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GENÇ FUTBOLCULARDA PLİOMETRİK EGZERSİZLERİN MÜCADELE GÜCÜNE VE AGRESİFLİĞE ETKİSİ

THE EFFECTS OF PLYOMETRIC EXERCISE OF YOUNG SOCCER PLAYERS' TO COMBAT POWER AND AGGRESSIVENESS

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ABSTRACT

Plyometric training is a technique used to increase strength and explosiveness. It consists of physical exercises in which muscles exert maximum force at short intervals to increase dynamic performances. The performing-enhancing effects of plyometric exercises are widely accepted, as is the inclusion of plyos in strength and conditioning programs in soccer. Soccer players are well known for their incredible endurance, running an average distance of six miles during a 90-minute match. However, the game is never played at one speed. Soccer is more about power, consisting of bursts of speed, long distance strikes and leaping goaltenders staving off attacks from airborne forwards. Since soccer is such a fast-paced game based on power, the best workouts for soccer players include plyometric exercises. Plyos allow muscles to achieve maximum force in the shortest time by using the stretch-shortening cycle (SSC), the key to running faster and jumping higher. In this study, we compared 24 young soccer players (14-17 y.o.), who were divided into two groups. One group engaged in their normal soccer training, and the other spent one session per week special training in plyometrics. They followed this regimen for seventeen weeks. We tested numerous typical factors, including sprinting, agility, and jumping. At the end of seventeen weeks, the plyometric group showed significant improvement in most of the tests, such as the twenty-meter sprint, agility test, various jumping protocols, combat power and aggression. This study suggests the power struggle of the players bounce the special training and will contribute in increasing their aggression.

Key words: Plyometric exercise, combat power, aggression, soccer, young players

ÖZET

Pliometrik antrenman, kuvvet ve patlama oranını arttırmak için kullanılan bir tekniktir. Dinamik performansları artırmak için kasların kısa aralıklarla maksimum kuvvet uyguladığı fiziksel egzersizlerden oluşur. Pliometrik egzersiz programlarının, futbolda güç ve kondisyon performans arttırıcı etkileri yaygın olarak kabul edilmektedir. Futbolcular, 90 dakikalık bir maç boyunca ortalama altı millik bir mesafeden geçen inanılmaz dayanıklılıklarıyla bilinirler. Ancak, oyun asla sadece bir hızla oynanmaz. Futbol, gücün ötesinde hız patlamaları, uzun mesafeli vuruşlar ve hücum oyuncuları havadan ataklarından kurtulmak için havaya sıçrayan ve yere atlayan oyunculardan ibarettir. Futbol, temelinde güce dayalı ve hızlı tempolu bir oyun olduğundan, futbolcular gelişimleri için en iyi antrenmanlardan olan pliometrik egzersizleri içerir. Pliometrik antrenman, kasların, daha hızlı koşmanın ve daha yüksek atlamanın anahtarı olan esnetme-kısalma çevrimini (SSC) kullanarak en kısa sürede maksimum güç elde etmesini sağlar. Bu çalışmada 24 genç futbolcuyu (14-17 y.o) iki gruba ayırarak karşılaştırdık. Bir grup normal futbol antrenmanlarına katıldı ve diğer gruba ise haftada bir seans özel pliometrik antrenman uygulandı. On yedi hafta boyunca bu program uygulandı. Sprint, çeviklik ve sıçrama gibi birçok tipik faktörü test ettik. On yedi hafta sonunda, pliometrik grup, yirmi metrelik sprint, çeviklik testi, çeşitli sıçrama protokolleri, mücadele gücü ve saldırganlık gibi testlerin çoğunda belirgin bir iyileşme gösterdi. Bu çalışma, oyuncuların güç mücadelesinin (Combat) özel eğitimle geri döndüğünü ve saldırganlığı arttırmada katkıda bulunacağını göstermektedir.

