10.2478/tperj-2023-0004

The effect of Blazepod Flash Reflex Training program on vertical jump in U15 female volleyball players

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Abstract

Introduction: In modern volleyball, the vertical jump represents an important factor that conditions the achievement of sports performance. *Aim and purpose*: This study has monitored the integration of sensory technology through the Flash Reflex Training BlazePod system in a specific physical training program focused on the vertical jump development in the case of U15 female volleyball players. *Materials and methods:* This group consisted of 17 volleyball players (1.65 ± .059 m /48.65 ± 9,31 kg) with an experience of at least 3 years. The duration of the intervention was 10 weeks, twice a week. Predefined tests provided by the Optojump Next optical measuring system were used in this sense: the countermovement jump (CMJ), the squat jump (SJ), the 30 cm drop jump (DJ) and jumps 15 s (15 s). *Results*: After 20 training sessions, 11 parameters out of the 16 measured have improved significantly (p<0,001) as follows: the flight time increased at CMJ from .427 to .458 s, at SJ from .459 to .481 s, at DJ from .448 to .477 s; the jump height increased at CMJ from 22,32 to 25,86 cm, at SJ 26.10 to 28.53 cm, at DJ from 24.88 to 28.22; the specific energy increased at CMJ from 2.18 to 2.53 J/kg, at SJ 2.57 to 2.79 J/kg, at DJ from 2,42 to 2,76 J/kg, at 15 s from 45.20 to 48.59 J/kg; the average specific power at 15 s increased from 26.04 to 28.56 W/kg. *Conclusions*: The validation of the exercises' effectiveness was given by the data obtained by applying the tests with the OptoJump Next system, confirming the hypothesis that this program has beneficial effects on the vertical jump of the volleyball players participating in the study.

***Key words**: plyometrics, sensory technology, performance, power.*

Rezumat

Introducere: În voleiul modern, săritura verticală reprezintă un factor însemnat ce condiţionează realizarea performanţei sportive. *Scopul și obiectivul*: Acest studiu a monitorizat integrarea tehnologiei senzoriale prin intermediul sistemului Flash Reflex Training BlazePod într-un program specific de pregătire fizică axat pe dezvoltarea săriturii verticale în cazul jucătoarelor de volei U15. *Materiale și metode*: Grupul de studiu a fost compus din 17 voleibaliste (1.65 ± .059 m /48.65 ± 9,31 kg) cu o experienţă de minim 3 ani. Durata intervenţiei a fost de 10 săptămani, de 2 ori pe săptămână. Au fost utilizate teste predefinite oferite de sistemul optic de măsurare Optojump Next: săritură cu contra-mişcare (CMJ), genuflexiune cu săritură (SJ), săritură în adîncime – 30 cm (DJ) și sărituri verticale succesive timp de 15 s (15 s). *Rezultate*: După 20 de sesiuni de antrenament, 11 parametri din 16 măsurați s-au îmbunătățit semnificativ (p<0,001); astfel: timpul de zbor a crescut la CMJ de la .427 la .458 s, la SJ de la .459 la .481 s, la DJ de la .448 la .477 s; înălțimea săriturii a crescut la CMJ de la 22,32 la 25,86 cm, la SJ 26.10 la 28.53 cm, la DJ de la 24.88 la 28.22; energia specifică a crescut la CMJ de la 2.18 la 2.53 J/kg, la SJ 2.57 la 2.79 J/kg, la DJ de la 2,42 la 2,76 J/kg, la 15 s de la 45.20 la 48.59 J/kg; media puterii specifice la 15 s a crescut de la 26.04 la 28.56 W/kg. *Concluzii*: Validarea eficienței exercițiilor a fost dată de datele obţinute prin aplicarea testelor cu sistemul OptoJump Next, confirmând ipoteza că acest program are efecte benefice asupra săriturii verticale la voleibalistele participante în studiu.

