

# Volleyball training and practice: vertical jump and agility tests

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## ABSTRACT

This study aimed to research peculiarities of improving high jump techniques training in modern volleyball and developing agility amongst sportsmen in the context of attributive components, that influence the success of team competition plays. The methodological basis of this study consists of methods of systematic analysis of key components in distributing training loads amongst volleyball team members on a stage of pre-season training with complex research of various aspects of jumping ability and agility of sportsmen tests employment and their practical use on the stage of preparing sportsmen in the competitive period as well. The results of the study showed the high practical importance of testing the real jumping and agility characteristics of volleyball players and show prospects for the practical use of the test system for these characteristics at the training level of athletes in order to achieve high fitness of sports commands and successful games in monthly competitions. The practical benefit of these results obtained during the research lies in the ability to use them in the training process of modern volleyball teams to develop the agility and jumping abilities of athletes, which has prospects for higher results of sports teams in competitions.

## KEYWORDS

Team Sports; Training Process; Competition Period; Volleyball Players

## 1. INTRODUCTION

Problematics of the topic of the research on the current stage of analysis is in need to find new effective methods to develop agility and jump abilities of sportsmen of modern volleyball teams to utilize those methodologies in the training process, for improvement of method effectiveness and achieving better overall team progress. The most important aspect in the context is the development

and practical employment of test tasks, aimed at an objective evaluation of agility and jumping abilities of volleyball players with the intention of further use of these tests in the training process of sportsmen.

Highlighted questions are also discussed in the scientific work of Bruner et al. (2022), aimed at the research of a training process composition peculiarities of a volleyball team in the context of leadership influence. In this scientific work, the effectiveness of a leader's psychological influence on the training process is noted, from the moment of training initiation until the complete end. Authors especially note that the leader role in a volleyball team is also comprised of expediting proper distribution of physical load and proper realization of it by sportsmen concerning requirements of strengthening a series of individual aspects of a separate team member. Improving the jumping ability and agility is prioritized amongst the volleyball team members as a key component to success in sports (Bruner et al., 2022).

Raised problematics gained its development in joint research of Backler et al. (2021), dedicated to the series of problematic aspects of developing a uniformity during physical exercises in the training process. Researchers focus attention on the fact, that quality physical fitness shows an overall improvement of sportsmen's bodies and activates the active functioning of all organs of a body. Muscles, and cardiovascular, are strengthened as well as strength, and jumping ability, which in combination positively influence the uniformity of team members (Backler et al., 2021).

Lath et al. (2021) have made joint research in a similar sphere by analyzing the functional peculiarities of the training working model, used by sports trainers while talent hunting for the sports team. Researchers have concluded that recruitment of prospective sportsmen into the volleyball team is mainly composed of testing their jumping abilities as well as agility due to them being the most basic components during an evaluation of the sports capabilities of a candidate (Lath et al., 2021). According to the researchers, the recruitment process into a modern volleyball team improvement process will be expedited by the development of a special testing system, which will allow us to objectively evaluate the level of these components of physical fitness in future volleyball players.

Topics of cognitive function and various physical fitness problem evaluation influence degree of influence on the development of characteristics are discussed in the research of Sakalidis et al. (2021). They, particularly, note, that for the effectiveness of training system to be built, an initial level of candidate's fitness should be known, and special attention should be paid at the weak abilities, which are to be developed first (Sakalidis et al., 2021). Authors note that the constant

training process of physical fitness of volleyball team members allows to correct training process and appoint new exercises, that develop and reinforce specific aspects of young athletes' training.

Schlappi-Lienhard & Hossner (2015), have researched specific peculiarities in making decisions in modern volleyball concerning the individual level of fitness of each sportsman. They have concluded that effective development of specific physical qualities of volleyball players fully expedites their ability to quickly make decisions mid-play, which greatly influences a final score. A substantial part of the competitive play preparation process is achieving an optimal combination of sportsmen conditions until the moment of a match (Schlappi-Lienhard & Hossner, 2015). Determining the optimal combination in each case is a key task for the trainer during volleyball team training.

The main goal of the research is to analyze peculiarities of developing techniques of volleyball players' vertical jump training as well as agility improvement as a key component of high physical fitness and achieving success in sports competitions.

## **2. METHODS**

The methodological basis of this study consist of methods of systemic analysis of volleyball player training load distribution during the stage of pre-seasonal preparation with complex research of jump height and agility test development peculiarities as well as the effectiveness of their practical implementation in the training process and during competition. A comparative analysis method of acquired results with results from other researchers, who analyzed a similar topic, was also employed. The main research was followed by a preparation of a theoretical basis, which consists of several domestic and foreign research results, aimed at analyzing the topic or similar.

