

COMPARATIVE STUDY ON THE USE OF A PORTABLE ALTERNATIVE METHOD FOR MEASURING HIGH JUMP IN MEN'S VOLLEYBALL GAME

STUPAR RADU-CRISTIAN^{1,*}, MONEA GHEORGHE¹,
ŞANTA CRISTIAN¹, SOMÂTCĂ IOANA ALEXANDRA

ABSTRACT. High jump is a very important skill in the modern volleyball game. The height of the vertical detachment can be measured in a variety of ways, from the most sophisticated (jumping platform, jumping mats) to those available to all (Sargent test, and Vertec). Through this study we followed the comparative analysis of an alternative method for measuring detachment on the spot, using the G-Vert device, with a device known and currently used by several federations for measuring vertical detachment. Following the application of the Counter-movement jump Test (CMJ) or Static Vertical Test (SVT) and Approach Vertical Test (AVT), the values obtained were recorded, analyzed, and compared using the Microsoft Excel and IBM SPSS statistical processing and analysis programs. The results of the analysis show small differences between them, which attests to the G-Vert device, as a reliable device for measuring vertical detachment. The G-Vert device, in addition to the ability to record vertical detachment, gives us information about the gravitational force that is exerted on the body during the jump, and the force with which the detachment is performed on the spot, information that can be obtained by the jumping platform.

Keywords: *G-Vert, high jump, measurements, tests.*

REZUMAT. *Studiu comparativ privind utilizarea unei metode alternative portabile pentru măsurarea desprinderii de pe loc în jocul de volei masculin.* Desprinderea de pe loc este o calitate foarte importantă în jocul de volei modern. Înălțimea desprinderii pe verticală poate fi măsurată printr-o varietate de modalități, de la cele mai sofisticate (platforma de sărituri, covoarele de sărituri), la cele la îndemâna tuturor (testul Sargent, și Vertec). Prin intermediul acestui studiu am urmărit analiza comparativă a unei metode alternative pentru măsurarea desprinderii de pe loc, folosind dispozitivul G-Vert, cu un dispozitiv cunoscut și utilizat în prezent de mai mult federații pentru măsurarea desprinderii de pe loc. În urma aplicării testărilor Counter-movement jump Test, (CMJ) sau Static

¹ Babeş-Bolyai University, Faculty of Physical Education and Sport, Cluj-Napoca, Romania.
* Corresponding author: stupar_radu@yahoo.com.

Vertical Test, (SVT) și Approach Vertical Test (AVT), valorile obținute au fost înregistrate, analizate și comparate cu ajutorul programelor de prelucrare și analiză statistică Microsoft Xcel și IBM SPSS. Rezultatele analizei celor două teste, ne indică diferențe mici între ele, fapt care atestă dispozitivul G-Vert, ca dispozitiv de încredere pentru măsurarea desprinderii de pe loc. Dispozitivul G-Vert, în plus pe lângă capacitatea de a înregistra desprinderea pe verticală, ne oferă informații legate de forța gravitațională care este exercitată asupra corpului în timpul săriturii, și forța cu care se realizează desprinderea de pe loc, informații care sunt oferite de platforma de sărituri.

Cuvinte-cheie; G-Vert, desprindere pe verticală, săritură, măsurători, teste.

Introduction

Vertical detachment is used to estimate sports performance in children, elderly people, performance athletes, and non-athletes.

In DEX, vertical detachment is defined, as the ability of the individual to detach from the ground in height or length easily. The measurement of height jump can be done in two ways. By methods, available to all, like the Sargent test and Vertec, the vertical jump device, that can be done in the training facilities where they are training. The other method is more demanding, time time-consuming, and requires the movement of athletes from the training facility. These measuring methods are the jumping mat and jumping platform Sattler T, Sekulic D, Hadzic V, Uljevic O, Dervisevic E. (2012).

The training process of athletes usually takes place in the same court and at the same time, in training according to planning, with the participation of several athletes. Most of the time, testing athletes using traditional testing methods require time and a dedicated team that must pay attention to the measuring process and record the data obtained.

For example, the use of motion capture methods can provide fully accurate results and be considered the gold standard when it comes to measuring vertical detachment. But this method is time-consuming, it can be done only with one athlete, it is not possible to measure several athletes at once. It requires technical expertise from the evaluators and a complex system of cameras to be able to record the actions that need to be monitored and evaluated.

Traditionally, the Sargent test is the most used method to measure vertical detachment because it is simple and does not require many materials to be implemented Luis F. A. (2000). The possibility of using portable microtechnology G-Vert, is an attractive way to monitor athletes in official competitions or training by coaches. This device is designed to support coaches and athletes in measuring vertical detachment.