***Cuvinte cheie**: pliometrie, tehnologie senzorială, performanță, putere*

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Introduction

Volleyball is a non-invasive sports game (Lima et al., 2023) in which two competing teams of six members control the ball with various parts of their bodies (mainly, the upper limbs are used for the execution of technical elements). To a large extent, the fight for the ball in volleyball is an indirect fight (Zapolska et al., 2014), determined by the fact that the two teams are separated by the net, but the penetration of the opponent's space above the net during the block gives a dose of relativity to this statement (Lobietti, 2009). The aggressive block used in modern volleyball actually can constitutes a direct contact between opponents. The actions on the ball are carried out in the form of hitting or repelling, which requires the existence of some special qualities and abilities in the case of the players of this game, and in the organization of the game in a field only three or four shots are allowed (if the ball is touched by the block), an aspect suggesting a unique aspect among sports games, in all the other sports games, the development of the attack and defense is free or conditioned by time (Hileno et al., 2020). According to Sopa & Szabo (2018), as a sports game, volleyball is characterized by a logical chain of individual and collective motor actions which, in order to be executed efficiently, require great speed, strength and precision, given the variability of all the situations encountered in the game, and the pace of the game is conditioned both by the physical and technical training of the team, and the players' tactical conception and temperament. Modern volleyball largely depends on the explosive power developed in the lower limbs to reach the maximum height where certain actions that require jumping can be performed (Mroczek, 2017). In a 5-set match, the performance volleyball players perform approximately 250-300 actions with high power indices. Considering the total number of activities, more than 50% are various types of jumping (Hasegawa et al., 2002).

The vertical jump is one of the most explosive physical movements performed in a multitude of sports, and the higher the athlete's ability to jump, the higher the prospects for success in that discipline. Volleyball and basketball are the two most prominent examples of sports where this correlation is evident (Karatrantou et al., 2019). The main objective of the vertical jump is to reach the highest possible height, but in volleyball there are two other specific objectives, hitting the ball on the attack, the jump set, the jump serve, and intercepting the path of the ball when blocking (Psycharakis, 2012). The athlete's vertical jump is a general indicator of athletic ability and can be used as a test to assess muscle strength (Fatouros, 2000).

Nowadays, volleyball players are training by using different innovative devices that monitor their performance or develop various skills (Sousa et al., 2023). In addition to these devices, the training methods have changed drastically with the help of technology, better and safer ways of training have been introduced in sports training. They can improve the parameters of volleyball players, who can perform at their maximum capacity. The right technology can have a massive impact on the athlete's ability to perform and improve over time, but most of all, it allows him to replicate different situations he might face during the competition, become more informed about his recovery, and adopt a data-driven approach when training (Roda, 2019).

BlazePod is a system of pods that emit a visual signal designed to enhance training by adding color-coded lights for different exercises. The Flash Reflex Training BlazePod system combines cognitive training that teaches the brain to think better and faster with physical training that pushes the athlete's motor qualities to the maximum. The BlazePod pods can be placed in different positions bringing major improvements in reaction time, agility, power, strength, and decision-making (De-Oliveira et al., 2021). The BlazePod application, available for Android and iOS devices, provides access to hundreds of pre-defined exercises and activities, thus monitoring the athletes' performance. It also allows users to create their own exercises or customize the pre-defined ones according to their needs.

Aim

This study has monitored the integration of sensory technology through the Flash Reflex Training BlazePod system in a specific physical training program focused on the vertical jump development in the case of U15 female volleyball players

Materials and methods

Participants

The study group consisted of 17 female volleyball players U15 from Cetate Deva Sports High-School Romania.

Table I. The age of subjects

	Frequency	%
13 years	8	47.1
14 years	9	52.9

The anthropometric measurements of the female volleyball players participating in this study are presented in Table II.

Table II. Anthropometric measurements

	Height (m)	Weight (kg)
Average	1.65	48.65
Standard deviation	0.59	9.31
Minimum	1.55	36
Maximum	1.75	65

Each female volleyball player in this study has a minimum of 3 years of specific training, participating in daily training (from Monday to Saturday) lasting 120 minutes.

Measurements

Pre-defined tests provided by the optical measurement system, Optojump Next, were used in this study (CMJ), the squat jump (SJ), the 30 cm drop jump (DJ), and jumps 15 s (15 s). For a better understanding of the jumps used, two days before the tests, the subjects performed a session of similar jumps. Before the tests, the volleyball players performed a directed warm-up for 20 minutes. The tests used in this study were performed on a wooden surface, and each participant performed two trials for each test, with the best result considered.

Design and procedures

The duration of the intervention was 10 weeks, twice a week (on Monday and Thursday), thus in the gross 20 training sessions. The actual program consists of 6 plyometric pre-defined exercises from the BlazePod application. A single set was performed for each training session, and the 6 exercises were preceded by a guided warm-up. The break between the exercises was equal (2 min), although the feeling of physical exhaustion appeared towards the end of the series. During the breaks between the exercises, the athletes performed some shaking of the muscles involved in the effort and some light running to restore the muscle work capacity.