Employment of systemic analysis on main aspects of training load distribution amongst volleyball players during the pre-seasonal stage allowed to research key phases of a vertical jump as well as to determine a type of primary sport element (speed-strength) and its structure (acyclic). Furthermore, fundamental factors, which influence the development of the jumping ability of volleyball players during the distribution of physical loads in the training process were highlighted.

Employment of complex research methods of development and implementation of jumping ability and agility tests peculiarities allowed to determine the practical requirement of such tests for volleyball players at any stage of a training process and during a competitive period. Key tasks of such testing of sportsmen, information, gained through testing, and potential problems, development

of which are avoidable during the training period of volleyball players as well as during competitive activity were determined.

The selection of mentioned method combination with scientific research caused us to divide the article into several stages. The first stage of the scientific research included a distinction of primary phases of vertical jump in modern volleyball, and factors, which define the effectiveness of volleyball players' jumping. Furthermore, the importance of agility as a fundamental basis of volleyball player mastery was highlighted, and a systemic differentiation of agility by jumping and acrobatic factors was presented, which underlines the existence of complex interplay of sportsmen's agility and jumping ability as well as other components of physical, technical, and tactical training.

In the second stage of the research, test exercises for determining the jumping ability and agility of volleyball players were presented, which are designed for use in any stage of the training process for the volleyball team. Test scale marks for evaluating the readiness of sportsmen on analyzed attributes were also presented, which could and should be used by trainers during training and competitive preparations.

In the final stage of the research, an analytic comparison of data, acquired during research with the research of other researchers, who studied similar problems of preparing volleyball players for agility and jumping abilities was concluded. This allowed to refine results and form final recommendations of the scientific research, which serve as a logical representation and conclusion of the whole complex of a concluded scientific work.

### **3. RESULTS**

The development of jumping ability and agility of volleyball players is one of the most important elements of sportsmen training during the preparational period. Today, volleyball has serious challenges to the level of physical, technical, and tactical fitness of players. In this context, we should focus on the fact, that the jumping ability of volleyball players during a match is a fundamental factor in achieving victory (Kucikkubas & Korkusuz, 2019). Readiness of volleyball players to jump and their ability to perform such physical techniques is important due to the fact, that most of the game score (up to 90-95%) is gained near a net during a performance of jumping blocks while falling after the ball and rolling on the field. This is the reason why searching for effective methods of jumping ability and agility of volleyball players is of high importance as well as control and testing of these mastering components during the training process and in the competitive period (Shchetinina & Krivosheeva, 2020).

Basic techniques of jumping in modern volleyball consist of two stages:

- amortization (bending the legs);
- active push.

During the amortization phase, a shift of a mass center into a lower part of a sportsman's body, closer to its point of axis, occurs. Legs are bending in the knees, and an angle of leg rotation is usually between 90-110°. Leg muscles, during the action, are in inferior mode. During the active push phase, the mass center moves further from the point of standing while muscles switch to the overcome mode. During the shift of inferior to overcome mode leg muscles are under the maximum possible load.

As such, concerning how muscles work during a jump in volleyball, this technical element can be classified as a speed-strength exercise with an acyclic structure of moves. The node element of jumping is a push, in the moment of which a maximum muscular load of reactive, explosive nature is achieved.

The explosive character of a muscular load is characterized by the existence of three elements of neuromuscular apparatus: higher muscular load, ability to show external force during overloading of muscle groups, and ability to gain muscular force during a maximum acceleration of moving mass (Shchetinina & Krivosheeva, 2020). It is important to keep in mind, that it is impossible to instantly show muscular force as they need a specific amount of time to accumulate it. Due to this reason, in a vertical jump as a practical exercise of speed-strength type, a maximum performance may not be achieved through the maximum possible pull.

Quality development of the jumping ability of a volleyball player during the training process may be defined by the following factors:

- the ability of muscles to quickly accelerate to the maximum possible value of dynamic pull;
- the high degree of neuromuscular response of volleyball players, is expressed in an ability to quickly shift muscle groups from inferior to overcome mode.

As such, jumping ability is a complex quality, which is based on a strength of leg muscles, which directly participate in a jump as well as on the speed of muscle contraction concerning optimal amplitude of volleyball player movement. The effectiveness of jumping ability development is determined by the ability to achieve the major strength of a sportsman as fast as possible.

