

The impact of a training program using different floor surfaces on the physical abilities and offensive skills among Jordan university students enrolled in volleyball courses: A Comparative Study

Wafa' Ismai

Department of Physical Education, School of Sport Sciences, The University of Jordan, Amman

wafaatrt@gmail.com

. Abstract:

This study aimed to investigate the impact of a proposed plyometric training program using different floor surfaces on the physical abilities and offensive skills among Jordan university students enrolled in volleyball courses. The research involved two groups: one training on hard flooring and the other on grass flooring, with pre- and post-training assessments conducted for physical abilities (explosive power, agility, and speed) and offensive skills (spiking, setting, and serving). The results indicated that the plyometric training program had a statistically significant positive effect on the physical abilities of both groups, enhancing explosive power, agility, and speed. However, offensive skills, such as spiking and serving, did not show significant improvements for either group. Notably, there was a significant improvement in the setting skill for the grass court group. Additionally, the study found that the choice of court flooring did not significantly impact skill development for most abilities and offensive skills. Both hard flooring and grass flooring training proved effective, with the setting skill being the exception. These findings suggest that plyometric training programs can effectively enhance the physical abilities, regardless of the court flooring. However, skill-specific training may be necessary to improve offensive skills.

Keywords: training program, floor surfaces, physical abilities and offensive skills, Jordan university students, volleyball courses.

أثر برنامج تدريبي باستخدام أسطح أرضيات مختلفة على القدرات البدنية والمهارات الهجومية لدى طلبة الجامعة الأردنية الملتحقين بدورات الكرة الطائرة: دراسة مقارنة

وفاء اسماعيل

قسم التربية البدنية كلية علوم الرياضة - الجامعة الاردنية، عمان، الاردن

wafaatrt@gmail.com

المخلص:

هدفت هذه الدراسة إلى معرفة أثر برنامج تدريبي باستخدام أسطح أرضية مختلفة على القدرات البدنية والمهارات الهجومية لدى طلبة الجامعة الأردنية الملتحقين بدورات الكرة الطائرة. شمل البحث مجموعتين: تدريب إحداهما على الأرضيات الصلبة والأخرى على الأرضيات العشبية، مع إجراء تقييمات ما قبل وبعد التدريب للقدرات البدنية (القوة الانفجارية، وخفة الحركة، والسرعة) والمهارات الهجومية (تسديد الضربات القوية، والإعداد، والإرسال).. أشارت النتائج إلى أن البرنامج التدريبي كان له تأثير إيجابي ذو دلالة إحصائية على القدرات البدنية لكلا المجموعتين، وتعزيز القوة الانفجارية، والرشاقة، والسرعة. ومع ذلك، فإن المهارات الهجومية، مثل الضربات القوية والإرسال، لم تظهر تحسينات كبيرة لأي من المجموعتين. ومن الجدير بالذكر أنه كان هناك تحسن كبير في مهارة الإعداد لمجموعة الملاعب العشبية. بالإضافة إلى ذلك، وجدت الدراسة أن اختيار أرضيات الملعب لم يؤثر بشكل كبير على تنمية المهارات لمعظم القدرات والمهارات الهجومية. أثبت كل من التدريب على الأرضيات الصلبة والأرضيات العشبية فعاليته، وكانت مهارة الإعداد هي الاستثناء. وتشير هذه النتائج إلى أن برامج التدريب البليومتري يمكن أن تعزز القدرات البدنية بشكل فعال، بغض النظر عن أرضية الملعب. ومع ذلك، قد يكون التدريب على المهارات المحددة ضروريًا لتحسين المهارات الهجومية.

الكلمات المفتاحية: برنامج تدريبي، أسطح الأرضيات، القدرات البدنية والمهارات الهجومية، طلبة الجامعة الأردنية. دورات الكرة الطائرة.

Introduction

The global community is currently observing advancements in several domains of human existence, and the field of sports is not exempt from this ongoing improvement. The presence of individual and team global championships, as well as the establishment of records, serves as compelling evidence of the significant advancements made in the realm of sports, which have become increasingly intricate and multifaceted. Individuals who aspire to become part of the global community must demonstrate a substantial level of dedication and exertion. Contemporary sports training methodologies have shifted their emphasis towards include a comprehensive range of physical, psychological, skill-based, and strategic aspects. One of the primary determinants that differentiates the sports training procedure is the training programs adhered to by coaches and instructors in the preparation and conditioning of diverse athletic endeavors. A training program refers to a meticulously organized series of activities and procedures intended to augment an individual's understanding, expertise, proficiencies, and aptitudes in a certain field or subject matter. These programs are commonly structured and administered by educational institutions, organizations, or training providers with the aim of enhancing the performance and skills of individuals involved (Pardos et al., 2021)¹.

