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Vertical Jump as the Main External Load in Volleyball: It is Time to Change!

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Short Communication

The oldest documents depicting the systematization of physical training in improving athletic performance date from the first centuries after Christ. Lucian (A.D. 120 to 180) already recommended training in distance running as well as sprinting, including training in soft sand to improve running strength. Galen (A.D. 131 to 201), the doctor of gladiators, pointed out the benefits of training in games with small balls for working the whole body and Philostratus (A.D. 170 to 249 AD) developed the Tetra system, a cycle of 4 days, each of the which are dedicated to a different activity [1].

In the strength and conditioning scientific area, the first researchers investigating how the human body is affected by strength training date from 1894. The main finding between 1894 and 1979 about the strength training and sports training possible application reveal that the strength training improves various measures of physical health and fitness and, that the strength training does not hinder movement speed or joint range of motion, refuting the concept of "muscle boundness" [2]. Training monitoring in the sports arena date from initial 1900s, when Hannes Kolehmainen e Paavo Nurmi ran with a stopwatch to track the speed of travel over a known distance, when GöstaHolmér developed the Fartlek training and Gerschler e Reindell developed a heart rate-based interval training in the 30s [3]. Since then, training monitoring in sports is done by volume quantification (kilometers run, swam, cycled, number of throws, weight lifted), effort intensity (m/s, watts) and by physiological measures such as heart rate.

More recently in 2003, the concept of internal and external training load emerged, initially proposed in the context of team sports and now largely used in other contexts of research and practice [4,5]. In resume, in team sports the External Load (EL) covers measures of physical demand as total distance covered, distance covered in specific speed bands, accelerations, jumps and others, while the Internal Load (IL) comes to be the psychophysiological repercussions to complete certain EL [5].

Sports context application of these terms like IL, EL, workload or even just work or load receive much criticism because of the conceptual translation of load and work into the International System of Units (SI) and their application into mechanics and, consequently, into biomechanics, what has encouraged many scientists to claim that terms such as workload, IL, EL and work rate should be abandoned [6-8]. However, perhaps because of the easy applicability and understanding of these concepts both in sports science and practice, their use has been widespread. For example, today if you search for the terms external load or internal load in sports you will find around 3,000 results in the PubMed database.

Volleyball scenario is not different. In two recent systematic reviews about internal [9] and external load in male professional volleyball [10] 36 studies about this specific population were reached. Rate of Perceived Exertion (RPE), Session Load (sRPE), your derivatives metrics and number of jumps performed are the most common measures of internal load and external load in volleyball.

The main problem starts here. In studies that analyzed the relationship between the number of jumps performed and values of RPE or sRPE was not conclusive. Which means that the psychophysiological repercussion of volleyball physical demands is not directly or only related to the number of jumps performed by the athletes in the training sessions or in the matches, what is reasonable because volleyball practice involves also high intensity intermittent multidirectional movements in displacements to cover short or very short distances and not only vertical jumps [11,12].

Investigating this relationship Rabello et al. [13], do not observed changes and correlation

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between the number of jumps and RPE in 7 weeks training and Lima et al. [14], observed small correlation between number of jumps and RPE (r=0.17) and sRPE (r=0.49). Important to note that in these two studies the sRPE was largely influenced by the session duration and not by the number of jumps. In a study by our group (data unpublished yet) the number of jumps in the training sessions showed no correlation with both RPE and sRPE. In Horta et al. [15], study, the RPE has correlation with only attack jumps (r=0.26; p<0.001).

And how to evaluate the relationship EL/IL of the libero (defense specialist) that doesn't realize a considerable number of jumps? And about the different functions, physical and cognitive demands between the player positions? Maybe technology could help us.

Recently, the wearable technology development like Inertial Measures Unit (IMU) composed by accelerometer, gyroscope, magnetometer and the Local Position System (LPS) has become more accessible for both research and practice, being used to measure both the number of jumps performed and the displacements, accelerations, decelerations and other metrics that these devices can provide.

Vlantes and Readdy [16] using accelerometer-based measures observed that libero had higher sRPE than outside hitter and middle blocker even performing fewer vertical jumps, lower player load and high impact player load. The metric of EL which correlated with the sRPE was “Explosive Efforts” count (r=0.43, p<0.001). Horta [17], using LPS found that the intermittent displacements performed in the volleyball practice demonstrate a strong relationship with IL variables as sRPE and Altundag et al. [18], found external load metrics with negative and positive effects on internal load.

These studies show us that the simple number of jumps analysis does not provide the necessary subsidies to understand the physiological and metabolic effects of volleyball physical demand and reinforce the importance of the use of new technologies and analytical approaches, which are essential tools for monitoring athletes and to really understand the volleyball demands.

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