Alongside that, a volleyball player has to consider coordinative abilities, which allow him to fulfill coordinative shifts mid-match, depending on external conditions. Aside from strength and jumping ability, a sportsman also requires such qualities, as agility, flexibility, endurance, and speed as well as quick thinking right on the field. Similar qualities are developed by utilizing special methods and exercises, which should be based on constant, spontaneous changes in playing conditions, planned in accordance to set goals, which are defined during the development of one or another game aspect.

A special place amongst the abovementioned qualities of a volleyball player is dedicated to agility as a component, required to achieve success in a match. Modern volleyball players should develop such qualities:

- acrobatics;
- jumping.

Developed acrobatic agility at sufficient levels allows sportsmen to effectively perform technical tricks, which hold various acrobatic elements, such as jumps, rolling, receiving, and deflecting low-passing balls, etc.

The proper jumping agility of a volleyball player allows him to fully control his body during a jump without solid ground under the legs. Developed jumping agility is required to commence attacks from a high jump, effectively block, commencing a second, linking pass even in a jump.

To train volleyball agility, it is necessary to do special gymnastic and acrobatic exercises during simulation training. One such exercise is vertical jumps with hand waiving movements (Caputo et al., 2019; Maffulli et al., 2021). Exercises of this nature develop hand and leg strength, which are important for an effective play of volleyball and achieving success during a match.

Physical state control should be monitored during the training process by utilizing a special testing system, developed to evaluate key parameters of competitive loads readiness. Below are stated a set of test exercises, developed specifically for the use of training the volleyball team and for objective evaluation of the current vertical jumping ability of the sportsmen (reliability):

- vertical jump from a fixed in-run (6 meters), which is followed by a vertical push with two legs and raising both hands and landing in a set position (in centimeters). Three attempts are given, and the best result is used for evaluation.

- the difference from a previous test is that a difference between the biggest height of a vertical jump and a height, performed with a vertically raised hand and standing on tiptoe, is noted. Three attempts are given, and the best result is used for evaluation.
- the second variety of a presented test, during which a difference between the biggest height of jump and height performed with a vertically raised hand and standing on tiptoe, is noted. Three attempts are given and the best result is used for evaluation.

Marks (validity):

- 1.33 - satisfactory;
- 1.33-1.38-good;
- 1.38 and higher - excellent Standards are developed for sports school (14-15 years).

A series of specially developed test exercises for the evaluation of playing agility amongst volleyball players are presented below (reliability):

1. A rope is tightened at 80-100 centimeters to an average point of the playing field and on the height, no more than 75% of the maximum vertical jump of a sportsman with raised hands. In a middle of a field, in the opposite team's half, a square 1-meter target is set. Volleyball players make 10 throws to a target with tennis balls, located in a bin after a line of attack. All throws should be made from the run-up and in a jump through the rope.

Marks (validity):

- less than 4 hits – bad;
- 5-7 hits – satisfactory;
- 8 hits – good;
- More than 8 hits – excellent.

2. A volleyball player imitates a play block and after a fall a push-up has to be made (3 times for males, 1 time for females). Then a ball is thrown into a target from 10, 7, and 4 meters. Number of throws from each point – 10. The target is round and located on a wall. Diameter: 10 meters for a 1 meter, 7 meters for 0.75 meters, and 4 meters for 0.5 meters (reliability).

Marks (validity):

- less than 15 hits – bad;
- 16-20 hits – satisfactory;
- 21-24 hits – good;

- more than 25 hits – excellent.

Hits are fixated and added from three different points.

These standards were developed for adult volleyball teams.

During the development of test standards, a fundamental focus is on the qualification level of training and competitive readiness of sportsmen, for which standards are compiled. To test the agility and flexibility of sportsmen, representing master teams, usage of the kid and juvenile-oriented tests and vice versa is pointless. The usage of tests with wrong intentions leads to corruption of information and false representation of the real fundamental capabilities of sportsmen.

Following the results, gained from the vertical jump ability and agility testing process, special exercises should be utilized, aimed at developing weak aspects of sportsmen. It is important to keep in mind, that, to achieve the required training effect, which is expressed by good results in practice, an optimal combination of methods and means of training should be achieved. Particularly, during training of jumping ability, main efforts should be focused on jumping exercises with or without further higher difficulty as well as highly specialized technical elements, such as performance of jump attacks or of blocking.

Amongst special jumping exercises on developing vertical jump ability, the following should be noted:

- speed-strength exercises with additional weight on legs (multi-stage running, sequential jumping on one leg);
- jumping with obstacles (with or without weights, from a run-up or without);
- long jumps (with or without weights, from a run-up or without).

