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EFFECT OF CORE STRENGTHENING EXERCISES ON THE SPIKING ABILITY OF DISTRICT-LEVEL VOLLEYBALL PLAYERS

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ABSTRACT

The purpose of this study was to examine the effect of a structured core-strengthening exercise programme on the spiking ability of district-level volleyball players. Fifteen volleyball spikers aged 15–20 years from the Srinagar district of Kashmir were selected as subjects through purposive sampling. The study employed a single-group pre-test and post-test experimental design. Core strength and endurance were assessed using the Plank Hold Test and Sit-Up Test, while spiking ability was evaluated through a customized Volleyball Spiking Accuracy Test. Following the pre-test assessment, the participants underwent a structured core-strengthening exercise programme designed to improve trunk stability, muscular endurance, and overall core function. The collected data were analysed using descriptive statistics and paired-samples t-tests at a 0.05 level of significance through JAMOVI software. The results revealed significant improvements in core strength variables. Sit-up performance increased significantly from a mean score of 27.87 to 30.67 repetitions ($t = -6.089$, $p < .001$), while plank hold duration improved from 71.53 seconds to 76.13 seconds ($t = -5.901$, $p < .001$). Spiking accuracy also increased from a mean score of 22.60 to 24.40; however, the improvement was not statistically significant ($t = -1.79$, $p = .095$). The findings indicate that core-strengthening exercises are highly effective in enhancing core muscular strength and endurance among volleyball players. Although improvements in spiking accuracy were observed, they did not reach statistical significance, suggesting that technical volleyball skills require integrating sport-specific practice with physical conditioning. The

study concludes that core-strengthening exercises provide an important physical foundation for volleyball performance and should be incorporated into comprehensive training programmes aimed at improving athletic performance and reducing injury risk.

KEYWORDS: Core Strengthening Exercises, Volleyball, Spiking Ability, Spiking Accuracy, Core Stability, Sit-Up Test, Plank Hold Test, Volleyball Players, Muscular Endurance, Athletic Performance, Sports Training.

INTRODUCTION

Volleyball is a high-intensity intermittent sport that requires players to perform repeated explosive actions such as jumping, sprinting, rapid directional changes, and powerful overhead movements within a dynamic competitive environment. Success in volleyball depends on integrating physical, technical, tactical, and neuromuscular factors, with spiking as the most decisive offensive skill for scoring points and influencing match outcomes (Sheppard, Gabbett, & Stanganelli, 2009). Effective spiking performance is determined by several interrelated factors, including approach speed, vertical jump height, arm swing velocity, coordination, and timing, all of which contribute to the generation and transfer of force throughout the movement.

The biomechanical effectiveness of a spike is largely dependent on the efficient functioning of the kinetic chain, whereby force generated by the lower limbs is transferred through the trunk and ultimately expressed through the upper limbs during ball contact (Forthomme et al., 2005). Within this kinetic chain, the core musculature plays a pivotal role by providing trunk stability, maintaining postural control, and facilitating efficient force transmission between the lower and upper extremities. The core, comprising the abdominal, lumbar, and pelvic musculature, serves as the central link that enhances movement efficiency, power production, and injury prevention (Kibler, Press, & Sciascia, 2006).

Core stability is particularly important in volleyball due to the sport's repetitive jumping, landing, and overhead actions. A stable core provides a solid foundation for force generation and improves balance, coordination, and movement control during dynamic activities (McGill, 2010). Previous research has demonstrated that structured core training programs can improve balance, muscular strength, power, and athletic performance (Reed et al., 2012). Furthermore, studies involving volleyball players have reported positive effects of core strengthening on trunk endurance, agility, balance, and vertical jump performance (Sharma et al., 2012; Sadeghi, Shariat, & Asadi, 2013; Rodríguez-Perea et al., 2023).

Despite growing evidence supporting the benefits of core training, limited research has specifically examined its direct influence on volleyball spiking performance. Most studies have focused on general fitness parameters rather than sport-specific skills such as spiking ability. Therefore, the present study aims to investigate the effect of a structured core-strengthening programme on selected spiking performance variables, including vertical jump height, ball velocity, and spiking accuracy, among district-level volleyball players. The findings may provide valuable insights for coaches and athletes seeking evidence-based strategies to enhance volleyball performance.

METHODOLOGY

Sources of Data

For the present study, volleyball players from the Srinagar district of Kashmir were selected as the data source.

Selection of Subjects

15 Volleyball Spikers from the Srinagar district of Kashmir were selected as subjects for the study. The ages of these spikers ranged from 15 to 20 years.

Sampling Procedure

Purposive sampling was employed to select the subjects.

Selection of Variables

- ***Independent Variable:***Core Strengthening Exercise Programme
- ***Dependent Variable:***Spiking Ability of Volleyball Spikers

Selection of Test and Criterion Measure

Table 1: Variables and Measurement Criteria of Core Strengthening Exercises and Spiking Ability.