As Fawzi and Badr al-Din (2001) have emphasized, sports training interacts with performance, no matter how complex or compound it may be. It enhances control and coordination in movements, which is reflected in the physical, skillful, and strategic performance with proper harmony. Therefore, persisting in training leads the athlete to master the skill in less time and with a high degree of proficiency. Rago and others (2019) argue that sports, particularly volleyball, require the effective use of physical aspects to generate and employ strength in skills. Volleyball, relies on the availability of a high level of strength, endurance, and flexibility. This is achieved through weight training, muscle strength exercises, underwater running, stationary training wheels, and sprinting over short distances during training.

There are various training methods employed by those involved in volleyball training to enhance the physical fitness of players. One of the most crucial training components in the programs of volleyball coaches is plyometric training. It is one of the modern training methods aimed at developing explosive power, and it can be utilized by many coaches in various sports, where athletes in different disciplines have achieved advanced results using this approach. In general, Jaksic and others (2014) mentioned that training with diverse methods can have a positive impact on sports performance. Mixing and varying the training program provide an effective and engaging influence on both sports and athletes, leaving a positive effect.

The nature and specificity of volleyball with its skills that require repeated jumping, especially in attacking, serving, and setting while jumping, most coaches in the field of volleyball have turned to developing muscular strength through plyometric training methods. Monson and others (2018) pointed out that plyometric training reflects the neuromuscular system's working mechanism. The ability to combine strength and speed simultaneously is crucial when performing jumps in plyometric exercises. Athletes should execute vertical jumps immediately, which are achieved through plyometric training, and they should consider the correct mechanical factors of movement when performing these exercises. De Villarreal and others (2010) also noted that plyometric exercises affect muscular strength, which is produced through a constant overload during eccentric contractions, also known as

lengthening contractions, where the muscle is stretched to its maximum length, followed by a concentric muscular contraction just before the completion of the eccentric contraction, causing the muscle to shorten toward its center.

Bompa (1993) emphasizes the importance of technical performance during jumping. When jumping with both feet, the push against the ground should occur simultaneously and equally, so that both sides of the body have a linear motion. However, when jumping off with one foot, the center of gravity aligns in a single line with the jumping foot. This is achieved by moving the opposite knee forward and swinging the arm forward on the same side as the jumping foot.

Research importance

The concept of training on different surfaces has emerged as a type of training aimed at improving physical fitness, skill proficiency, and efficiently utilizing time and effort. It also involves selecting faster ways to achieve the desired goal in the development of players, both physically and, consequently, skill-wise and strategically.

The sports halls where the students of the University of Jordan train typically feature conventional hard floors, which are commonly used for indoor training. These floors are the standard surfaces approved by the International Volleyball Federation for volleyball practice. On the other hand, the grassy surfaces proposed by the researcher represent an unconventional type of flooring for University of Jordan students. Therefore, grassy surfaces constitute a new type of flooring that can be used for training in novel conditions that students are not accustomed to for their plyometric physical exercises.

The current research problem arises from the researcher's observation that previous studies did not address the use of plyometric exercises on different surfaces (hard and grassy). This is despite the increasing need to enhance physical fitness using modern methods, which are considered the foundation for improving physical capabilities such as explosive power, agility, and speed, as well as offensive skills such as smashing, serving, and setting.

Research Objective:

The research aims to investigate The impact of a proposed plyometric training program using different floor surfaces (hard flooring and grass flooring) on the physical abilities (explosive power of the legs, speed, agility) and offensive skills (spiking, setting, serving), and to compare the effects of plyometric exercises on hard flooring and grass flooring among Jordan university students enrolled in volleyball courses.

Research Methodology:

Research Design:

The researcher employed an experimental research design with two experimental groups using a pre-post measurement approach.

Research Population:

The research population consists of students enrolled in the volleyball course at the University of Jordan, with a total of 20 students.

Research Sample:

The researcher selected the research sample through purposive sampling and divided them into two groups. The first group, consisting of 10 students, underwent plyometric exercises on hard flooring, while the second group, consisting of 10 students, underwent plyometric exercises on grass flooring. Sample homogeneity was

ensured by considering anthropometric variables (height, weight, age). Table 1 illustrates this.