Intervention program

1.Plyo Codes

Set-up: 4 Pods placed in a row on the ground.
Distances: 20 cm between the Pods.
Starting Position: The subject stands 2m back from the row of Pods.
Structure: When a Pod lights up the subject performs the exercise according to the color of the Pod and carries on performing the exercise until the next Pod lights up.
1st color- Burpees; 2nd color – Star Jumps; 3rd color – Plyo lunges.
Duration: 30 s

2. 2 Up 2 Down

Set-up: 2 Pods placed on the floor and 2 Pods high up on a bar.
Distances: Pods placed on the bar 2.2-2.6 m up (depending on the height of the subjects), 2m apart. Pods on the floor are 5m apart and 2m in front of the bar.
Starting position: The subject stands between floor Pods, facing the Pods placed high up.
Structure: When the first 2 pods light up, the subject taps them both as quickly as possible and then he is ready to tap out the next 2 Pods that light up. The subject repeats until the activity ends.
Duration: 30 s

3. Burpee Delight

Set-up: 6 Pods placed in a circle on the ground.
Distance: 5-6 m diameter.
Starting position: The subject stands inside the circle ready to go.
Structure: When a Pod lights up, the subject runs to the Pod and performs the number of burpees the color defines. After completing the burpees, the subject taps out the Pod and scans the next Pod that lights up.
1st color = 1 burpee; 2nd color = 2 burpees; 3rd color = 3 burpees
Duration: 45 s

4. Burpee Box Jump

Set-up: One Pod is placed on top of one box and one on the opposite box and the home base pod is placed on the floor between the boxes.
Distances: Approximately 2m between boxes.
Starting position: The subject stands above the Pod on the floor, looking around to see which Pod lights up.
Structure: When a Pod lights up, the subject comes down to a squat and jumps up onto that box using arms to help propel, taps out the Pod Jumps back down to the floor over the Pod placed there, drops down doing press up, then jumps back up to a squat position and taps out the floor Pod. The subject repeats the exercise till the activity ends.
Duration: 45 s

5. Lateral Hurdle Jumps

Set up: 5 low Lying Hurdles are laid out in a line with a Pod placed between each hurdle.
Distances: 5 low Lying Hurdles half a meter apart in a line. A Pod is placed after each hurdle, half a meter in front of the line of hurdles.
Starting Position: The subject stands between 2 of the hurdles, facing the Pod ahead.
Drill structure: When one of the Pods lights up, the subject jumps with both feet, sideways, over the hurdles, until reaching the lit pod, taps out the Pod with hand, and looks for the next Pod that will light up. He repeats the process until the drill ends.
Duration: 45 s

6. Power Jump Challenge

Set-up: 3 Pods placed up high on a rig.
Distances: 1 m between Pods.
Starting position: The subject stands underneath the middle Pod
Structure: When a Pod lights up, the subject shuffles under that Pod, get down into a low squat, and jumps up to tap the Pod. He lands softly back into the squat and looks for the next Pod that lights up. The subject repeats until the activity ends.
Duration: 30 s

Statistical analyses

The IBM SPSS Statistics for Windows software, Version 26.0. Armonk, NY: IBM Corp were used for the statistical processing of the data. The variables were expressed through median values, standard deviations, minimum and maximum, and the nominal data were presented as absolute frequency and percentage. To compare the average of the parameters between the samples, the t-test for paired samples, respectively the Wilcoxon test, were used. A statistical significance coefficient value of $p<0.05$ was considered significant. The t-test for dependent (paired) samples aims to compare the scores of two paired variables. In our case, the approach aims to compare the evaluation of the subjects at two different times.

Results

Following the centralization of the CMJ results (Table III), we notice a slight increase in the average flight time of 0.03 s. The average jump height also expressed a progress of 15.86%, and the average specific energy amplified by 0.3 J/Kg, after the final testing. Regarding the flight time, the extremely high homogeneity of the collective in the two tests should also be noted: 7.49% (initial test) and 7.84% (final test). Considering that for all 3 parameters measured at CMJ the statistical link is highly significant ($p<0.001$=99.9% confidence), we can consider that the training program had positive effects on the vertical jump.

