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Plyometric training for physical education university students

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Abstract

The purpose of this research is to analyze and describe the plyometric training of university students in the professional career of physical education. The design is non-experimental, cross-sectional of the descriptive type whose approach is of the quantitative type. The data collection was done through an intentional online survey in which 885 university students participated and responded to eight items voluntarily and anonymously. The results show that university students who practice sports have the desire to want to represent their institution for which they use various plyometric methods for their workouts or daily routines in an informal way that keeps them in a competitive physical state at a regional or national level but not for a competition at an international level. Conclusion. University students perform their own workouts because they believe they have experience in training which is false that is, they themselves create their own daily routines without a professional trainer. They also need an adequate place equipped with trainers with experience in national or international competitions to improve their physical performance. This research has implications for the students because they have to adapt to the rhythm of plyometric exercises to be fit in any national or international competition and the implications for the teachers are that they must take into account which competition they want to participate in to be able to train them as appropriate.

Keywords: Muscular endurance, Physical training, Plyometric training, Sports competitions, Sports competitions, University students.

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1. Introduction

Currently, numerous countries seek to encourage the general population's interest in physical and recreational activity since it is important to promote sports and an active lifestyle [1]. Similarly, physical fitness is essential for sports performance [2] and to achieve good physical condition. There are various methods which include rigorous training programs [3]. Athletes need to develop effective skills to cope with their opponents, including high reactivity and agility [4] while muscular strength often has an explosive force that is essential in most sports disciplines [5]. Training is an effective method to improve physical fitness but there are various training approaches that can be even more beneficial as is the case with plyometric training [6] which can be performed on different types of surfaces [7]. However, it is necessary to take into account several variables to design and implement an effective plyometric training program [8]. Since a deep understanding is required to understand this type of training and its effect on improvement in the physical condition of athletes [9].

It has been proven that plyometric training offers multiple advantages with few adverse effects [10] because plyometric exercise is widely recognized as a fundamental element in neuromuscular training programs [11] in addition to being effective in reducing the risk of knee injuries in athletes during jumping activities or explosive movements [12]. Plyometric training is a crucial tool to enhance explosive capabilities [13]. Plyometric training programs are believed to improve explosive strength and speed [14]. It has been shown in countries such as Indonesia that plyometric training does have very significant effects on increasing agility and explosive strength in athletes [15]. Explosive strength is fundamental to the performance of rhythmic gymnasts and it has been proposed that core stability and plyometric training can enhance it [16]. Similarly, combined plyometric exercises improve the development of strength in the legs and arms of volleyball players [17] which in turn can cause changes in muscle strength which can increase the distance that swimmers travel [18] and have been used to develop strength and precision in the fingers of pianists [19].

The plyometric training protocol has been compared with different training protocols in order to analyze the immediate differences in the performance of athletes [20]. Some studies have attempted to compare the benefits of plyometric training with those offered by weight training [21]. Comparisons have been made with many types of strength training [22] and even contrasted with isometric training [23].

Plyometric training is used in many sports, speaking specifically of volleyball, a high-speed discipline where plyometric training programs play an important role in enhancing the performance of athletes [24] and improving their jumping ability [25] in addition to their strength and cardio respiratory skills [26]. On the other hand, soccer is a team sport that requires great physical demand, including speed, agility and plyometric skills such as changes of direction and jumps [27] to achieve high performance. Players depend on the solid scientific support provided by their coaches who are kept updated through constantly developing research [28]. In addition, there are several situations in which explosive strength plays a crucial role and plyometric training can be a viable alternative to develop this characteristic [29]. It is estimated that plyometric training programs have effects on the explosive strength of the lower body of soccer players [30].

On the other hand, among the many sports that employ plyometric training, we have handball where they seek to improve the performance of athletes through this method [31]. Some coaches have opted for ten-week programs where strength is trained during the first five weeks and the remaining five follow with plyometric training hoping that this sequence can be significantly improved in strength and lower body [32] as it is also expected that players can manage to develop better jumping skills [33]. Similarly, plyometric training programs are employed by rugby players [34]. These athletes employ this type of training on both hard and soft surfaces [35]. Some studies have sought to evaluate the differences between plyometric training and traditional training and their effects on the muscle structure of the players with the sole purpose of looking for significant differences [36]. Plyometric training has also been employed by pencak silat athletes either in its artistic aspect or in combat tactics, since this discipline requires an excellent physical condition as a base [37]. Another style of martial arts that employs this type of training is Judo where some coaches have used physiological or inertial sensors to evaluate its effect on the performance of the practitioners [38]. A similar case is that of taekwondo athletes [39] who use it to develop great kicking strength [40]. It should be noted that several investigations show improvements in physical performance due to plyometric training but a more exhaustive analysis of its impact on technical skills in sports is needed [41], its impact on the psychological well-being of athletes has yet to be explored [42] and there is little information on the ideal rest time in order to improve physical condition [43]. Other studied aspects are the influence of age and gender on the motor adaptation of children and young people to this type of training [44], the effects on the aerobic capacity of the athlete [45] and how the surface influences the outcome of the training program [46].