Table 1
Independent samples t test

Anthropometric variable	Group	Mean	SD	T	df	Sig.	F
Height	hard flooring	179.2	5.007	-0.633	18	0.439	0.627
	grass flooring	180.5	4.143				
Weight	hard flooring	82.7	7.646	-0.465	18	0.354	0.904
	grass flooring	81.3	5.677				
Age	hard flooring	19.8	0.632	-0.452	18	0.046	4.595
	grass flooring	20.0	1.247				

(n=10)

Research Measurements and Tests:

The researcher employed a set of standardized and pre-established physical fitness and offensive skill tests after selecting specific offensive skills for study, which included serving, spiking, and setting. Additionally, several physical variables were included, such as leg explosive power, agility, and speed. These physical capabilities are fundamental for volleyball games.

To measure leg explosive power, the researcher applied the Vertical Jump Test (Squat Jump). The researcher used the 20-meter Sprint Test to measure speed, and Shuttle Run Test (4x10 meters) to assess agility.

To assess the accuracy and effectiveness of the student's spikes, each student was given 10 attempts. A point is awarded for each successful spike the student made within the designated areas set by the coach. To evaluate the student's ability to accurately set the ball to specific points, the coach tosses the ball in an arc towards the student standing in the setting position, and the student was required to set the ball accurately to points specified by the coach. Each student was given 10 attempts. Then the student performed 10 consecutive serving attempts, trying to direct the ball to a predefined area designated by the coach. They had the choice to either perform the serve from above or below.

Procedures

The researcher designed a plyometric program to be applied to the sample using different types of flooring (grass and hard flooring). The program was developed based on scientific principles and rules before being applied to the students. For example, the researcher ensured that the rest periods between training sessions were not less than 48 hours, and sufficient time was given for rest between each set of exercises, which could be up to two minutes.

To verify the validity of the proposed plyometric program, the researcher used the content validity method. The program was presented to a group of expert specialists in the field of sports training, and its reliability was ensured by applying the tests to a pilot sample outside the original research sample. Then, the pre-test measurements for physical and offensive skill variables were recorded for all participants in the research sample.

The individuals in the research sample were randomly divided into two equal groups (hard flooring group and grass flooring group), and equivalence between them was ensured through anthropometric variables.

The researcher recorded the pre-test measurements for all study variables before implementing the proposed plyometric training program, which was applied for a

duration of 8 weeks, with three training sessions per week for the participants in both groups. Subsequently, post-test measurements for physical and offensive skill variables were conducted for individuals in both groups (hard surface and grass surface). Finally, the data were collected, coded, input into a computer, and analyzed using statistical software packages such as SPSS for Social Sciences.

Results and discussion

To test the first hypothesis, which states "there are statistically significant differences between pre-test and post-test measurements of physical capabilities (leg explosive power, speed, agility), and offensive skills (spiking, setting, serving) for the hard flooring group in favor of the post-test measurements," a Paired Samples t-Test was used for the paired samples between pre-test and post-test measurements of physical capabilities (leg explosive power, speed, agility), and offensive skills (spiking, setting, serving) for the hard flooring group. Table (2) illustrates the results of the t-Test.

Table 2

Results of the Paired Samples t-Test for the Hard Flooring Group

Variable	Test	Mean	SD	t	df	Sig.
Leg explosive power	Pre-test	38.7	1.889	12.534	9	0.002
	Post-test	43.8	2.440			
Agility	Pre-test	12.77	0.739	2.353	9	0.043
	Post-test	12.59	0.620			
Speed	Pre-test	4.49	0.427	2.922	9	0.017
	Post-test	4.33	0.412			
Spiking	Pre-test	8	1.054	0.246	9	0.811
	Post-test	8	0.738			
Setting	Pre-test	7	1.197	7.584	9	0.000
	Post-test	9	1.414			
Serving	Pre-test	8	1.054	2.236	9	0.052
	Post-test	8	0.972			

(n=10)

The previous table reveals statistically significant differences at a significance level ($\alpha \leq 0.05$) between pre-test and post-test measurements for all physical capabilities (leg explosive power, agility, speed) in favor of the post-test measurements for the hard flooring group. There was also a statistically significant difference at a significance level ($\alpha \leq 0.05$) between the pre-test and post-test measurements for the setting skill. However, regarding the spiking and serving skills, there were no statistically significant differences between the pre-test and post-test measurements.