Table III. CMJ results

Parameter	*M*	*SD*	*p*
Flight time (s) It	.427	0319	<0.001
Flight time (s) Ft	.458	0359	
Jump height (cm) It	22.323	3.381	<0.001
Jump height (cm) Ft	25.864	4.071	
Specific energy (J/kg) It	2.188	.330	<0.001
Specific energy (J/kg) Ft	2.539	.394	

Legend: 1-M: mean; 2-SD: standard deviation; 3-It: initial test; 4- Ft: final test.

In the case of the three elements measured at SJ (Table IV) we observe a progress between the initial and final testing.

Table IV. SJ results

Parameter	*M*	*SD*	*p*
Flight time (s) It	.459	.041	<0.001
Flight time (s) Ft	.481	.042	
Jump height (cm) It	26.105	4.700	<0.001
Jump height (cm) Ft	28.535	4.873	
Specific energy (J/kg) It	2.571	.468	<0.001
Specific energy (J/kg) Ft	2.791	.477	

Legend: 1-M: mean; 2-SD: standard deviation; 3-It: initial test; 4- Ft: final test.

The final testing recorded an average flight time 0.02 s longer than the average of the initial testing. The average jump height improved by 9.31 %, and the one of specific energy by 0.22 J/Kg. Similar to the CMJ, the homogeneity of the collective is also high at the time of flight measured at SJ, and the jump height and specific energy maintain their average homogeneity. The statistical link is highly significant (p< 0.001 = 99.9% confidence) for all measured elements, which confirms the effectiveness of the exercises used in the training plan.

Compared to the first two tests, the CMJ and SJ, in the DJ we can identify two new elements, the ground contact time and the specific power. The average of all the 5 measured elements show relatively average improvements after the final testing (Table V). The average jump height indicates an increase of 13.42 % between the two tests, and the average specific power improved by 3.41 W/Kg. Although three out of the five measured parameters show a statistically significant connection (p<0.001), we generally report the lack of homogeneity in all the five elements measured in the case of the DJ.

Table V. DJ results

Parameter	*M*	*SD*	*p*
Contact time (s) It	.371	.115	0.449
Contact time (s) Ft	.351	.102	
Flight time (s) It	.448	.047	<0.001
Flight time (s) Ft	.477	.047	
Jump height (cm) It	24.882	5.050	<0.001
Jump height (cm) Ft	28.224	5.502	
Specific power (W/Kg) It	25.208	6.030	0.004
Specific power (W/Kg) Ft	28.648	6.381	
Specific energy (J/kg) It	2.424	.496	<0.001
Specific energy (J/kg) Ft	2.767	.539	

Legend: 1-M: mean; 2-SD: standard deviation; 3-It: initial test; 4- Ft: final test.

The results of the 15 s test were noted for an upward trend between the two tests, without emphasizing some spectacular increase (Table VI). Again, just like in the DJ case, the 15 s test undergoes the collective's lack of homogeneity for most of the measured parameters. The statistical link is highly significant (p < 0.001) for the average specific power and the specific energy.

Table VI. 15 s results

Parameter	*M*	*SD*	*p*
Avg contact time (s) It	.304	.193	0.076
Avg contact time (s) Ft	.288	.165	
Avg flight time (s) It	.412	.053	0.003
Avg flight time (s) Ft	.428	.048	
Avg jump height (cm) It	21.724	6.575	0.113
Avg jump height (cm) Ft	22.905	5.032	
Avg specific power (W/Kg) It	26.046	7.117	<0.001
Avg specific power (W/Kg) Ft	28.564	7.682	
Specific energy (J/kg) It	45.200	10.746	<0.001
Specific energy (J/kg) Ft	48.592	10.877	

Legend: 1-M: mean; 2-SD: standard deviation; 3-It: initial test; 4- Ft: final test; 5- Avg: Average.

Discussions

In order to implement this study, we started from the premise that plyometrics and the sensory technology will have positive effects on the vertical jump performance in the case of junior volleyball players.

The analysis of the physical training level carried out with the help of modern technology outlines clear training lines and provides objective answers on the direction we have to focus the specific physical training on, while also clarifying the benefits it can bring.

Comparing the results obtained in our study with those obtained in some similar research, that incorporated the plyometric training, they used samples of junior volleyball players, measured and reported the vertical jump height by using the CMJ, DJ, SJ, 15 s. I noticed the same development trend of some parameters defining the vertical jumps.