Plyometric training stands out for its emphasis on muscular strength and power helping to improve the physical performance of students. When combined with weight training it creates a synergy that significantly impacts athletic performance and promotes general well-being such as academic success [47]. In turn, the use of weighted jump ropes has been proposed as a novel and effective alternative to traditional plyometric training particularly for students seeking to improve their explosive power and anaerobic endurance [48]. Plyometric training focusing on explosive strength and jumping skills involves exercises such as box or depth jumps designed to improve muscular power and explosiveness [49].

1.1. Literature Review

Several studies have analyzed the impact of plyometric exercises that reduce ground contact time on leg power and jumping ability [50] also investigating how an external attentional approach during practice produces superior improvements in jumping performance compared to internal attentional approaches or control conditions [51]. Similarly, different applications of plyometric training have been examined from its effect on muscle growth in university students to its influence on the physical preparation of elite handball players [52]. In addition, its impact combined with the administration of creatine monohydrate on anaerobic capacity and muscle damage has been evaluated [53]. Plyometric

training has also been the subject of comparisons with specific exercises in depth jumps either in their vertical or horizontal versions or in combinations of both in relation to running speed [54]. This type of training focused on the lower body and its impact on bone mass, bone indicators and physical condition in university students [55]. On the other hand, in the sports field, understanding the elements that influence the success of a championship program and the practical skills of athletes is essential for managers and administrators [56]. How plyometric training influences the speed of college students over a four-week training period has been extensively studied [57]. The impact of combining plyometric exercises with resistance training on sprint performance in college students with different levels of body fat has been compared [58]. Some countries during the pandemic had to integrate 3D classes to teach physical education classes in educational institutions in order not to leave physical training [59] because fitness and physical attitude are important to maintain a mental and health state in good conditions and even more so when dealing with university students who do not have a personal trainer and they are the ones who keep themselves in acceptable physical conditions to lead a healthy lifestyle but are not competitive [60]. The trainers using virtual reality or other technologies after conducting research groups on physical training with technologies were not very acceptable because university students prefer face-to-face training [61] because they better understand aspects of morality, sports values and personal values as well as reject all kinds of antisocial behaviors [62].

1.2 Justification and Objectives of the Research

Plyometric training should be improved in order for university students to adequately develop their training. Observing the training of university students in training facilities, parks or university gyms does not establish a methodology or pace of training. The plyometric training of university students in physical education will be investigated with the sole purpose of seeking improvements and implementing new training techniques among students to have better results. There are university students who practice plyometric training much earlier because these students have been practicing since high school for some national or international sports competition but in a very informal way. The general objectives are to analyze the different types of training and the different types of exercises that university students perform and our next specific objective is to analyze the effects of the training practices they perform without any professional guidance.

2. Methodology

2.1. Methodology

This applied research has a quantitative approach with a non-experimental correlational design.

2.2. Sample

The population is made up of university students from a public university whose sample will be concentrated in university students of the professional career of physical education who are the ones who participated with a total of 885 students of which there is a homogeneous sample between males (49.4%) and females (50.6%). The age range of the university students was 60.5% between 15 and 20 years old, 25.4% between 21 and 25 years old, 9.4% between 25 and 30 years old and only 4.7% between 30 years old and older. The participating students have experience with training before entering university and during their stay in university they improve their plyometric training.

2.3. Instrument

To carry out the research, the article by Romdhani, et al. [63] was selected from seven articles. This article was much better adapted to our student and local environment because it had the same study characteristics. After selecting the article, we proceeded with the translation from English to Spanish to analyze the research in an easier way and then we proceeded to review each question that was adapted to the Peruvian version to be able to conduct the survey in our environment. Once we selected and adapted the questions we requested, we received the review of four experts in physical training of recognized trajectory who suggested making some arrangements in some words in the questions of the survey. Once, we had the approval of the experts, we proceeded to conduct some pilot tests to measure some statistics and continue with the research. Thus, the Google form was used to carry out the survey and after configuring it to be answered only once and with any email. It was distributed among physical education students from the first cycle to the tenth cycle. The survey provided information that participation was completely voluntary and anonymous and authorization was also requested to proceed with analyzing the data once the research was concluded.