The most important training effect, achieved through this type of exercise, is triggering the neuromuscular apparatus (Magee et al., 2010). This is achieved through massive muscular loads on a push, while exercises with additional weights act as an additional development of vertical jumping ability in this context while jumping exercises are the main way to train and developed vertical jumping ability.

Development of playing agility amongst volleyball players requires a targeted influence on a set of key factors, which predefine success in achieving mastery of the factor. Among those factors are:

- development of secondary abilities and skills in movement ability amongst volleyball players;



- ability to quickly react to the environment and orient in time;
- high reaction time to fast changes in the environment;
- ability to control one's own body and properly coordinate in various situations;
- developed jumping ability and high movement speed during technical tricks performance.

Effective development of gaming agility is achieved through the implementation of two-team games into the training process, which is characterized by the high mobility of players and many initial trainer instructions, which set the goal of performing a series of unexpected actions and movements across the game field (Biger, 2021). This demands quick, dashing, adequate, complex actions from opponents, which is dictated by the need to make non-standard decisions in a well-known game environment.

As such, the topic of developing and implementing special testing exercises, aimed at evaluating vertical jumping ability and agility amongst volleyball players and the development of aforementioned qualities is in systemic relations and requires deep analysis by experts in sports science. Currently, concerning the modern level of its development and abilities of computer technology used to develop effective tests for evaluating these components of physical fitness amongst volleyball teams, everything necessary for the creation and implementation of special tests for vertical jumping ability and agility in the training process is already present, which will substantially improve training process and will expedite achieving higher results in competitions.

#### **4. DISCUSSION**

Problematics of individual technical and tactical sportsmen action biomechanics in sports and other related principles of training and testing jumping ability and agility has been analyzed in the research of Rodin (2016). It is noted that biomechanical component of sportsmen training should be considered a substantial element during the training process and preparation for young athletes of 10-12 years. Agility and jumping ability training in basketball and volleyball take a prominent place as well as tactical and technical training due to their components being extremely important during the training process in matches and they are considered key components in gaining an individual advantage in sports competition. Similar conclusions expand the results, gained in this scientific research. Additional attention is focused on the importance of jumping ability and agility in single playoffs, occurring in modern team sports (Rodin, 2016).

Radak (2017) further develops the topic in his scientific article, dedicated to the problems of sportsmen's physical fitness. During his analysis of various aspects of the physiology of physical

fitness, he notes, that careful and qualitative physical exercise selection for jumping ability and agility training amongst volleyball players and their proper implementation in the training process is required to initiate physiological processes of a cell level and adaptive reactions of the body, which, in complex, will ensure stage-by-stage development of aforementioned components of volleyball players physical fitness (Radak, 2017). The responsibility of tracking the effectiveness of the physiological influence of exercises and tests is given to the team trainer as a director of the training process. The researcher's conclusions may be expanded with a note, that the team trainer himself is not responsible for the physical fitness of team members, as his functions are to delegate similar responsibilities to assistants and control the quality of their responsibility implementation.

Raab et al. (2017) stated that one of the most important aspects of achieving a high score in team sports is a high level of functional fitness of every player in every category (Raab et al., 2017). That is achieved through the implementation of a special system of physiological component development and their testing of functional and psychological preparedness at all stages of the training process as well as in the competitive period into the team training process. Overall, these research results confirm the acquired information of the scientific analysis, which underlines the role and importance of player functional abilities testing systems in the training process of the team.

Lyle & Cushion (2020) in their joint research, have analyzed a series of aspect problematics of sports coaching, which can be applied to the training of athletes in the game and non-game sports. Researchers have concluded, that with game sports (particularly basketball and volleyball), during a training cycle of team preparation planning, the most important aspect is distributing the load considering the individual aspect of members' physical fitness. This foresees a necessity of physical contact between the team trainer and his subordinates, which are responsible for distributing team loads between sportsmen considering their wellbeing, ability to experience training loads, and necessity to solve specific tasks in the development of one or another game aspect (Lyle and Cushion, 2020). Conclusions of scientists may be expanded with the fact, that for a proper evaluation of individual aspects of team members, a planned medical check-up should be done with intention of detecting those aspects and immediately informing team trainers.

