35	1.348	2.322

It is clear from the results of Table 2. that the torsion coefficients of the total study sample in the variables (age, weight, and height) and the physical and skill variables ranged between (-3, +3) (Bougie & Sekaran, 2019), meaning that there is homogeneity in these variables for the total sample of the study.

RESULTS

First: The results related to the study's first hypothesis, which was "There are statistically significant differences at a significance level (α≤ 0.05) in the effect of the conventional program on selected physical and skill variables among volleyball players of Palestine Technical University - Kadoorie for the control group, between the pre-test and post-test means, in favor of the post-test mean" Therefore, in order to ensure the validity of this first hypothesis and examine it, a (paired samples t-test) was used, and the results of Table 3 show that.

Table 3. The results of the first hypothesis (n = 10)

	Dependent Variables	Pre-Measurement (N=10)		Post-Measurement (N=10)		T-Value	Sig.	Change %
		M	SD	M	SD			
Physical Tests	Vertical Jump from Standstill	51.00	5.869	52.10	7.015	2.898	0.002	2.11%
	Vertical Jump from Movement	67.90	3.635	68.70	3.773	6.000	≤0.001	1.16%
	Medical Ball Throws from Overhead	5.950	0.0946	6.140	0.1231	7.052	≤0.001	3.09%
	Medical Ball Throws from Chest	5.150	0.0946	5.239	0.0706	7.679	≤0.001	1.70%
	Push-Up	9.90	0.994	11.30	1.494	4.118	0.003	12.39%
Skill Tests	Spiking	8.20	1.989	9.30	1.947	11.00	≤0.001	11.83%
	Blocking	6.60	0.699	7.20	0.919	3.674	0.005	8.33%

Values are presented as mean (M), standard deviation (SD), * The tabular value of (T) at the level of significance (α≤ 0.05) = 2.09, * The tabular value of (T) at the level of significance (α≤ 0.01) = 2.86

Second:

The results related to the study's second hypothesis, which was "There are statistically significant differences at a significance level (α≤ 0.05) in the effect of a training program using elastic bands on selected physical and skill variables among volleyball players of Palestine Technical University - Kadoorie for the experimental group, between the pre-test and post-test means, in favor of the post-test mean" Therefore, in order to ensure the validity of this first hypothesis and examine it, a (paired samples t-test) was used, and the results of Table 4 shows that.

Table 4. The results of the Second hypothesis (n = 10)

	Dependent Variables	Pre-Measurement (N=10)		Post-Measurement (N=10)		T-Value	Sig.	Change %
		M	SD	M	SD			
Physical Tests	Vertical Jump from Standstill	52.20	2.201	57.70	3.129	7.342	≤0.001	9.53%
	Vertical Jump from Movement	65.50	4.601	72.60	3.978	13.498	≤0.001	9.78%
	Medical Ball Throws from Overhead	5.95	0.1048	6.259	0.1852	8.516	≤0.001	4.94%
	Medical Ball Throws from Chest	5.179	0.127	5.414	0.0999	8.448	≤0.001	4.34%
	Push-Up	10.80	1.549	17.60	1.174	17.493	≤0.001	38.64%
Skill Tests	Spiking	8.90	2.132	11.70	1.829	21.000	≤0.001	23.93%
	Blocking	6.10	0.738	8.80	0.422	17.676	≤0.001	30.68%

Values are presented as mean (M), standard deviation (SD), * The tabular value of (T) at the level of significance (α≤ 0.05) = 2.09

Third

The results of the third hypothesis which states that "There are statistically significant differences at a significance level (α≤ 0.05) in the post-test measurement between the experimental and control groups for selected physical and skill variables among volleyball players of Palestine Technical University - Kadoorie, in favor of the experimental group" and in order to test this hypothesis an independent samples t-test was carried out as shown in table (5).

Table 5. The results of the third hypothesis (n = 20)

	Dependent Variables	Control group (N=10)		Experimental group (N=10)		T-Value	Sig.
		M	SD	M	SD		
Physical Tests	Vertical Jump from Standstill	52.10	7.015	57.70	3.129	2.305	0.033
	Vertical Jump from Movement	68.70	3.773	72.60	3.978	2.250	0.037
	Medical Ball Throws from Overhead	6.0830	0.1231	6.259	0.1852	2.502	0.022
	Medical Ball Throws from Chest	5.239	0.0706	5.414	0.0999	4.523	≤0.001
	Push-Up	11.30	1.494	17.60	1.174	10.484	≤0.001
Skill Tests	Spiking	9.30	1.947	11.70	1.829	2.842	0.011
	Blocking	7.20	0.919	8.80	0.422	5.004	≤0.001

Values are presented as mean (M), standard deviation (SD), * The tabular value of (T) at the level of significance (α≤ 0.05) = 2.09, * The tabular value of (T) at the level of significance (α≤ 0.01) = 2.86

DISCUSSION

The reported findings give a detailed review of the effects of two separate training interventions - a traditional training program and a proposed training program employing elastic bands - on the physical and skill characteristics of volleyball players. These findings illustrate the important contributions each training strategy made to the players' performance, as well as the advantages of the proposed elastic band training above the conventional approach. The results of our study confirmed as the another step in proving the effective role of elastic band training on young volleyball players. This has been indicated by recent studies that confirm the importance of this

training and its impact on the youth group (Aloui et al., 2019; Hammami et al., 2022).