The instrument was adapted for physical education students who trained personally and those who performed their own exercises without the help of a trainer. The survey had two dimensions. The first dimension deals with training and exercise and it has three items. EE1: What sport do you practice frequently? The answers were multiple choice from the sport of soccer to the least practiced rugby then EE2: How many years of sports experience do you have with answers of less than 3 years, 4 to 9 years, 10 to 19 years and more than 20 years? EE3: What method of exercise do you use frequently? Whose answers are multiple choices?

The second dimension which deals with the training practices in your exercise routine has five items. PE1: What are the general purposes of your training? PE2: What type of training do you use? PE3: With whom do you train? PE4: What are the exercises you do constantly? (at least twice a week) and PE5: What are the specific types of training that you can do with the same intensity with multiple choice answers.

2.4. Procedure and Data Analysis

The survey was conducted through a Google form that was shared among students of physical education who in the future will be coaches of various sports at the local, national and international levels. They must be prepared to carry out all types of training and choose the most appropriate for their application with their members. Once the survey began, we proceeded to search for information to put together the introduction and once the survey was over which began in July and ended in September. After finishing the survey, we proceeded to download the file and thoroughly review the data to be adapted and analyzed.

3. Results

Here, we show the results of the dimensions of training and exercise performed by the physical education student. Figure 1 corresponds to item one when asked about which sport you practice frequently, achieving that the sport of soccer has a wide advantage over the other sports, thus the preferences to more than one sport are Fu=football 30% (362), At=athletics 9. 5 % (115), Ci=cycling 5.7% (69), Vo=volleyball 18.2% (220), Bc=basketball 7.4% (89), Bm=handball 4.0% (48), Am=martial arts 3.5% (42) and Ot=other sports 21.8% (263). It is clearly shown that the most preferred sport is soccer followed by volleyball. They do not have an adequate rhythm or coordinated training. The other sports continue at a slow pace but are maintained and other sports are appearing as well as disappearing. In this question, there were answers with more than two options to choose their preference for sports.

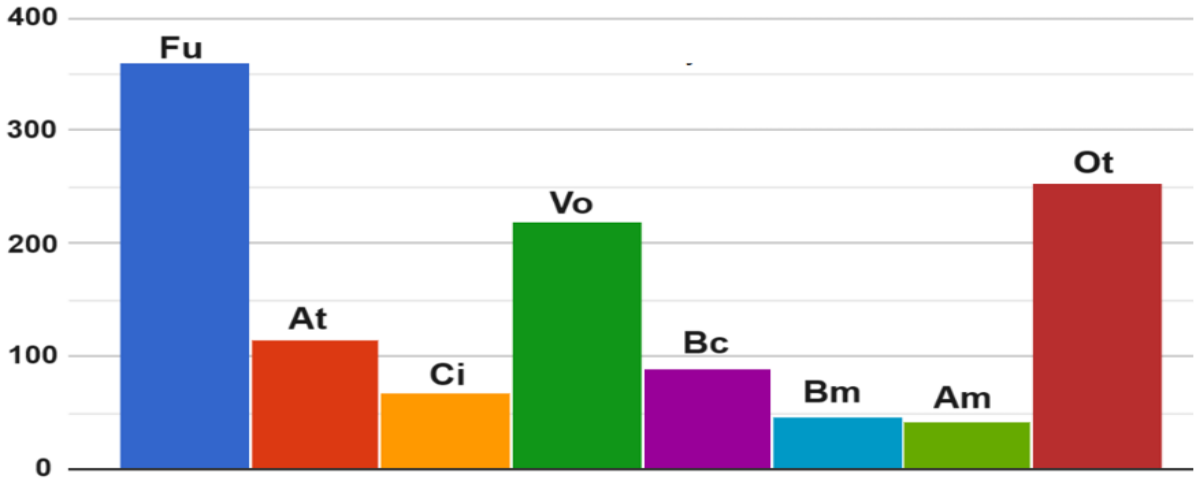

Figure 1.
Distribution of sports preferences by university students.