Thus, after the application of a program of plyometric exercises the height of the jump at the CMJ increased by 11.08% (Martel et al., 2005), 25.19% (Perreira et al., 2015), 13.69% (Lehmert et al., 2009), 16.9% (Idrizovic et al., 2018), 20.11% (Velickovic et al., 2018), 7.79% (Enkeleida, 2015), 8.58% (Saaed, 2013), 16.83% (Gul et al., 2020), 9% (Hewett et al., 1996), and at the end of our study the jump height at the CMJ increased by 15.86%.

Regarding the jump height at the DJ, Velickovic et al. (2018) reported an improvement of 17.23%, while Vilela et al. (2021) reported a 31% increase after the application of the plyometric program. After the application of the intervention, the subjects of our study improved their DJ with 13.7%.

At the end of our study, the jump height at SJ increased by 6.45%. Similar studies in literature reported increases of 27.07% (Velickovic et al., 2018), 7.69% (Cankaya et al., 2018), 6.03% (Enkeleida, 2015).

Applying a plyometric program on junior volleyball players, Radu et al. (2015) noticed an improvement of the average jump height of 12.98%, while the training sessions applied during the study on the junior volleyball players from our club brought an increase of only 5.45%.

Given the fact that the athletes did not train within the frames of a centralized context, diet and recovery represent two variables that could have influenced the vertical jump performance. Other important factors limiting the vertical jump were the lack of control in genetic loads, more precisely, the type of muscle fibers (Bosco & Komi, 1979) and the subjects' menstruation (Yapici-Oksuzoglu & Egesoy, 2021).

Taking the age of the subjects in this study into account, we believe that we obtained and identified not only a certain image of extremely little studied physical parameters, but also the development trends, the elements that generate progress and the factors that limit the physical indices in the female athletes at puberty.

Conclusions

The technology used in the intervention plan (BlazePod and OptoJump Next) has been verified to give credit to its reliability in the field of vertical jump development and the analysis of physical indicators. Moreover, the use of this technology in the investigation of the vertical jump made it possible to objectify the training program to increase the motor performance of junior female volleyball players.

The introduction of sensory technology in the training sessions resulted in the dynamism of the physical training sessions and the sportswomen's increased level of involvement, an extremely important aspect, especially in the non-competitive periods when sports motivation can be lost.

The application of an intervention program based on plyometrics combined with sensory technology significantly increases most of the vertical jump parameters in U15 female volleyball players.

References

1. Bosco, C., & Komi, P. V. (1979). Mechanical characteristics and fiber composition of human leg extensor muscles. *European journal of applied physiology and occupational physiology*, *41*, 275-284.
2. Çankaya, C., Arabacı, R., Kurt, E., Doğan, S., Erol, S., Gürak, A. N., & Korkmaz, F. (2018). Examining the effects of the pliometric (jump squat) exercise on vertical jump in female volleyball players. *European Journal of Physical Education and Sport Science*.
3. De-Oliveira, L. A., Matos, M. V., Fernandes, I. G., Nascimento, D. A., & da Silva-Grigoletto, M. E. (2021). Test-retest reliability of a visual-cognitive technology (BlazePod™) to measure response time. *Journal of Sports Science & Medicine*, *20*(1), 179.
4. Enkeleda, L. (2015). Performance of the vertical jumps ability influenced by plyometric exercises in female volleyball players. *European journal of education and applied psychology*, (3).
5. Fatouros, I. G., Jamurtas, A. Z., Leontsini, D., Taxildaris, K., Aggelousis, N., Kostopoulos, N., & Buckenmeyer, P. (2000). Evaluation of plyometric exercise training, weight training, and their combination on vertical jumping performance and leg strength. *The Journal of Strength & Conditioning Research*, *14*(4), 470-476.
6. Gül, M., Eskiyecek, C. G., Şeşen, H., & Gül, G. K. (2020). Determining Effect of Plyometric Exercises on Various Motoric Characteristics for Woman Volleyball Players. *Türk Spor ve Egzersiz Dergisi*, *22*(1), 38-43.
7. Hasegawa, H, Dziados, J, Newton, RU, Fry, AC, Kraemer, WJ, and Hakkinen, K. Periodized training programmes for athletes. In: Handbook of Sports Medicine and Science: Strength training for sports. Kraemer, W J and Hakkinen, K, eds. Oxford: Blackwell Science, 2002, pp. 69–134.
8. Hewett, T. E., Stroupe, A. L., Nance, T. A., & Noyes, F. R. (1996). Plyometric training in female athletes: decreased impact forces and a crescut hamstring torques. *The American journal of sports medicine*, *24*(6), 765-773.
9. Hileno, R., Arasanz, M., & García-de-Alcaraz, A. (2020). The sequencing of game complexes in women's volleyball. *Frontiers in Psychology*, *11*, 739.
10. Idrizovic, K., Gjinovci, B., Sekulic, D., Uljevic, O., João, P. V., Spasic, M., & Sattler, T. (2018). The effects of 3-month skill-based and plyometric conditioning on fitness parameters in junior female volleyball players. *Pediatric exercise science*, *30*(3), 353-363.
11. Karatrantou, K., Gerodimos, V., Voutselas, V., Manouras, N., Famisis, K., & Ioakimidis, P. (2019). Can sport-specific training affect vertical jumping ability during puberty?. *Biology of Sport*, *36*(3), 217-224.
12. Lehnert, M., Lamrová, I., & Elfmark, M. (2009). Changes in speed and strength in female volleyball players during and after a plyometric training program. *Acta Gymnica*, *39*(1), 59-66.
13. Lima, R. F., Silva, A. F., Matos, S., de Oliveira Castro, H., Rebelo, A., Clemente, F. M., & Nobari, H. (2023). Using inertial measurement units for quantifying the most intense jumping movements occurring in professional male volleyball players. *Scientific Reports*, *13*(1), 5817.
14. Lobietti, R. (2009). A review of blocking in volleyball: from the notational analysis to biomechanics. *Journal of Human Sport and Exercise*, *4*(II), 93-99.
15. Martel, G. F., Harmer, M. L., Logan, J. M., & Parker, C. B. (2005). Aquatic plyometric training increases vertical jump in female