The results show that the standard training program resulted in considerable gains in numerous physical and skill characteristics for the control group. We are able to notice from the results of Table No. (3) that there is statistically significant difference at the level of significance ($\alpha \leq 0.05$) in the effect of the conventional training program on some physical and skill variables of the volleyball players for the control group, where the percentage change for the physical and skill tests was (Spiking (11.83%), Blocking (8.33%), Vertical Jump from Standstill (2.11%), Vertical Jump from Movement (1.16%), Medical Ball Throws from Overhead (3.09%), Medical Ball Throws from Chest (1.70%), Push-Up (12.39%). These improvements, albeit varying in size, demonstrate the effectiveness of the traditional training program in improving the players' spiking accuracy, blocking proficiency, jumping abilities, upper body strength and power, and overall physical fitness. These results are consistent with the findings of (Ayyub et al., 2023; Elsharnoby, 2022; Ibrahim, 2022; Sari et al., 2023; Tarigan et al., 2022). These results show that many physical and skill variables of the volleyball players in the control group were significantly affected by the traditional training program. The percentage improvements in the players' performance across spiking, blocking, jumping, throwing, and push-ups show that the program helped them improve in some important areas of their skills, possibly improving their overall performance on the volleyball court. On the contrary, some studies mentioned that there are many trainings, such as variable resistance training that includes elastic band training, eccentric training, postural sway, and strength training, all of these are training that young people undergo and work to improve the level of their athletic performance in playing volleyball beyond those skill developments in their performance that were achieved by traditional training (Hammami et al., 2022; Elsharnoby, 2022; Suchomel et al., 2018).

We are able to notice from the results of Table 4 that there is statistically significant difference at the level of significance ($\alpha \leq 0.05$) in the effect of the proposed training program using elastic bands on some physical and skill variables of the volleyball players for the experimental group, where the percentage change for the physical and skill tests was Spiking (23.93%), Blocking (30.68%), Vertical Jump from Standstill (9.53%), Vertical Jump from Movement (9.78%), Medical Ball Throws from Overhead (4.94%), Medical Ball Throws from Chest (4.34%), Push-Up (38.64%). And these results are consistent with the findings of (Elsharnoby, 2022; Ibrahim, 2022; Nasrulloh et al., 2021; Nassar, 2022; Sari et al., 2023; Tarigan et al., 2022). These results show that the elastic band-based training program that was suggested had a statistically significant and favorable effect on a number of physical and skill variables for the volleyball players in the experimental group. In addition, the results showed that the highest percentage of change related to physical and skill tests was for the push-up exercise, followed by the blocking, and finally the vertical strike. This indicates that applying the training program using elastic bands has a clear and effective impact over a short period on these physical skills among young players. This result is consistent with the evidence provided by some studies confirming that exercises based on the application of elastic bands have contributed significantly to improving and developing the physical variables associated with the skill of push-up exercises, blocking, and vertical striking in the volleyball (Fang et al., 2023; Aloui et al., 2021; Ataee et al., 2014; Elsharnoby, 2022). The program's success in boosting the players' ability in important areas is shown by the sizable percentage changes in performance across spiking, blocking, jumping, throwing, and push-ups, which help to improve their overall performance on the volleyball court.

We are able to notice from the results of Table No. (5) that There are statistically significant differences at a significance level ($\alpha \leq 0.05$) in the post-test measurement between the experimental and control groups for selected physical and skill variables among volleyball players of Palestine Technical University - Kadoorie, in favor of the experimental group, where the percentage change for the physical and skill tests were Spiking (20.51%), Blocking (18.18%), Vertical Jump from Standstill (9.71%), Vertical Jump from Movement (5.37%), Medical Ball Throws from Overhead (2.81%), Medical Ball Throws from Chest (3.23%), Push-Up (35.80%). These results are consistent with the findings of (Elsharnoby, 2022; Ibrahim, 2022; Nasrulloh et al., 2021; Sari et al., 2023; Tarigan et al., 2022; Xu, 2019; Yee, 2019).