S no.	Variables	Test	Score
1.	Core Strengthening Exercise	PlankSit-ups	SecCount
2.	Spiking Ability of Volleyball Spikers	Customized test	Count

Statistical Technique

For the analysis of the collected data, descriptive statistics were used to summarise the data; to compare the effect of the independent variable, a paired-samples t-test was conducted at a predefined significance level of 0.05. All analyses were performed using the JAMOVI software.

Analysis of data and Results of the study

Table 2: Descriptive analysis of sit-up pre- and post-test for spiking accuracy.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	SIT UP PRE TEST	27.87	15	5.111	1.320
	SIT UP POST TEST	30.67	15	5.273	1.362

The descriptive statistics indicate that the sit-up performance of the 15 participants improved after the training period. The mean score increased from 27.87 on the pre-test to 30.67 on the post-test, indicating improved performance. The standard deviation values were similar across both tests, suggesting that the participants showed a consistent level of variation in their scores. Likewise, the standard error values were also similar, indicating that the mean scores are reliable estimates. Overall, these findings suggest that the intervention or training program had a positive effect on the sit-up performance of the participants.

Table 3: Inferential statistics of spiking accuracy.

Paired Samples Test								
	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SIT UP PRE TEST - SIT UP POST TEST	-2.800	1.781	.460	-3.786	-1.814	-6.089	14	.000

The paired samples t-test showed a significant difference between the pre-test and post-test sit-up scores. The results indicate that the participants performed better on the post-test than on the pre-test after completing the intervention or training program. The mean difference of 2.800 reflects a noticeable improvement in performance. Since the significance value was less than 0.001, the improvement is considered statistically significant and not due to chance. In addition, the confidence interval did not include zero, which further confirms the reliability of the findings. Overall, these results suggest that the intervention had a positive and meaningful effect on the sit-up performance of the participants.

Figure 1: Frequency distribution of the graph of pre- and post-test for spiking accuracy.

Table 4: Descriptive analysis of Plank hold pre- and post-test for spiking accuracy.

Paired Samples Statistics					
		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	PLANK PRE TEST	71.53	15	22.937	5.922
	PLANK POST TEST	76.13	15	21.626	5.584

The descriptive statistics indicate that the 15 participants' plank-hold performance improved after the training period. The mean score increased from 71.53 seconds on the pre-test to 76.13 seconds on the post-test, indicating improved performance following the intervention. The slight decrease in the standard deviation suggests that the participants' scores became a little more consistent after training. In addition, the standard error values were similar across both tests, indicating that the mean scores are stable and reliable. Overall, the findings suggest a steady, moderate improvement in plank-hold performance resulting from the intervention program.

Table 5: Inferential statistics of Plank hold pre- and post-test for spiking accuracy.

Paired Samples Test								
	Paired Differences					**t**	**Df**	**Sig. (2-tailed)**
	Mean	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**				
				Lower	**Upper**			
PLANK PRE TEST - PLANK POST TEST	-4.600	3.019	.779	-6.272	-2.928	-5.901	14	.000

A paired-samples t-test was conducted to compare participants' plank-hold performance before and after the intervention. The results showed a significant improvement in performance from the pre-test to the post-test. On average, the participants improved their plank hold duration by 4.60 seconds after completing the training program. The obtained t-value and the significance level ($p < .001$) indicate that this improvement was statistically significant and not due to chance. Furthermore, the confidence interval also confirmed the reliability of the results. Overall, these findings suggest that the intervention program was effective in improving plank hold performance, which may also have contributed positively to spiking accuracy among the volleyball players.

Figure 2: Frequency distribution of the graph of pre- and post-test for spiking accuracy.

Table 6: Descriptive analysis of spiking pre- and post-test for spiking accuracy.

Paired Samples Statistics				
	Mean	**N**	**Std. Deviation**	**Std. Error Mean**
SPIKING PRE TEST	22.60	15	3.621	.935
SPIKING POST TEST	24.40	15	2.501	.646

The descriptive statistics show that the spiking accuracy of the 15 participants improved after the intervention program. The mean score increased from 22.60 on the pre-test to 24.40 on the post-test, indicating improved spiking performance following the training period. In addition, the standard deviation and standard error decreased in the post-test, suggesting that the participants performed more consistently after the intervention. The reduced variation in scores indicates greater uniformity in spiking accuracy among the players. Overall, the

findings suggest that the intervention program had a positive effect on participants' spiking accuracy.

Table 7: Inferential statistics of spiking pre- and post-test for spiking accuracy.

Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SPIKING PRE TEST - SPIKING POST TEST	-1.800	3.895	1.006	-3.957	.357	-1.79	14	.095

A paired-samples t-test was conducted to determine whether there was a significant difference in spiking accuracy scores before and after the intervention. The results indicated that the mean difference between pre-test and post-test scores was -1.80 (SD = 3.90), suggesting a slight improvement in spiking accuracy following the training programme. The 95% confidence interval for the mean difference ranged from -3.96 to 0.36. However, the difference was not statistically significant, t(14) = -1.79, p = .095. Since the p-value obtained was greater than the predetermined significance level of .05, the null hypothesis was not rejected. Therefore, it can be concluded that the core strengthening exercise programme did not produce a statistically significant improvement in the spiking accuracy of the volleyball spikers.