Figure 2 shows the results of the years of experience that university students have practicing their preferred sport without a coach or guide. Students have been practicing since the youngest ages since elementary or high school but they did it out of obligation It is one of their favorite sports as it is now and with the little knowledge that university students have of the physical education career they practice their training in the best possible way for them, so all physical education students should be oriented to perform an exercise program according to their needs and for which sports they are profiled. The highest percentage is below nine years of experience practicing their sport of choice.

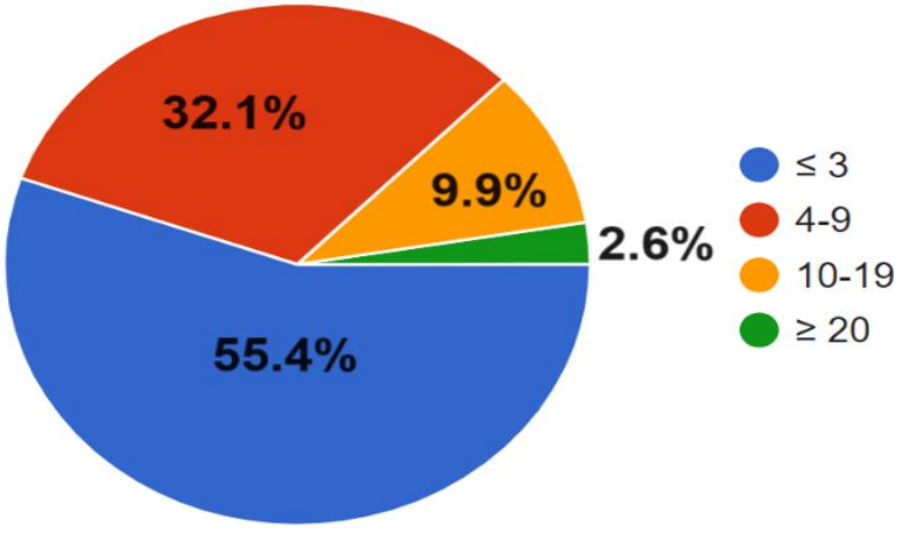

Figure 2.
Distribution of years of experience.

In Figure 3, we have the results of the item that deals with the method used by the university student to exercise whose answers were given by multiple options where the student could choose more than one method to train, so the highest preference was: M1: exercise alone and at home (481), M2: exercise in spaces available in the vicinity of his home (209), M3: exercising outdoors (85), M4: running in a recreational park, sports ground or stadium (126), M5: walking outdoors in non-public facilities (87), M6: borrowing equipment from a sports institute or organization (20), M7: training in the gym (124), M8: training in a sports academy or institute (72) and M9: other types of methods (120).

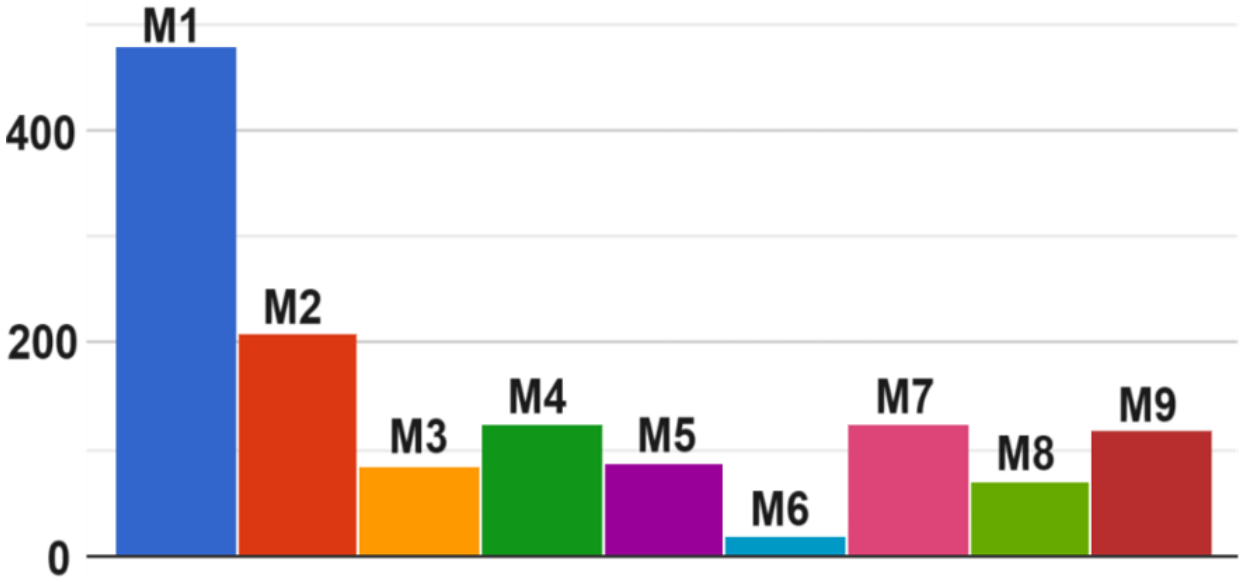

Figure 3.
Distribution of the methods of exercising.

