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Arms involvement and their impacts on player vertical jump volleyball tests performance

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Abstract

Objective

The purpose of this study was to investigate how the use of arms affects the accuracy of vertical jump volleyball tests conducted in field settings. To evaluate the impacts of arm implication, the study utilized the Standing Reach versus Myotest accelerometric system arm protocols. The study aimed to examine the relationship between arm involvement and performance in block and spike volleyball techniques, both with and without a step at the start of the jump.

Materials and Methods*:* We evaluated the performance of our top players in the national championship based on the following criteria: Standing Reach, Myotest system results, Vertical Jump Spike, and Vertical Jump Test with and without arm swings.

Results: Our results validated Standing Reach as the most correlated test with technical volleyball tests when compared to the Myotest accelerometric system. Additionally, Standing Reach showed a significant correlation with Myotest in predicting the maximum athletic height in vertical jump.

Conclusions: Based on the study design and protocol involving arm swings, we affirm that the movement of the arms is a crucial factor in assessing vertical jumps in technical or athletic volleyball tests. Acknowledged in

this study by the significance of arm swings in determining Standing Reach and their correlation with player performance in the Spike or Block test. The relationships between arm swings and player performance, as measured by the Myotest accelerometric system and its arms protocol, are inversely correlated. The study concluded that measuring lower extremity strength in volleyball requires the coach to isolate the involvement of the arms, in contrast to measuring take-off strength, which requires the player to coordinate the upper and lower extremities to achieve maximum results.

Keywords: hoop task, mass height, vertical jump, field tests, volleyball.

Introduction

The use of statistical analysis to evaluate players and team performance is a crucial factor that has greatly contributed to the advancement of the sport of volleyball. (Han & Robert, 1991).

Literacy in senior volleyball players is demonstrated by their action outcomes related to match performance (win or lose). These outcomes are critical factors to consider when designing and implementing players' and team training aspects. (Eleni & all, 2006).

Mention upon jump volleyball actions as the more decisive in the victory of this sport (J.M. Palao & all, 2004).

Agree through blocks and spikes games actions as the essential skills in establishing team success (Han & Robert, 1991)

Appraised nowadays by the combination of video recordings and accelerometer sensors, tracking devices have been developed to measure the basic movements of jumps from the outcomes of playing actions (Nelson, 2017) in competitions or training programs (Oliveira & all, 2018).

Endorsed by the Myotest system (Myotest SA) as a reliable tool for assessing force and power in different sports such as basketball, volleyball, and rugby. Utilizing the vertical jump (VJ) as a screening tool and predictor of athletic performance based on training level. (Vladimír & all, 2018).

Admit in volleyball sport based on its high correlation and consistent with Standing Reach (V J) method (YongSuk Lee & all, 2020). Estimated in this investigation to inspect the impact of arms in hopping tasks (M-A Choukou, G Laffaye, R Taiar , 2014) comparable to volleyball vertical jumps technical or athletic tests (Vladimír & all, 2018).

Recognised by the similarities in their contributions, which may increase vertical jump height by about 10% compared to jumping without an arm swing (Giatsis & all, 2017).

Material and methods

Tests and protocol:

Tests, were based on:

- Standing Reach (V J): measuring the vertical jump height jumped.
- Vertical jump Spike Approach (VJS): athletes should attempt to touch the vertical at the highest point of the jump (with one hand, like a volleyball spike). Used in this study with a step at the beginning of the test (VJSH) and without hoop momentum (VJS).
- Vertical Jump Test Block (VJB): athletes should attempt to touch the vertical (with both hands like a block in volleyball). Used in this study with a step at the beginning of the test (VJBH) and without step momentum (VJB).
- The Myotest accelerometric system from Sion, Switzerland, was used to assess high-jump performance. The system included a 3D inertial accelerometer with a range of ±8 g. To standardize body position and minimize its impact on jump performance, the Myotest was placed at the mid-Third-Fourth lumbar vertebra height of each participant. For the evaluation of maximal jump velocity and height, participants began in an upright standing position with hands on hips. They were then instructed to bend their knees to a predetermined angle (approximately 90°) and hold that position for 3 seconds before jumping as high as possible without any preliminary countermovement. Each participant performed 5 maximal vertical jumps, and the results were recorded.