Anahtar Kelimeler: Pliometrik egzersiz, mücadele gücü, saldırganlık, futbol, genç futbolcular

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INTRODUCTION

Plyometric training (PT) consists of dynamic and rapid stretching of muscles (eccentric action) immediately followed by a concentric of shortening action of the same muscles and connective tissues (Häkkinen, 1985). This training focuses on learning to move from a muscle extension to a contraction in a rapid or 'explosive' manner, such as in specialized repeated jumping. Exercises are of high-intensity, explosive muscular contractions combining strength and speed for acquisitions of benefits in power. PT involves hops and jumps used to capitalize on the stretch-shortening cycle of the muscle (Häkkinen, 1985). The stored elastic energy within the muscle is used to produce more force than can be provided by a concentric action alone. It is distinguished by a rapid deceleration of mass followed immediately by its rapid acceleration in the opposite vertical direction. For the lower limbs, PT entails exercise such as hopping, bounding or drop-jumping (depth jumping) from a raised box or platform and immediately jumping vertically after an 'amortization' period of ground contact (Boocock, 1990). The PT programme typically includes sport-specific exercises including exercises for shoulder and muscles of arms (Carter , 2007; Schulte-Edelmann, 2005) and has traditionally been used for sprinting, jumping, and sports with rapid changes in direction.

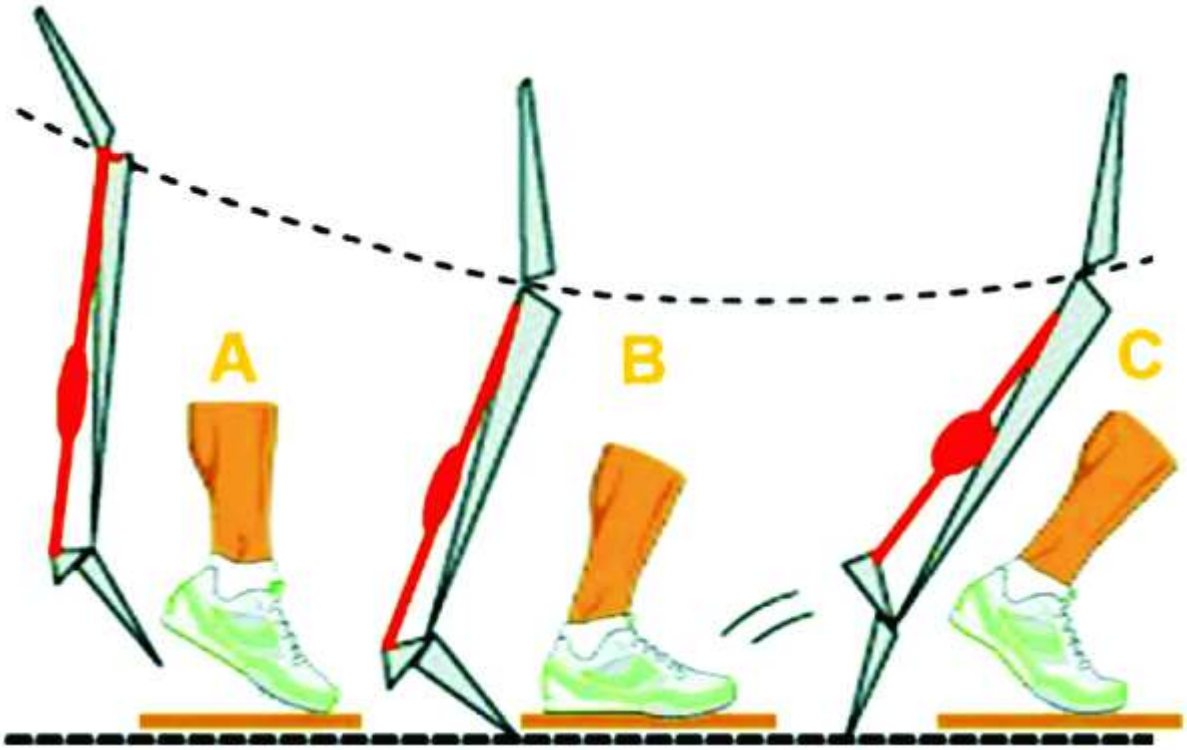

Figure 1.