This section shows the responses to dimension two which deals with the training practices performed by the university student in the professional career of physical education.

Figure 4 shows the perspectives of what there are, and with an overwhelming response. P1: to maintain and develop fitness and health 41.5% (628) followed by P2: to maintain and develop technical skills 11.3% (171), P3: to maintain and develop strength and power 9. 4% (143), P4: to maintain and develop muscular endurance 7.3% (110), P5: to maintain and develop abdominal strength 4.6% (69), P6: to maintain and develop flexibility 5.3% (81), P7: to improve muscular balance4.6% (69), P8: to control my weight 10.2% (155) and P9: Other 5.9% (89). Responses were multiple choice i.e. they could choose more than one option.

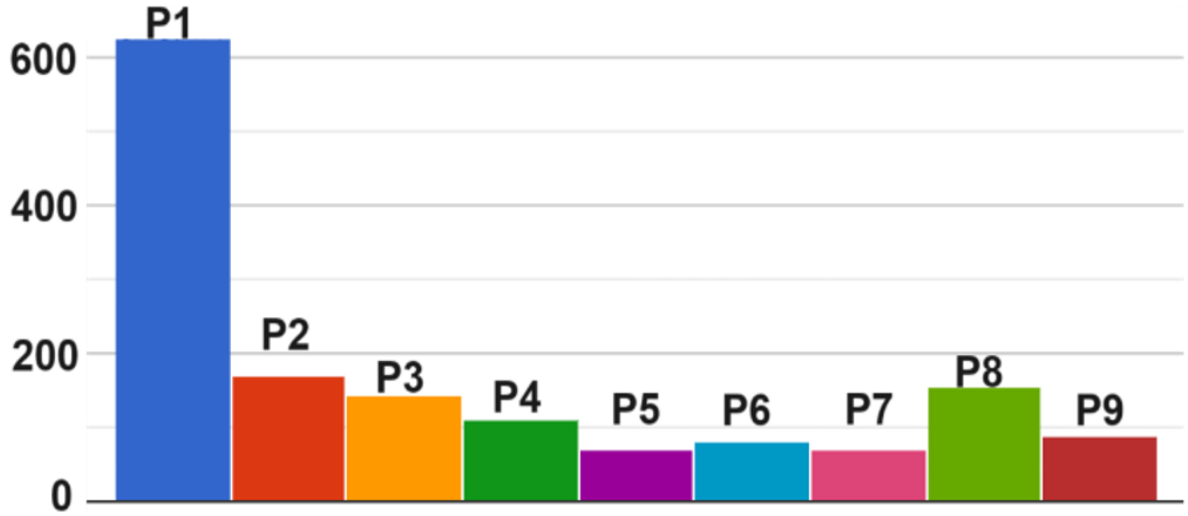

Figure 4.
Distribution of the purposes for training.

Figure 5 presents the results of item five (what type of training program do you use?) with the following results own training program 54%, training program from my gym instructor 9.6%, combined training program (own and from my gym trainer) 11.8%, training material found in an external source (online, social networks, TV, a friend, etc.) 13.3% and other 11.3% showing that there is more than half of university students only use their own program because the student is the one who claims to know his body and is the one who manifests which part of his body needs to be exercised.