The application of the plyometric training program on a hard flooring had a statistically significant positive impact on physical capabilities. This is evidenced by the increase in leg explosive power and the reduction in the recorded time for both agility and speed. The researcher attributes the significance of these differences to the optimal use of the proposed training program, which was scientifically designed and tailored to the research sample's level while taking into consideration the specific nature of volleyball.

The researcher also utilized the components of training load (volume, intensity, density) in a scientific and progressive manner to regulate the physical exercises, recognizing their significant importance and direct influence on speed development.

Indeed, the findings align with Al-Rabaidi's (2004)¹ assertion that the progression in the intensity of training load ultimately leads to speed development. These results are also in agreement with Khalil et al.'s (2019)² study, which concluded that plyometric training has a positive impact on certain physical capabilities. Similarly, the study by Boukratem and Madani (2019)³ demonstrated that the plyometric training program had a positive effect on the repeated sprint test among players in the experimental group.

These studies collectively support the idea that plyometric training, when properly designed and executed, can contribute to improvements in physical capabilities and speed development, which is consistent with the observed outcomes in the present research.

The results also indicated that the application of the plyometric training program on a hard flooring did not have a statistically significant impact on the spiking and serving skills. This is evident from Table (2), where the mean scores for the pre-test and post-test measurements for both spiking and serving skills were similar. This suggests a stability in the level of these skills.

The researcher attributes this outcome to the nature of spiking and serving skills in volleyball. These skills require students to accurately direct the ball towards the opponent's court, and any technical error during their execution can result in the loss of a point, potentially causing anxiety for the student. Students may have experienced past failures or losses during class or exams when performing these skills, which could lead to anxiety. In contrast, the setting skill in volleyball involves preparing the ball for a teammate on the same team, and any technical errors can often be corrected quickly by the team. This makes setting a less anxiety-inducing skill to perform.

The observed improvement in the setting skill as a result of the plyometric training program aligns with a study by Abdel Dayim (1985)¹, which found that a structured and scientifically organized training program positively contributed to the development of basic skills in young athletes. This reinforces the idea that well-structured training programs based on scientific principles can enhance both physical and skill-related aspects of players.

Therefore, the first hypothesis was rejected. The statistically significant differences observed were limited to the physical abilities and the setting skill, and there was no positive impact of the training program on the spiking and serving skills on a hard flooring.

To test the second hypothesis, which states that "there are statistically significant differences between pre-test and post-test measurements in physical abilities (explosive leg strength, speed, agility) and offensive skills (spiking, setting, serving) for the grass flooring group in favor of post-test measurements," a Paired Samples t-Test was conducted for the paired measurements between pre-test and post-test for physical abilities (explosive leg strength, speed, agility) and offensive skills (spiking, setting, serving) for the grass flooring group. Table (3) illustrates the results.

Table 3
Results of the Paired Samples t-Test for the Grass Flooring Group

Variable	Test	Mean	SD	t	df	Sig.
Leg explosive power	Pre-test	38.5	1.650	10.173	9	0.000
	Post-test	43.1	2.283			
Agility	Pre-test	13.03	0.691	2.508	9	0.033
	Post-test	12.88	0.544			
Speed	Pre-test	4.50	0.468	3.070	9	0.013
	Post-test	4.35	0.411			
Spiking	Pre-test	7	1.033	1.909	9	0.089
	Post-test	7	0.994			
Setting	Pre-test	6	0.919	2.372	9	0.042
	Post-test	7	1.229			
Serving	Pre-test	7	1.174	1.177	9	0.269
	Post-test	7	0.919			

(n=10)

The table above demonstrates the presence of statistically significant differences at a significance level ($\alpha \leq 0.05$) between pre-test and post-test measurements for all physical abilities (explosive leg strength, speed, agility) for the grass flooring group in favor of post-test measurements. Additionally, there was a statistically significant difference at a significance level ($\alpha \leq 0.05$) between pre-test and post-test measurements for the skill of setting. However, concerning the skills of spiking and serving, there were no statistically significant differences at a significance level ($\alpha \leq 0.05$) between pre-test and post-test measurements.