It can be an important tool that helps to investigate the possibility of changing the ability to detach vertically of the athletes during attacking or blocking phases in training or official matches.

G-Vert is a small inertial measuring sensor, inserted in an elastic band. The sensor records and calculates the vertical detachment of each jump. The data obtained by the device is sent to your phone or tablet via OTA (Over the Air) wireless technology.

The ability to jump is a basic requirement of any volleyball player, to be able to perform various game-specific actions, such as passing jump, jump service, attack, and blocking Hsieh C.-Tu (2006). According to Sheppard Jeremy, Gabbett Tim, Reeberg Stanganelli Luiz, Newton Robert (2010) the performance of the attack actions are dependent on the height at which it is executed in relation to the height of the net and are determined by the player's ability to and high vertical center of gravity.

High-performance players record 250-300 actions in a 5-set match, and the vertical detachment is at the basis of all actions completed in force. Of these, attack and blockade account for 45% of all game actions Sheppard et al. (2010). In the game of volleyball, there are several specific movements associated with vertical detachment: vertical detachment at the block and vertical detachment with momentum for the attack. The vertical movements used for blocking and attacking, usually end with a maximum vertical detachment Sattler T., et al. (2011). Both are made with the help of the balance of the arms, the vertical detachment used in attacking is made after a momentum of two or three steps.

At a national level, the high jump tests used by the Romanian Volleyball Federation comprise three of the samples. Two of the jumps mentioned above by Sattler T., et al. (2011): counter-movement jump and approach counter-movement jump.

The test used by the Romanian Volleyball Federation in which they test the high jump are:

Detachment vertically, with momentum, reaching the maximum point, with one hand - attack momentum, jumping, and touching as high as possible with the arm outstretched.

Detachment vertically, from the spot, with the touch of the maximum point, with two hands, arms swing, jumping and touching with both hands as high as possible.

Methods

To carry out the study, several, volleyball players, members of the National Center of Excellence from Dej, Cluj County, participated as volunteers.

After performing a standardized warm-up protocol. All athletes participated in the presentation of the methodology for conducting the tests, providing additional explanations upon request.

The methodology for conducting the tests consists of using two types of vertical detachments measured with two different devices.

The two types of vertical detachment are recognized in the literature under several names, the biomechanics of movement being the same.

The first type of vertical detachment, from the spot, reaching the maximum point, with two hands -arms swing, jumping and touching with both hands as high as possible, is known in the international literature as Counter-movement jump Test, (CMJ), Static Vertical Test, (SVT). The second vertical detachment, test, with an approach and reaching the maximum point, with one hand - attack approach, jumping and touching as high as possible with the outstretched arm, known in the literature as the Approach Vertical Test (AVT).

Each participant had a number of three repetitions for each type of test. The G-Vert device was placed for each participant in the pelvic region using an elastic band.

The data obtained from the tests were recorded, analyzed, and compared using the statistics and analysis programs Microsoft Xcel and IMB SPSS, in order to highlight the possible differences between the two types of devices.

Results

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	87.000 ^a	80	.277
Likelihood Ratio	48.547	80	.998
Linear-by-Linear Association	9.671	1	.002
McNemar-Bowker Test	.	.	. ^b
N of Valid Cases	12		

Table 1. Chi-Square Tests

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
VERTEC	25.427	11	.000	69.00000	63.0274	74.9726
GVERT	28.877	11	.000	70.41667	65.0495	75.7838

Table 2. One-Sample Test

Art. No.	Standing one hand touch	Standin Vertec the highest point reached	approach Vertec the highest point reached	CMJ Test Vertec	AVJ Test Vertec	CMJ Test G-Vert	AVJ Test G-Vert
P1	234	290	300	<u>56</u>	66	<u>55</u>	68
P2	259	305	316	<u>46</u>	57	<u>42</u>	58
P3	245	303	319	<u>58</u>	74	<u>57</u>	73
P4	259	313	324	<u>54</u>	54	<u>54</u>	65
P5	257	317	332	<u>64</u>	79	<u>70</u>	80
P6	247	305	314	<u>48</u>	57	<u>49</u>	55
P7	247	304	313	<u>57</u>	66	<u>54</u>	67
P8	233	295	308	<u>62</u>	75	<u>57</u>	77
P9	235	300	320	<u>65</u>	85	<u>62</u>	84
P10	239	303	310	<u>64</u>	71	<u>63</u>	71
P11	245	309	316	<u>64</u>	71	<u>50</u>	73
P12	237	300	310	<u>63</u>	73	<u>65</u>	74