Lieshi (2014) in his scientific research, has analyzed separate aspects of jumping ability development of volleyball players through the employment of special exercises in the training process. The author notes, that a vertical jump with push requires substantial leg muscle force in combination with hand waiving movement, which is a key component of volleyball (Lieshi, 2014). According to the researcher, achievement of high results in the development of these components

depends on the employment of a special evaluative test system in the training process, which will evaluate the muscle strength and jumping ability of athletes at any stage of the training process. These results fully coincide with those, achieved in this scientific analysis.

Barh & Ahmetov (2019) have concluded similar results during their joint research of most perspective and novel fields of sports sustenance genomics and its relation to sports exercise complexes. The authors note, that a relationship between the quality of sportsmen's nutrition and physical exercise is evident. Moreover, this tendency is prominent in all types of sports with no exception. Balanced nutrition in combination with proper physical exercise and periodic muscle strength tests of game sports sportsmen ensure high results in jumping, which is important for proper performance in technical movement in basketball and volleyball (Barh & Ahmetov, 2019). Their conclusions expand the results of this scientific research, even though it is important to note, that the implementation of nutritional methodic preparation of modern sports teams should be concluded only by a doctor.

Meanwhile, Miller & Thompson (2018) in their joint research of various sportsmen sports (both non-game and game) trauma treatment, note, that improperly compiled training exercise and load, in conjunction with the problem of athlete recovery, is often a cause of traumas, which hinder the training process and makes competition impossible. Particularly, many episodes of volleyball player traumas, related to the achillea sinew and caused by improper testing of sportsmen wellbeing after agility and jumping ability exercise completion are highlighted (Miller & Thompson, 2018). According to the opinion of the authors, the issues could be positively resolved by constantly monitoring the well-being of sportsmen at any stage of the training process. Scientists' opinions do not intervene with the results of this scientific research, although it is important to underline the role of sports doctors in the team in questions of preventing traumas.

The problem is also analyzed by Loffing, Hagemann, Strauss & MacMahon (2016) in their joint research of sport laterality. The fact, that problems and misfunctions of motor control as well as miscalculations of sportsmen's training process cause frequent leg muscle trauma, which hinders the training and learning process and makes important competition unreachable, is noted in their scientific work. A possible solution may be found in the development and implementation of test evaluation of the physical well-being of sportsmen in all stages of preparation for important competitions (Loffing et al., 2016). This will prevent any further trauma during speed-strength exercise, especially with those, that develop jumping ability with explosive muscular loads. In general, the results of their research correlate to the conclusions, achieved in this scientific article.

By analyzing a series of problematic aspects of the game and non-game sportsmen biomechanics, Wirthed (2006) has concluded, that during the composition of the training process of a volleyball team, individual and anthropometric characteristics of each sportsman during agility, flexibility, and jumping ability exercise development should be considered (Wirthed, 2006). This will enable to properly coordinate training load and achieve maximum effect, expressed by optimal values of mentioned physical qualities amongst volleyball players as well as to prevent trauma, that hinders the training process and makes further competition impossible. While analyzing the conclusions of the scientist, it is important to note, that coordination of training load requires a joint effort of training staff experts, which, in turn, creates a need for qualified personnel.

As such, demonstrated results and conclusions generally coincide with the results of the scientific research, which concludes the scientific solidity.

## **5. CONCLUSIONS**

Jumping ability and agility in modern volleyball are mandatory components of player mastery, without which victory is impossible. This fact is a reason trainers and team leaders pay detailed attention to the steady development and improvement of agility and jumping ability of their members at all stages of the training process. Moreover, implementation of testing methods for evaluation of the real level of jumping ability and flexibility of volleyball players on any level of the training process is of high importance as well as preventing over-training and traumas.

Tests for evaluating the jumping ability and agility of volleyball players are usually a set of special exercises, during which test subjects demonstrate their gained skills, acquired during training of physical and technical fitness. This will properly inform trainers, responsible for the training process, and will allow them to rate the true well-being of their team members as well as to detect existing problems and fix them right away. Moreover, this information should be a basis for further planning of the training process and expected load on volleyball players to achieve maximum effect and avoid trauma.

Results, acquired in this research, will allow us to effectively correct the volleyball team in face of upcoming calendar matches, which is extremely important from the perspective of achieving optimal sports results. This foresees a need for a detailed compilation of test exercises to ensure objectiveness and truthfulness of information about a real level of volleyball player readiness and accordance of their jumping ability and agility to the requirements of modern volleyball.

The qualification level of sportsmen should be considered while compiling the tests. Members of adult volleyball teams should be tested by the exercises, compiled by their training staff, while testing the competitive readiness of schoolchildren of Olympic reserve, tests, compiled according to their functional and technical level, should be used.

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