The results indicate that the application of the plyometric training program on grass flooring had a statistically significant positive impact on physical abilities (explosive leg strength, agility, speed). Explosive leg strength increased, and the recorded time for both agility and speed decreased, indicating improvements in motor skills. The researcher attributes the significance of these differences to the optimal use of the proposed training program, specifically in terms of training loads. Abu Al-A'la (2003)¹ emphasized the importance of training loads in sports training, considering them the basic building blocks for achieving higher levels of performance. The plyometric training program was designed scientifically and tailored to suit the specific needs of volleyball and its physical requirements. The researcher also applied the components of training load (volume, intensity, density) practically and progressively.

Furthermore, Hussein and Nsief (1988) highlighted the importance of physical capabilities, including physical fitness, in the preparation and enhancement of athletic abilities. Scientifically structured training programs play a crucial role in developing general and specific physical capabilities, significantly impacting athletic performance. These results align with the findings of Al-Mousawi (2017), who concluded that the proposed training program in her study had a positive effect on the development of certain physical abilities.

The results also showed that the application of the plyometric training program on grass flooring did not have a statistically significant effect on the spiking and serving skills. This is evident from Table (3), where the average scores before and after training for both spiking and serving skills were nearly identical, indicating the stability of these skills. The researcher attributes this result to the nature of the spiking and serving skills, as discussed in the previous hypothesis. As a result, the second hypothesis was rejected, as statistically significant differences were only observed in

physical abilities and the setting skill, while there was no positive impact of the training program on spiking and serving skills on grass flooring.

To test the third hypothesis, which states "There are statistically significant differences between the post-intervention measurements for both groups (hard flooring, grass flooring) in physical abilities (explosive power of the legs, speed, agility), and offensive skills (spiking, setting, serving) in favor of the hard flooring group," an independent samples t-test was used to compare post-intervention measurements between the two groups in certain physical abilities, and offensive skills. Table (4) below illustrates the results.

Table 4

Results of independent samples t-test for post-measurements between the hard flooring and grass flooring groups

Post-test	Flooring	n	Mean	SD	t	df	Sig.
Leg explosive power	Hard flooring	10	43.8	2.440	0.662	18	0.516
	Grass flooring	10	43.1	2.283			
Agility	Hard flooring	10	12.59	0.620	1.111	18	0.281
	Grass flooring	10	12.88	0.544			
Speed	Hard flooring	10	4.33	0.412	0.125	18	0.902
	Grass flooring	10	4.35	0.411			
Spiking	Hard flooring	10	8	0.738	0.511	18	0.616
	Grass flooring	10	7	0.994			
Setting	Hard flooring	10	9	1.414	3.038	18	0.007
	Grass flooring	10	7	1.229			
Serving	Hard flooring	10	8	0.972	1.655	18	0.115
	Grass flooring	10	7	0.919			

(n=10)

It is evident from Table (4) that there were no statistically significant differences at the ($\alpha \leq 0.05$) level in the post-intervention test for physical abilities between the two groups. Similarly, there were no statistically significant differences in the post-intervention test for offensive skills (spiking and serving) between the two groups. However, there was a statistically significant difference in the post-intervention test for the setting skill between the two groups in favor of the hard flooring group.

It is evident from Table (4) that there were no statistically significant differences in the post-intervention measurements for physical abilities and offensive skills (spiking and serving) between the two groups. This means that there was no advantage for one type of court flooring over the other. The researcher attributes this result to the nature of the grass court used in the study, which resembled the characteristics of a hard flooring to a large extent. The grass court in this study was covered with very short synthetic grass and had a flat surface underneath, which did not have any bumps. Additionally, it was dry during the training sessions. These characteristics made the grass flooring similar to a hard flooring in terms of training conditions, which may explain the absence of statistically significant differences. The result aligns with a study by Dawson et al. (2014)¹, which also found no statistically significant differences in study variables when training on grass courts.

However, there was a statistically significant difference in the post-intervention test for the setting skill in favor of the grass court group. The researcher attributes this result to the fact that the setting skill is one of the basic skills and is less complex than other skills. Additionally, training on the grass court may have been a new experience for the students, which could have contributed to the observed

improvement in the setting skill. Furthermore, training on grass courts may have exposed the players to different environmental conditions compared to the indoor hard court training. Grass courts are typically outdoors and may subject players to weather conditions such as cold in winter or heat in summer, providing a unique training experience.

Conclusion

The study yielded several key findings (1) The plyometric training program had a statistically significant positive impact on physical abilities, including explosive power, agility, and speed for both hard flooring and grass flooring groups. This indicates that the training program effectively improved the players' physical capabilities. (2) The training program did not have a statistically significant impact on offensive skills such as spiking and serving for both groups. However, there was a significant improvement in the setting skill for the grass flooring group. (3) There were no significant differences between hard flooring and grass flooring training for physical abilities and offensive skills, except for the setting skill, which showed improvement in the grass court group. This suggests that the choice of court flooring may not be a critical factor in developing most skills.