Table 3. Result obtained after applying the tests

VERTEC	G-VERT
66	68
57	58
74	73
54	65
79	80
57	55
66	67
75	77
85	84
71	71
71	73

Table 4. Results obtained in the AVT test

VERTEC	G-VERT
56	55
46	42
58	57
54	54
64	70
48	49
57	54
62	57
65	62
64	63
64	50
63	65

Table 5. Results obtained in the CMJ test

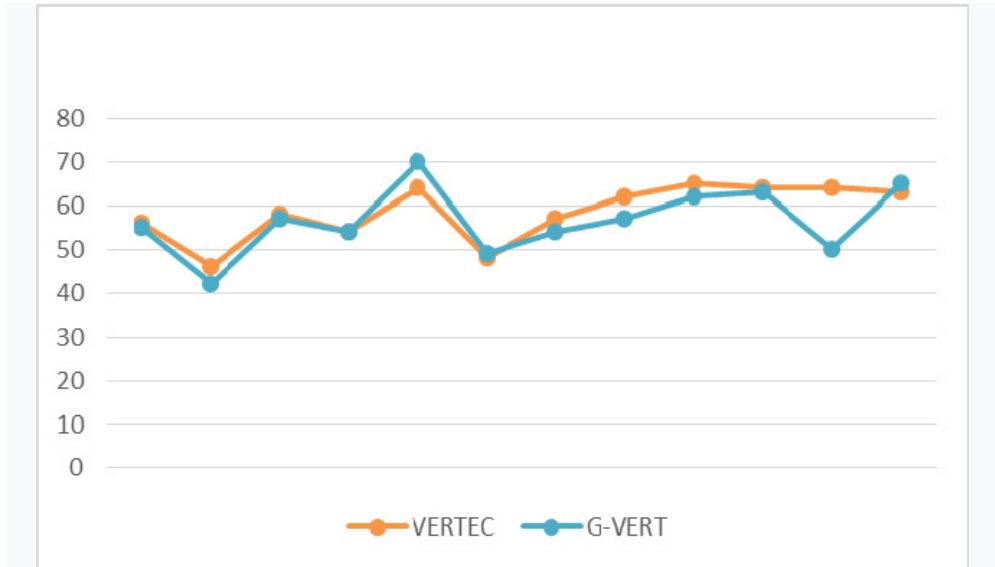


Fig. 1. Standing vertical test between VERTEC and G-VERT

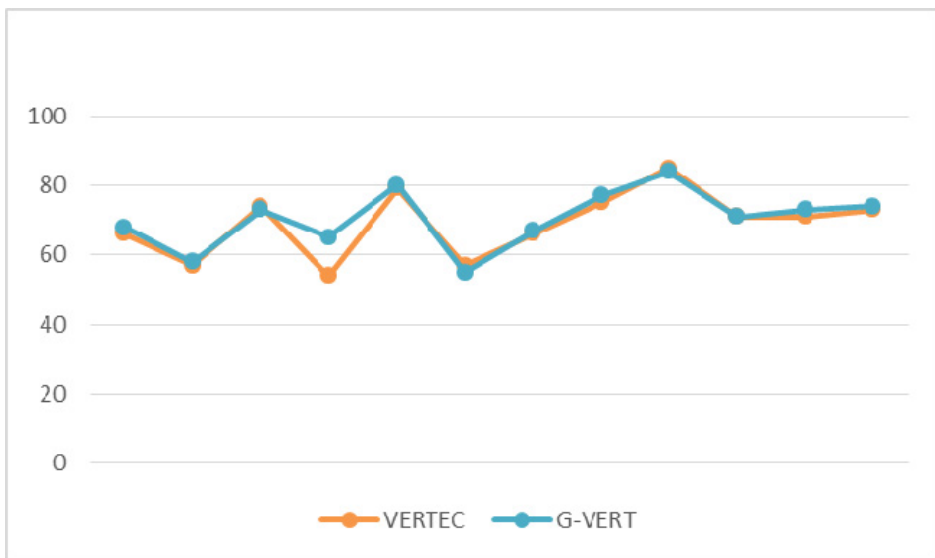


Fig. 2. Approach vertical test between VERTEC and G-VERT

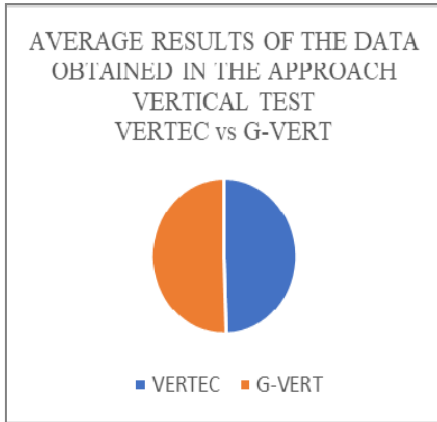


Fig. 3. Comparison of the obtained results in the approach vertical test

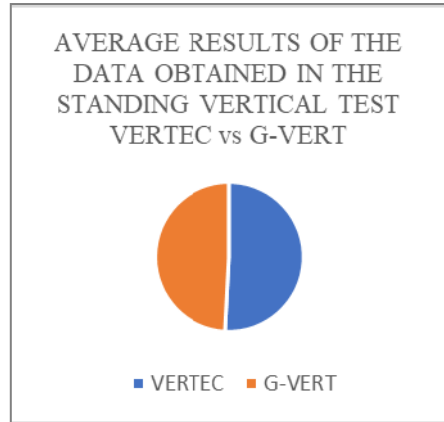


Fig. 4. Comparison of the obtained results in the standing vertical test

Conclusions

The G-Vert device proved to be a very good device for measuring vertical detachments, both on the spot and with the approach. Demonstrated acceptable validity for measuring vertical detachment in volleyball players as shown in Tables 1 and 2.

As recording possibilities compared to the Vertec device, G-Vert it has proven that it can easily and accurately record higher vertical detachment being able to offer in addition pieces of information related to the gravitational force that the body exerts during detachment, the force with which detachment is achieved and the force exerted by the body during landing.

Analyzing the results obtained in the tests taken for measuring the detachment from the vertical, CMJ, and AVJ, recorded with the Vertec and G-Vert device, we observe an average of 58.4 cm for the CMJ with the Vertec device and 56.6 cm for the G-Vert device. The difference between the two devices being only 1.9 cm higher recorded by the Vertec device. When testing AVJ the average recorded between the two devices is 69 cm for the Vertec device and 70.4 cm for the G-Vert device, the difference by 1.4 cm higher recorded by the G-Vert device.

In Table no. 3 we notice that for the calculation of the vertical detachment height with the help of the Vertec device it is necessary the initial registration of the height with the outstretched arm. An additional heading, an additional measurement. The smallest differences were recorded in the AVJ test, from a

number of 12 participants to 7 participants was recorded difference between 0-1 cm, 4 participants, recorded values between 1-2 cm, and only one participant recorded values over 2 cm.