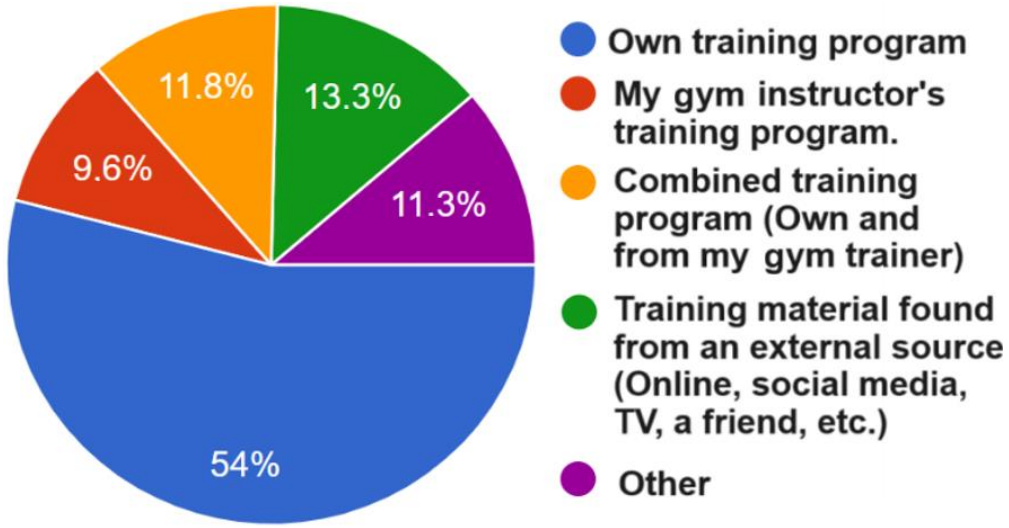

Figure 5.
Distribution of training programs.

Figure 6 shows the results of item six which deals with who you train with whose results are E1: alone 57% (591), E2: in a small group of peers of equal athletic ability 21.4% (222), E3: with family or friends with little athletic ability 14.7% (152) and E4: others 6. 9% (71) showing that the students prefer to train in a personal way, that is to say alone, they do not need a trainer because he knows what their body needs and he can train them, this thought comes because as they study physical education, they manifest to know the subject and feel better training alone.

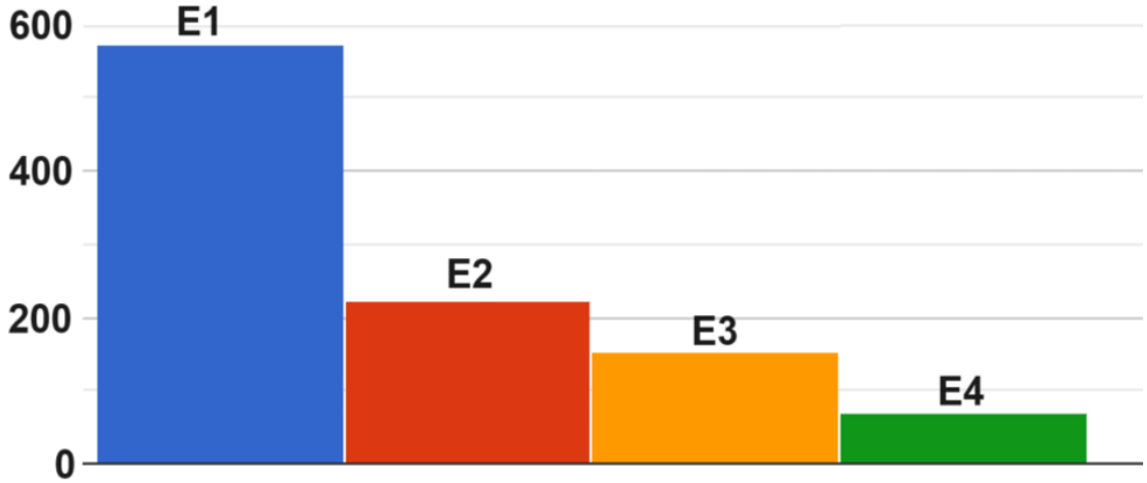

Figure 6.
Distribution of who you train with.

Figure 7 shows the results of item seven which deals with what exercises they perform and whose results are C1: Body weight exercises with limited equipment (calisthenics) 30.9% (376), C2: Weight lifting and strength training with appropriate equipment (dumbbells, barbells, etc.) 16. 1% (196), C3: Technical skills (sport specific skills) imitation or simulation of my sport's techniques 12.6% (153), C4: Cardiovascular training (running, cycling, jogging and rowing) 17.6% (214), C5: Plyometric training (repeated jumps) 8. 2% (100) and 14.7% (179) clearly show that physical education students prefer to perform body weight exercises with limited equipment, i.e. they look for any equipment or means that can serve them as weights or as some exercise instrument and use it to perform their respective exercises because they cannot buy the respective instruments due to economic scarcity or they cannot attend training centers due to authorizations for use or the cost of inscriptions in equipped premises.