Recommendations

Based on the study's findings, the following recommendations can be made (1) Volleyball coaches and trainers should consider incorporating plyometric training programs into their training routines to enhance the physical abilities of players, regardless of the court surface. These programs can be particularly beneficial for improving explosive power, agility, and speed. (2) While plyometric training was effective in improving physical abilities, it may not be the most suitable method for enhancing offensive skills like spiking and serving. Coaches and trainers should complement plyometric training with skill-specific drills and exercises to develop these aspects of the game. (3) The choice of court flooring should be based on factors such as player preferences, availability, and environmental conditions rather than the expectation of significant skill development differences. Both hard flooring and grass flooring training can be effective, and players should be exposed to various flooring to adapt to different playing conditions. (4) Further research can explore the long-term effects of plyometric training on volleyball players or students and examine other factors that may influence skill development, such as student experience and coaching methods.

References

- Abdul Dayim, M. (1985). *The Effect of a Proposed Program for Developing Basic Skills in Basketball for Youth*, Volume 2, Proceedings of the International Conference, High-Level Sports, Cairo.
- Abu Al-A'la, A. (2003). *Physiology of Sports Training*, 1st ed., Dar Al-Fikr Al-Arabi, Cairo.
- Al-Mousawi, S. (2017): The Impact of a Proposed Training Program in Water Using Ankle Weights on the Development of Some Physical Abilities in Volleyball Players. *Journal of Physical Education, College of Physical Education, University of Baghdad*.
- Al-Rabaidi, K. (2004): *Sports Training for the Twenty-First Century*, 2nd ed., Amman National Library Department, Jordan.
- Bompa, T. (1993). *Power Training for Sport plyometrics for maximum power development*, Mosaic and Oakville. London.
- Boukratem, B., & Madani, M. (2019): The Impact of a Plyometric Training Program on the Development of Maximum Speed and Agility in Football Players. *Scientific Journal of Physical Activity and Sports Sciences*, 16(2).
- de Villarreal E.S.S., Requena B., Newton R.U. (2010) Does plyometric training improve strength performance? A meta-analysis. *Journal of Science and Medicine in Sport* 13, 513-522.
- Dawson, B., Arnot, M. A., & Pinnington, H. (2014). Effect of sand versus grass training surfaces during an 8-week pre-season conditioning program in team sport athletes. *Journal of Sports Sciences*, 32(11), 1001-1012.
- Fawzi, A. A., & Badr Al-Din, T. (2001). *The Psychology of Sports Teams*, Dar Al-Fikr Al-Arabi for Printing and Publishing, Cairo.
- Hussein, Q. H., & Nsief, A. (1988). *Science of Sports Training*, University of Baghdad Press, Iraq.
- Jaksic, D., Lilic, S., Popovic, S., Matic, R. & Molnar, S. (2014). Application of a More Advanced Procedure in Defining Morphological Types. *International Journal of Morphology*, 32(1), 112-118.
- Khalil, M., Halawa, R., & Abu El-Taib H. (2019): The Effect of Plyometric Training in Aquatic Environments on Some Physical and Skill Abilities of Young Soccer Players. *Journal of Educational Sciences Studies*, 46(1).
- Monson, T.A., Brasil, M.F., & Hlusko, L.J. (2018). Allometric variation in modern humans and the relationship between body proportions and elite athletic volleyball. *Journal of Anthropology of Sport and Physical Education*, 2(3), 3-8.
- Pardos-Mainer, E., Lozano, D., Torrontegui-Duarte, M., Cartón-Llorente, A., & Roso-Moliner, (2021). Effects of Strength vs. Plyometric Training Programs on Vertical Jumping, Linear Sprint and Change of Direction Speed Performance in Female Soccer Players: A Systematic Review and Meta-Analysis. *International Journal of Environmental Research and Public Health*, 18(2), 401.
- Rago, V., Silva, J. R., Brito, J., Barreira, D., Mohr, M., Krstrup, P., & Rebelo, A. N. (2019). Switching between pitch surfaces: Practical applications and future perspectives for soccer training. *Journal of Sports Medicine and Physical Fitness*, 59(3), 510-519.