Protocol:

To evaluate the influence of arm swing on vertical jump performance, we observed the performance of our top players during a scheduled group session on the sixth day of the national championship. We conducted various tests including Standing Reach (V J), Vertical Jump Spike (VJS), Vertical Jump Spike with Hands (VJSH), Vertical Jump Test Block (VJB), Vertical Jump Test Block with Hands (VJBH), and Myotest accelerometric system (Jump height (MJVH)).

Experience progress:

All tests were conducted within two days following a standardized warm-up routine, which included about 3 minutes of jogging at a comfortable pace and 2 minutes of static stretching for the lower extremity muscles.

For the first day: we evaluate.

- Bodyweight (kg) and height (cm) were measured using a digital scale calibrated against known weights to ensure its validity and reliability.
- Height-jump performance using Myotest accelerometric.

For the second day:

- After the same warm-up, we made the other Jump test.

Sample:

All participants in this study are elite male volleyball players aged between 22 and 25 years, with at least 5 years of experience in elite championships. They willingly agreed to take part in the research and were selected from the Algerian national league, division one. The testing was conducted two days prior to their involvement in the sixth competition of the 2017-2018 season.

Their Descriptive Statistics present in **Table 1.**

Table 1. Present Descriptive Statistics of samples anthropometric parameters and Jump performance tests used.

Anthropometric parameters	N	Mean	S. D
Age	66	24.05	1.32
Height		185.81	2.05
Weight		78.17	3.12
BMI		20.22	1.04
BMI (kg/m2); Weight (kg); Height (cm)			
Jump tests (cm)	66	Mean	S. D
Standing Reach (VJ)		52.95	2.86
Myotest accelerometric (MJVH)		37.86	2.58
Vertical Jump Spike without star hoop momentum (VJS)		52.41	2.34
Vertical Jump Spike with star hoop momentum (VJSH)		61.06	2.61
Vertical Jump Test Block without star hoop momentum (VJB)		52.92	2.39
Vertical Jump Test Block with star hoop momentum (VJBH)		63.90	2.31

Statistical Analysis

SPSS Statistics 19 (Chicago, Illinois, IBM, USA) processed all statistical analyses.

Descriptive analysis, mean and standard deviation, was performed regarding anthropometric and fitness characteristics. Pearson correlation was used to inspect the relationship between variable studies.

Study Results

The data and descriptive statistics from the test are shown in Table 1 and 2. According to the study protocol, our results using Pearson correlation revealed that the Myotest accelerometric (MJVH) is strongly associated with Standing Reach (VJR) in predicting athletes' performance. In contrast, it showed weaker correlations with Vertical Jump Spike (VJS) or (VJSH), and Vertical Jump Test Block (VJB) or (VJBH), compared to its correlation with Standing Reach (VJR). Refer to Table 2 for more details.

Table 2. Present correlation between tests jumps used.

Pearson Correlation		VJR	VJS	VJB	VJSH	VJBH	MJVH
VJ	R	1	0.76**	0.83**	0.75**	0.78**	0.94**
	P≤0.05		0.00	0.00	0.00	0.00	0.00
MJVH	R	0.94**	0.32	0.28	0.18	0.22	1
	P≤0.05	0.00	0.07	0.06	0.15	0.09	

Results confirmed through arm swing as one of the most critical factors which contributed to volleyball spike jump or block jump (Nelson, 2017). Understood in volleyball game under the arm swing as a significant guideline influencing jump height, range of motion, angular velocity, and the Vertical Jump Spike and Block performance (Zerf M & Louglaib L, 2019).

Confirmed in this study based on Standing Reach (VJR) spike or block arms participation, more correlated with max jump players' performance records by Standing Reach (V J) compared to Myotest accelerometric max height jump index. Set in Table 2. Documented in sports literacy as a process that helps the player to maximizes the moment arm of the upper limb, resulting in a faster arm swing and a more powerful spike or blocks (Jonathan & Roald, 2003). Reported as storing and releasing elastic energy helping the trunk to move upward (Ikram & all, 2013).

Discussion

Acknowledging that volleyball involves a counter movement and the use of arm movements, as demonstrated in our test protocol conducted under two conditions: with and without arm participation**.** (Standing Reach (VJ) versus Myotest accelerometric). Set in **Figure 1**.