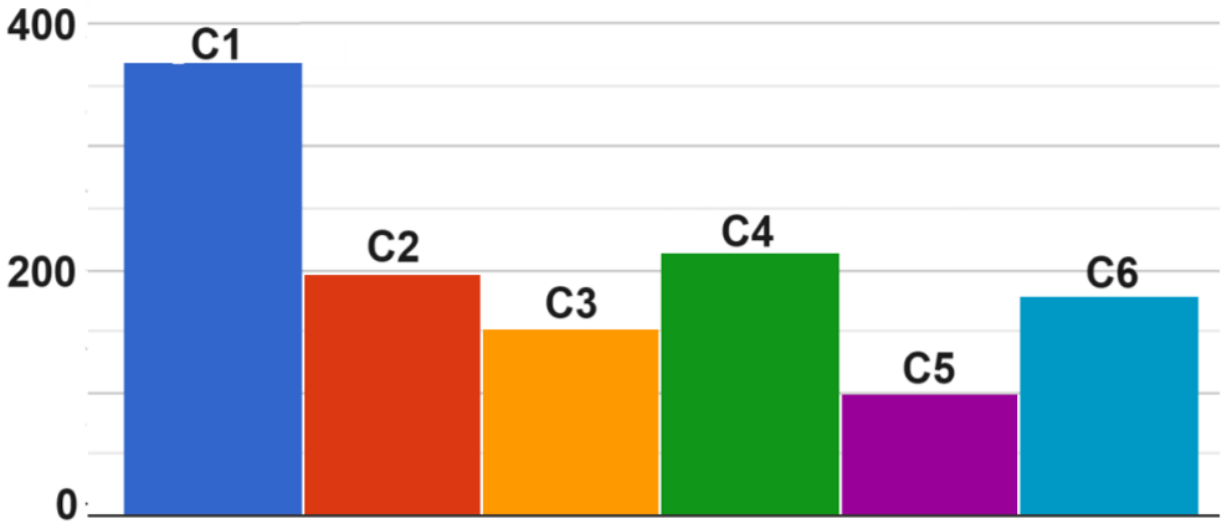

Figure 7.
Distribution of the exercises they practice.

Figure 8 shows the results of item eight which deals with what types of specific training they can perform with the same intensity and the answers were as follows: I1: warm-up and stretching: 43.8% (569), I2: weightlifting training (strength) 14.1% (183). I3: plyometric training (repeated jumps) 7.2% (93), I4: technical skills (specific to my sport) 9% (117), I5: speed training 6.5% (85), I6: endurance training 8.1% (105), I7: interval/intermittent training 3.2% (41) and I8: other 8.2% (106). The majority of physical education students prefer to perform warm-up and stretching and it is this type of warm-up that they can perform with the same intensity.

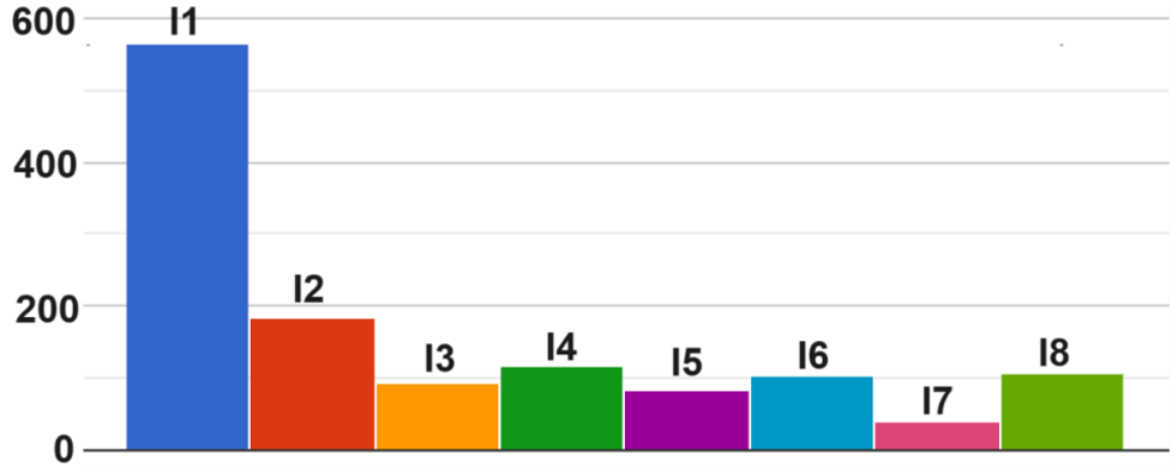

Figure 8.
Distribution of the types of training.