Furthermore, a study conducted by Hamami et al. reported that there were significant interactions and improvements in the performance of the vertical and horizontal jump among volleyball players in the experimental group two months after they underwent a training program that included elastic band training compared to the control group (Hamami et al., 2022). Conversely, Aloui et al. found no significant change or interactions in vertical and horizontal jumping performance after undergoing elastic band training for one month and a half in young players participating in their study (Aloui et al.,2019). Although there was a significant improvement in the jumping performance of the participating players after undergoing the rubber band training, they showed a slight improvement in the performance of medicine ball throws from overhead and chest (2.81%, 3.23%). This may be due to the fact that good performance in volleyball depends on the players' ability to perform movements such as throwing and jumping with rapid force (Fathi et al.,2019; Nunes et al.,2021). The statistically significant differences that were in the experimental group's favor were the outcome of a successful interaction of skill-specific drills, progressive overload, targeted training, encouraging coaching, and a happy training atmosphere. The volleyball players made notable improvements across a wide range of physical and skill characteristics as a result of this dynamic synergy. The outcomes demonstrate the intervention program's unquestionable success in maximizing the athletes' capacities and raising the bar for their performance. This is consistent with what has been confirmed by many recent studies on the importance of elastic band training and its effective role in improving many physical skills among volleyball players (Hammami et al., 2022; Zouita et al., 2023; Mascarin et al., 2017).

Finally, the findings from both training treatments highlight the potential for targeted and structured training programs to positively improve physical and skill factors in volleyball players. However, the proposed elastic band training program was especially effective in eliciting considerable improvements in many performance indicators. This was consistent with a several study where they demonstrated that elastic band training that athletes undergo improves and enhances their muscular, strength development, medicine ball throw (Lopes et al., 2019; Fang et al., 2023; Elsharnoby,2022). These findings have practical implications for coaches and players looking to optimize training protocols, and they highlight the importance of introducing innovative training modalities like elastic bands for greater athletic performance.

Conclusion

The findings of this study provide a comprehensive overview of the effect of two distinct training programs on the physical and skill attributes of volleyball players. Several aspects of player performance, including spiking accuracy, blocking proficiency, jumping abilities, upper body strength, and general physical fitness, were significantly enhanced by the conventional training program. These accomplishments demonstrate the significance of traditional training methods in fostering player development.

The proposed elastic band training program, on the other hand, resulted in statistically significant and observably superior gains across all examined metrics. In the experimental group, spike force, blocking efficiency, explosive jumping ability, upper body strength, and muscular endurance improved significantly. These findings highlight the specific advantages of incorporating elastic band training into the routines of volleyball players, highlighting its capacity to boost their performance to new heights.

When the experimental and control groups are explicitly compared, the superiority of the elastic band training method is reinforced. Across the board, statistically significant differences in favor of the experimental group were observed, highlighting the all-encompassing nature of the enhancements attained through this innovative training strategy.

In conclusion, while traditional training methods have their benefits, the advent of elastic band training represents a promising evolution in the development of volleyball players. It provides a comprehensive approach to improving players' physical and skill attributes, thereby enhancing their overall court abilities. These results call for additional research and application of elastic band training in the field of sports performance, indicating a promising future for this novel approach in volleyball and potentially beyond.

Recommendations

Several recommendations can be made to enhance the training and performance of volleyball players based on the study's findings and

outcomes. These recommendations cover a broad range of training, coaching, and player development-related topics:

Given the significant benefits observed in the experimental group as a result of the proposed elastic band training program, it is advised that coaches and trainers incorporate elastic band exercises into their regimens. Elastic bands are a versatile and efficient tool for targeting specific muscle groups, enhancing explosive power, and enhancing overall strength and stamina.

Each athlete should have a training regimen that is tailored to their individual requirements and goals. By analyzing an athlete's strengths and weaknesses, coaches are able to create individualized training plans that target areas in need of development, resulting in more well-rounded and capable athletes.

The efficacy of elastic band training and the standard training program in increasing vertical leap demonstrates the significance of explosive power exercises. Emphasis should be placed on plyometric drills, lower body strength training, and dynamic motions in order to improve the players' ability to generate force promptly and effectively.

As evidenced by the development of spiking and blocking skills, skill-specific drills should continue to be emphasized in training. These drills aid in the improvement of technique, timing, and coordination, all of which are necessary for the successful execution of crucial volleyball actions.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Ethics Committee

The current study involving human participants was approved and obtained ethical permission no. (2023/20 from 1.2.2023-2.4.2023) by the Scientific and Ethical Committee of the Faculty of Physical Education and Sports Sciences, Palestine Technical University - Kadoorie. Written informed consent was also obtained from all participants in the current study.

Author Contributions

The authors accomplished this study by making significant contributions including designing the study according to the formulation of its objectives. AFAN, IZ prepared the draft and carried out the study design; AFAN, AI, and NAR collected the data; AFAN, AD, and BMOA performed the statistical analysis of the data; AFAN, and MRK interpreted the data; and all authors of the manuscript performed the literature search and collaborated on the manuscript critical review and editing. All authors were contributors and responsible for the content of the manuscript and approved the version submitted for publication.

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