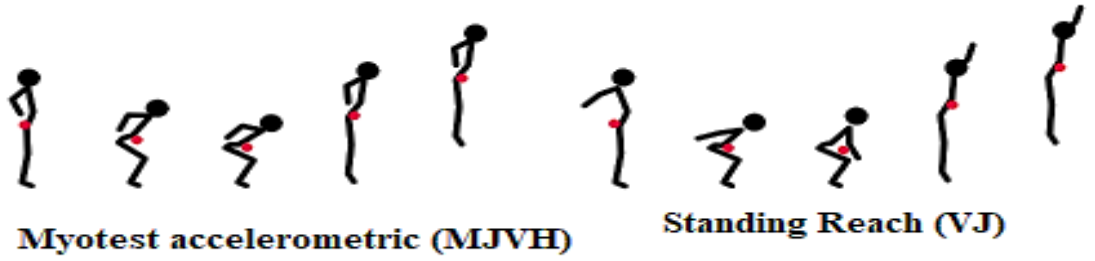

Figure 1. Present the arms protocol used in this study.

Our results conform with studies confirming Myotest accelerometric (MJVH) as a tracking tool to evaluate athletic jump performance (Vladimír & all, 2018). Interpret in similarities as general jumping ability more correlate with maximal jump ability and ballistic leg strength in athletes of many sports (Herbert & all, 2009). Support via this study through its relationships with Standing Reach (VJ). Admit to being highly correlation in estimating jump height (YongSuk Lee & all, 2020). Denied through Myotest accelerometric results that overestimates jump height compared to other methods (Castagna & all, 2013). Acknowledged through its inaccuracy to dictate the contact time and flight time (Artur & all, 2020). Due to its elastic belt placed to the hip that can affect results record during the propulsive phase of the jump due to trunk bending (Casartelli & all, 2010). As well as his flight time method calculations that requested the establishment of his equations (YongSuk Lee & all, 2020).

The claim in this study is attributed to its arms protocol, which involves starting the movement without the involvement of the arms. Recently shown to enhance countermovement vertical jump performance with a 38% increase in jump height compared to jumping without an arm swing. (Frantisek, & all 2016). Justified in this study based on the participation of arms in Vertical Jump Reach (VJR) and their positive impact on players' performance in jump tests. This is shown in Table 2. Recognized as the most significant factor contributing to improved block and spike performances. (Nelson & all, 2017) Estimated in this study due to arms participation, which increases the angular velocity and torque at lower extremity joints, the centre of the mass height, and speed at take-off for a countermovement jump (Blache Y & Monteil K., 2013).

Supported as body configuration, which should be controlled in selected jumping tasks (Giatsis & all, 2017). Permitted by the control of arm swings related to step approach, legged jump and countermovement (Jonathan & Roald, 2017). Confirmed as an important arms impulsion, able to high vertical jump in all vertical jump techniques (athletic or technical) (Abdel-Rahman Akl, 2015).

Backing in this study by validity of Standing Reach arms engagements and their relationships with the players' performance in spikes or blocks volleyball tests studies. Opposite to their interrelationships with players' performances registered by the Myotest accelerometric system arms protocol. Suggested in this study as a key protocol parameter, which should be considered by Myotest system jumping test assessments.

Conclusions

Based on the protocol studied and the results obtained from the current research, we have confirmed that the involvement of arms in the jumps volleyball field tests protocol is essential for estimating maximum height, overall jumping ability, and specific ability. This study highlights the importance of controlling arm swing and its impact on players' performance in volleyball jumping tasks. The arms protocols used in this study validate the Standing Reach (VJ) as a parameter that is highly correlated with Vertical Jump Spike (VJS) or (VJSH), as well as Vertical Jump Test Block (VJB) or (VJBH). The inverse correlation between their associations with player performance as evaluated by the Myot est accelerometric system and its arms protocol. The research findings indicated that when assessing lower extremity strength in volleyball, it is necessary for the coach to specifically focus on isolating the arms' involvement. In contrast, when measuring take-off strength, it is crucial for the player to synchronize the movements of the upper and lower extremit ies in order to achieve optimal performance.

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Conflicts of interest

There are no conflicts of interest.

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