4. Discussion

Plyometric training has a positive impact on tennis players' agility which may be beneficial for their performance on the court. Coaches may consider implementing similar methods to improve their players' skills in this aspect [2]. While specific training can have a positive impact on squat jump and maximal strength performance, the training objectives should be clear and tailored to the type of strength they aim to develop [3]. Thus, plyometric training program with various training approaches can have a positive impact on performance in tests related to change of direction and jumping ability [4] as seen in the effectiveness of plyometric training programs and their effects on strength and reactive agility in athletes [6].

Aquatic and plyometric training have a significant and positive impact on speed and explosive leg strength in adolescent athletes. This supports the efficacy of this type of training as a useful tool to develop physical skills in this age group [7] in addition to having a significant impact on jumping performance. These effects are maintained over a prolonged period of time which may be relevant for athletes and coaches seeking to improve lower extremity strength [9]. These strength training programs have a positive impact on improving muscle strength and lower extremity functional performance in soccer players compared to group plyometric work [10]. Plyometric training exercises are effective in improving muscle strength [11].

There is plyometric training that can modify muscle activity patterns and improve leg joint stability [12] proving to be effective in increasing speed and explosive strength in adolescents and it is estimated that this training model can be applied to elite athletes [14].These are also effective in improving explosive strength and specific performance in rhythmic

gymnastics indicating that coaches could consider applying this type of training improve performance [16]. Plyometric exercises help volleyball athletes improve their vertical jumping ability. However, it is not very effective for increasing muscle strength in the arms [17] as it is difficult to evaluate in depth the effectiveness of plyometric training for improving swimming exit technique [18] because these workouts are effective for improving strength, precision and physiological efficiency of finger movements and not for exit or drive [19].

Both strength training and plyometric training are useful for improving performance in different strength and power related tests in young handball players [22]. Therefore, it is recommended that coaches consider including a combination of plyometric and isometric exercises in their strength training programs as this may result in greater benefit in terms of improved strength and physical performance in athletes [23] but appears to be beneficial for vertical jumping and a specific focus on horizontal jumping is suggested for future research and training programs [25] due to the desire to improve horizontal jumping to compete at the international level. Plyometric training can be specifically modulated based on positional demands in some sports. Furthermore, different positions may require different muscular adaptations to optimize their physical performance [29].

Plyometric training produces significant improvements in physical and technical parameters in male players compared to regular handball practice [31]. It is hoped that future research will continue to explore the effects of plyometric training in both sexes at the adolescent stage which could provide more comprehensive guidance for training youth athletes [37] and that strength and conditioning coaches should consider the results of much research regarding this topic when designing training programs as the inclusion of plyometric training appears to be especially beneficial for improving performance [38] as these plyometric exercises are known to be effective for developing explosive strength and power in the lower extremities which can be beneficial for athletes in various sport disciplines [39]. These plyometric workouts should be under the supervision of an expert so that they can positively contribute to success [40].

Finally, it is important to note that the duration of the plyometric training program can influence the results [41]. These can be particularly beneficial for elite athletes recovering from some surgery for sports injuries by combining different training approaches [42]. These findings provide valuable information for coaches and athletes seeking to improve their performance in all types of sports [45]. These findings provide valuable information on training options and manage to have important implications for those seeking to improve their physical and athletic performance [48] and it is important to highlight plyometric training [53]. These findings possess relevance for both managers and coaches as they highlight the usefulness of plyometric training as an effective means of improving fitness [56] for college students who maintain their lifestyle with a mentally and physically active pace to improve fitness more than anything else versus other students who only perform physical training for some competition [60].

5. Conclusion

The perspectives of plyometric training in university students in physical education have good expectations because they practice this method in a very routine way with which they maintain themselves and try to be in some activity to continue maintaining the rhythm of work and achieve a good physique for some competition.

The university students of the physical education career use the plyometric method in an informal way because they do not have a trainer or guide to perform it correctly but with good results because they manage to have good physical performance and resistance.

It should be implemented in public places and free training centers to achieve a greater number of athletes with good physical performance and with the possibility of having a guide so they can train properly and correctly.

With respect to the limitations that occurred in the research, there was a lack of support from the university to authorize the use of the name of the same, as it was also difficult to locate each student practicing their daily routine because requesting support in university classrooms is a bit difficult. Some colleagues do not allow interrupting classes, much less if it is to conduct a survey or research.

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