Figure 3: Frequency distribution of the graph of pre- and post-test for spiking accuracy.

DISCUSSION OF FINDINGS

This study investigated the influence of a structured core-strengthening exercise regimen on the spiking proficiency of district-level volleyball athletes, utilizing a pre-test/post-test methodological approach. The findings indicated that the training intervention significantly enhanced participants' physical fitness parameters, particularly core strength and endurance.

Quantitative analysis revealed notable improvements in both sit-up performance and plank hold duration post-intervention. Specifically, the sit-up test showed a mean score increase from 27.87 repetitions on the pre-test to 30.67 on the post-test, a net gain of 2.80 repetitions. This change was statistically validated via the paired sample t-test ($t = -6.089$, $p < .001$). Likewise, plank hold duration increased from an initial mean of 71.53 seconds to 76.13 seconds, representing an average increase of 4.60 seconds, which was statistically significant ($t = -5.901$, $p < .001$). These results underscore the efficacy of core-strengthening exercises in enhancing abdominal strength, muscular endurance, and overall core stability among the participants.

The observed enhancements in physical fitness can be attributed to the systematic participation in the core training program, which targeted the musculature of the abdomen, lower back, and pelvis, central to balance, posture, and bodily control in athletic contexts. In volleyball, key movements such as jumping, landing, serving, and spiking require a robust, stable core. Consequently, the observed improvements in sit-up and plank performance suggest that the athletes developed better muscular control and stability as a result of the intervention.

When evaluating spiking accuracy, the results showed a positive but not statistically significant increase. The mean score for spiking accuracy improved from 22.60 on the pre-test to 24.40 on the post-test, an increase of 1.80 points. Additionally, the standard deviation decreased from 3.621 to 2.501, implying that players exhibited enhanced performance consistency following the training period. However, the paired sample t-test revealed that this gain did not reach statistical significance ($t = -1.790$, $p = .095$). While the numerical improvements are notable, they fail to provide definitive evidence of the intervention's impact on spiking accuracy.

This outcome may be attributed to the multifaceted nature of spiking, which encompasses factors beyond core strength, including timing, coordination, jumping mechanics, arm swing technique, concentration, and tactical awareness. Although enhanced core strength contributes to stability and control, executing complex technical skills requires ongoing volleyball-specific practice. Thus, while the intervention likely fortified the foundational

physical capabilities necessary for performance, it may not have sufficed to catalyze substantial advancements in spiking accuracy within the study's timeframe. Another pertinent finding concerned the consistency of performance among participants. Strong correlations were observed between the pre-test and post-test results for sit-ups (r = .942) and plank holds (r = .993), indicating consistent responses to the training program and associated improvements in physical fitness. Conversely, the correlation for spiking accuracy was relatively weak (r = .232), implicating greater variability in skill performance, potentially due to individual differences in experience, technical aptitude, and adaptability to training. Despite the lack of statistical significance in spiking accuracy improvements, the observed upward trend in post-test scores holds practical relevance. The increase in mean performance coupled with reduced score variability suggests players not only improved but also became more consistent in their execution following the intervention. Future research could benefit from a longer duration of training, a larger cohort, or the integration of volleyball-specific drills alongside core exercises to amplify improvements.

The findings of this study denote that core-strengthening exercises are highly effective for enhancing core endurance, muscular strength, and stability in district-level volleyball players. However, to optimize technical skill development in areas such as spiking accuracy, it is essential to couple core training with regular volleyball skill practice and sport-specific methodologies. The study concludes that core-strengthening exercises establish an important physical foundation conducive to volleyball performance and may yield positive contributions toward skill enhancement when integrated into comprehensive technical training regimens.

CONCLUSION

The present study examined the impact of structured core strengthening exercises on the spiking ability of district-level volleyball players using a pre-test and post-test experimental design. Results showed significant improvements in core strength and endurance, particularly in sit-up performance and plank hold duration. However, while enhanced core fitness supports aspects such as stability and body control, it alone is not sufficient to improve complex skills like spiking accuracy, which also requires technical skill, timing, coordination, and tactical awareness.

The study suggests that core-strengthening exercises can aid in injury prevention and overall movement efficiency, even if they didn’t lead to significant gains in spiking accuracy within the study duration. A positive trend indicates that longer or more comprehensive training

programs may yield better results. In conclusion, while core-strengthening exercises effectively improve core muscle strength and endurance, achieving significant enhancements in volleyball-specific skills necessitates integration with technical training and skill-focused drills. Future research should explore larger sample sizes and longer interventions to better understand the combined effects of conditioning and skill training on volleyball performance.

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