At CMJ test the values between 0-1 cm centimeters were recorded at a number of 5 participants, the value 1-2 cm at one participant, values between 3-6 cm, at 5 participants, and a single value was recorded over 6 cm. From this, we can conclude that the flexion angle of the thigh on the calf has an important role. Although the Vertec device was recorded at a certain height, due to the more pronounced flexion, the G-Vert storage was recorded a few centimeters higher.

In conclusion, using the G-Vert device we can obtain in the three tests, recorded for each test identifying the maximum and minimum value for the three jumps. The additional information provided by the G-Vert repository, information that can only be obtained by combining several devices for measuring detachment from the spot makes it a very useful tool for identifying the degree of muscle development in the lower part of the body.

REFERENCES

- Hsieh C.-Tu. (2006). Biomechanical and pedagogical analysis of the volleyball spike. *College of Natural and Health Sciences School of Sport and Exercise Science*.
- Luis F. A. (2000). Evaluation of Four Vertical Jump Tests, Methodology Reliability Validity and Accuracy. *Measurement in Physical Education and Exercise Science*. 4:4, 215-228, DOI: 10.1207/S15327841MPEE0404_2.
- Sattler T, Sekulic D, Hadzic V, Uljevic O, Dervisevic E. (2012). Vertical jumping tests in volleyball: reliability, validity, and playing-position specifics. *J Strength Cond Res*. Jun;26(6):1532-8. doi: 10.1519/JSC.0b013e318234e838. PMID: 21904238.
- Sheppard JM, Gabbett TJ, Stanganelli LC. (2009) An analysis of playing positions in elite men's volleyball: considerations for competition demands and physiologic characteristics. *Journal of Strength and Conditioning Research*. Sep;23(6):1858-1866. DOI: 10.1519/jsc.0b013e3181b45c6a.
- Sheppard J, Gabbett T., Taylor K., Dorman J. (2013). Development of a repeated-effort test for elite men's volleyball. *International Journal of Sports Physiology and Performance*.
- Yingling, V. R., Castro, D. A., Duong, J. T., Malpartida, F. J., Usher, J. R., & O, J. (2018). The reliability of vertical jump tests between the Vertec and *My Jump* phone application. *PeerJ*, 6, e4669. <https://doi.org/10.7717/peerj.4669>