Basis of PT. The three basis phase of PT include: phase I or eccentric (A) correspond to the preactivation phase or stretch of agonist muscle. Elastic energy is stored in the series elastic component. Muscle spindles are stimulated; phase II or amortization (B) is the pause between phases I and III. Type la afferent nerves synapse with α motor neurons. α motor neurons transmit a signal to agonist muscle group. The phase III or concentric (C) is the shortening of agonist muscle fibers. Elastic energy is released from the series elastic component. α motor neurons stimulate the agonist muscle group. PT, plyometric training.

Benefits of PT in young subjects and adolescents Findings supporting the benefits of repeated and intense physical efforts in young subjects and adolescents, thereby improving motor skills

and body composition in terms of reducing fat mass and enhanced bone health, particularly if sport practice began early, when subjects were pubescent, have been previously identified (Barbieri, 2013; Webb, 1990). These benefits enhance sports performance, and better prepare young athletes for the demands of practice and competition. However, age should be considered for both pre-pubescent and elderly because of hormonal changes, even if it can be concluded that strength training is a relatively safe and healthy practice for children and adolescents.

Soccer is an intermittent, highly-intensive and complex sport. A successful performance is dependent on basic abilities, in particular, repeated explosive burst, strength, power, kicking, tackling, and their derivatives such as jumping, turning, sprinting, and changing pace (Bangsbo, 2006), all making important contributions to the performance of the soccer player. Nevertheless, soccer relies primarily on aerobic metabolic for energy, and it has been suggested that up to 98% of the total energy expenditure during 90 min of the game play is derived from aerobic metabolism (Strøyer, 2004). Aerobic endurance performance in soccer is governed by three interrelated mechanisms including, VO_2 max, lactate threshold and RE (Pate, 1984). The average intensity is high, with a range of 75–80% of VO_2 max, despite periods of recovery (Castagna, 2007; Grieco, 2007). Consequently, maximal oxygen consumption corresponds to the most important component of aerobic endurance performance in soccer (Strøyer, 2004), and there is evidence that indicates maximal aerobic power correlates with soccer success (Castagna, 2007; Wisløff, 1998). Accordingly, a plyometric agility training program may increase the percentage of VO_2 peak in female soccer players (Grieco, 2012), increase several muscle powers and endurance measured after a 6-week PT program in young soccer players (Ramírez, 2015) and improve and maintain the soccer kick for ball speed (Sedano Campo, 2009), thereby confirming the place of PT in skill performance (de Sáez Villarreal, 2015) and decisive determining of neuromechanical training responses in high-level soccer players (Loturco, 2015).

METHODS

Starting and finishing with the biomechanical diagnostics of the squat jump (SJ), counter movement jump (CMJ), and drop jump (DJ) on force plates, kinematic analysis of forehand overhead smashes, anthropometric data as well as force data for pre- and post-test were analyzed. Before and after the biomechanical diagnostics, the players (n=24) undertook an eight week period of plyometric training (2 units per week) with a total of 2286 jumps. Young soccer players (age: 16.0 ± 1.6 years, height: 175.5 ± 9.9 cm, mass: 69.3 ± 11.4 kg) were tested in jumping height and forehand overhead jump-smashes performance. Also aggression invantory test used for young soccer players.

Data Analysis: In the analysis of the data obtained from the research, firstly, descriptive statistics was presented. Then,Pearson correlation analysis and multiple regression analyses with stepwise method were conducted to examinethe relationship between state and trait competition anxiety and aggression levels. All analyses were completed using IBM-SPSS 20.00. The normality of distribution for dependent variables was confirmed with the Shapiro-Wilk Test. Results of the pre- and post-tests were compared using the Pairedsample t test within each group. The differences between pre- and post-tests of the groups analysed with Independent t-tests (2-tailed). Statistical significance was set at $p \leq .05$. Cohen d effect size and effect-size confidence intervals were calculated. Effect sizes were interpreted as small (0.2 – .49), medium (0.50–0.79), and large (≥0.8) (18).