volleyball players. *Medicine and science in sports and exercise*, *37*(10), 1814-1819.

16. Mroczek, D., Januszkiewicz, A., Kawczynski, A.S., Borysiuk, Z., and Chmura, J. (2014), Analysis of male volleyball players' motor activities during a top level match, *Journal of Strength and Conditioning Research*, 28(8), 2297–2305.
17. Yapici-Oksuzoglu, A., & Egesoy, H. (2021). The effect of menstrual cycle on anaerobic power and jumping performance. *Pedagogy of Physical Culture and Sports*, *25*(6), 367-372.
18. Pereira, A., M Costa, A., Santos, P., Figueiredo, T., & Vicente João, P. (2015). Training strategy of explosive strength in young female volleyball players. *Medicina*, *51*(2), 126-131.
19. Psycharakis, S. G. (2012). Dynamics of Vertical Jumps. *Edinburgh Napier University*.
20. Radu, L. E., Făgăraş, S. P., & Graur, C. (2015). Lower Limb Power in Young Volleyball Players. *Procedia-Social and Behavioral Sciences*, *191*, 1501-1505.
21. Roda, M. *7 powerful ways to improve athletic performance.* Reflexion. https://www.reflexion.co/blog/improve-athletic-performance/ (accessed on 30.10.2019).
22. Saeed, K. K. (2013). Effect of complex training cu low-intensity loading interval on certain physical variables among volleyball infants (10-12 ages). *Sci Mov Health*, *13*(1), 16-21.
23. Sopa, I. S., & Szabo, D. A. (2019). Statistical comparison related to service and reception of the volleyball team CSM Volei Alba Blaj in the CEV Champions League Final Four 2018. *Timisoara Physical Education and Rehabilitation Journal*, *12*(23), 16-25.
24. Sousa, A. C., Marques, D. L., Marinho, D. A., Neiva, H. P., & Marques, M. C. (2023). Assessing and Monitoring Physical Performance Using Wearable Technologies in Volleyball Players: A Systematic Review. *Applied Sciences*, *13*(7), 4102.
25. Veličković, M., Bojić, I., & Berić, D. (2018). The Effects Of Programmed Training On Development Of Explosive Strength In Female Volleyball Players. *Facta Universitatis, Series: Physical Education and Sport*, *15*(3), 493-499.
26. Vilela, G., Caniuqueo-Vargas, A., Ramirez-Campillo, R., Hernández-Mosqueira, C., & da Silva, S. F. Efecto del entrenamiento pliométrico en la fuerza explosiva de niñas puberes practicantes de voleibol (Effects of plyometric training on explosive strength in pubescent girls volleyball players). *Retos*, (40), 41-46.