Aggression Inventory: In the study, a 30 -item aggression inventory which was developed by İpek İlter Kiper (Kiper, 1984) is employed in order to determine levels of aggression of football players. This inventory is a 30- itemself-report measure with three subscales of 10 items each. The three subscales include Hostile aggression,Passive aggression and Assertiveness. Using a 7-point Likert scale, respondents indicated the degree to whichthey engaged in the above mentioned dimensions (from not at all to very much so).

RESULTS

Table 1. Descriptive characteristics of groups

Variable	PG (n = 12)		CG (n = 12)		
	Mean	SD	Mean	SD	p
Age (yrs)	12.0	0.0	12.1	0.3	0.33
Height (cm)	150.3	6.2	150.9	6.6	0.83
Weight (kg)	38.4	10.7	44.7	15.2	0.30

Abbreviations: PG, plyometric group; CG, control group

Table 2. Training effects (with 95% confidence limits) for the performance variables of groups

Test	Group	Pre-Test	Post-Test	Performance Change (%)	Effect Size	p
Squat Jump (cm)	PG	15.98 ± 2.76	20.18 ± 3.63a	+26	0.54	0.024b
	CG	17.10 ± 4.77	18.94 ± 3.95a	+10	0.20	
Agility (s)	PG	20.04 ± 1.21	18.82 ± 1.23a	+6	0.44	0.008b
	CG	21.28 ± 1.70	21.74 ± 1.63	-2	0.13	

Abbreviations: PG, plyometric group; CG, control group. a Significant difference from pre-test ($p < .05$). b Significant difference from control group ($p < .05$).

The effect of the seventeen-week plyometric training in junior soccer players significantly increased height of the squat jump (p 0.05; dz = 0.3). Consequently, this form of training is considered essential for the development of junior soccer players. Moreover, the study has shown that the contact height of the head ball was not increased with improved plyometric strength training ($p>0.05$). Therefore, in complex movements, like the head ball, the focus must also be on technical training.

CONCLUSION

The reviewed studies have shown that PT can improve physical fitness in team sport players. The positive effects on explosive power associated with improved performance of the vertical jump, sprint performance and/or agility can be explained by the subject characteristics, in particular a training level, sports activity, age, gender, familiarity with as well as the choice of plyometric exercises and a program design (program duration, volume, rest periods, frequency, the type of exercises and their combination). The present review shows that PT with low intensity or without progressive PT has lower effects than moderately high and progressive PT. Also the combination of plyometric drills is a more effective method compared to single plyometric drills (e.g. DJ, CMJ). Furthermore, the combination of unilateral and bilateral jump drills seems more advantageous to induce significant performance improvements during high-intensity short-term plyometric training in team sport players. It appears that training duration of 6-7 weeks is too short to improve muscular power

in elite players. The general recommendation states that more than 8 weeks of systematic application of PT are necessary to improve physical performance in elite players. This review also shows that short PT (<8 weeks) has the potential to enhance a wide range of athletic performance (i.e. jumping, sprinting and agility) in children and youth amateur players. In addition, available evidence suggests that short-term PT on non-rigid surfaces (i.e. aquatic, grass or sand-based PT) could elicit similar increases in jumping, agility and sprinting performance as traditional PT. Thus, the present review indicates a greater effect of PT alone on jump and sprint (30 m sprint performance only) performances than the combination of PT with sprint/strength training. Moreover, given the specific nature of the selected training modality (plyometric training), their incorporation in the workout routines of technical and tactical training is fundamental for amateur and elite team sport athletes. The gains that were observed should be of great interest for players and coaches as performance in these team sports relies greatly on specific power, sprinting and agility which were shown to be significantly enhanced by many plyometric training regimens. It is thus recommend that team sport coaches implement in-season plyometric training to enhance performance of their athletes. Finally, future research is needed to identify the physiological and hormonal mechanisms responsible for these performance gains. At the end of seventeen weeks, the plyometric group showed significant improvement in most of the tests, such as the twenty-meter sprint, agility test, various jumping protocols, combat power and aggression. This study suggests the power struggle of the players bounce the special training and will contribute in increasing their aggression. The results showed that Hostile aggression was associated with Self-Confidence and Self-confidence was the most important predictor of Hostile aggression.

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