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The effects of supplementary plyometric training on the development of selected motor skills of young football players from Akademia Raków Częstochowa football club

Jak cytować [how to cite]: Szymanek-Pilarczyk M. (2021): *The effects of supplementary plyometric training on the development of selected motor skills of young football players from Akademia Raków Częstochowa football club*. Sport i Turystyka. Środkowoeuropejskie Czasopismo Naukowe, 4, 1, p. 129–138.

Wpływ uzupełniającego treningu plyometrycznego na rozwój wybranych zdolności motorycznych młodych zawodników piłki nożnej Akademii Raków Częstochowa

Streszczenie

Współczesna piłka nożna wymaga od zawodników wysokiego poziomu sprawności i wydajności na boisku. Statystyki meczowe prezentują zwiększoną ilość czynności ruchowych o krótkotrwałej, lecz wysokiej intensywności. W związku z kierunkiem zmian charakteru dyscypliny, poszukiwane są optymalne proporcje kształtowania parametrów motorycznych w treningu piłkarskim.

Celem badań było uzyskanie wiedzy, jak trening plyometryczny wpływa na poprawę wyników skoku w dal oraz skrócenie czasu sprintu na odcinku 5 m w wybranej grupie młodych zawodników Akademii Raków Częstochowa.

Badania zostały przeprowadzone na 24 zawodnikach piłki nożnej Akademii Raków Częstochowa w wieku 16–18 lat. Po zastosowaniu treningu plyometrycznego uzyskano istotnie statystycz-

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nie polepszenie wyników, zarówno w skoku w dal ($p < 0,001$), jak również w sprincie na dystansie 5 m ($p < 0,001$). Zaobserwowano także ujemną korelację długości skoku z czasem biegu na odległość 5 m. Otrzymany wynik był istotny statystycznie ($p < 0,001$).

Zastosowanie wybranego zestawu ćwiczeń plyometrycznych w uzupełniającym treningu piłkarskim w Akademii Raków Częstochowa wpłynęło na polepszenie wyników skoku w dal z miejsca oraz na skrócenie czasu sprintu na odcinku 5 m. Rezultaty zaobserwowano już po 8 tygodniach treningu.

Słowa kluczowe: trening plyometryczny, skok w dal z miejsca, sprint, piłka nożna.

Abstract

Contemporary football requires from players a high level of fitness and efficiency on the pitch. Match statistics display an increased number of short-term movements of high intensity. Due to the changes in the nature of this sports discipline, optimal proportions of shaping motor parameters in football training are sought for.

The aim of the research was to learn how plyometric training influences better results in long jump and decreased sprint time for the distance of 5m in a selected group of young players from Akademia Raków Częstochowa football club.

24 football players from Akademia Raków Częstochowa football club, aged 16–18, were subject of the research.

After using plyometric training, there were statistically relevant better results obtained, both in long jump ($p < 0.001$) and in a 5m sprint ($p < 0.001$). One could also notice negative correlation between the jump length and 5m sprint time. The obtained result was statistically relevant ($p < 0.001$).

The use of a selected set of plyometric exercises in supplementary football training in Akademia Raków Częstochowa football club led to better results in long jump without a run-up and shortened 5 m distance sprint time. The results were observed already after 8 weeks of training.

Keywords: plyometric training, long jump without a run-up, football.

Introduction

Due to growing competition in football, there is a bigger need to increase the efficiency of young football players [14]. In football training, like in the game itself, there are efforts of different intensity level. Walking on the pitch and trotting belong to low intensity efforts. Free run and executing basic technical elements are characterized by average intensity. Activities characterized by high intensity are sprints, jumps, changes of running direction, football kicks. The proportions of efforts during the game depend on how skilled players are and a game style preferred by a given team [8].

Although high intensity efforts statistically take the shortest period of time during the match, they decide to the greatest extent on the course of the match and its result [13]. That is why this type of training stimuli characteristic of football are in high demand [7].

Coaches all over the world look for efficient training methods, which shall improve their players' speed capacity. One of these well-tried methods used for speed capacity and strength development in football is plyometric training [2, 11, 16]. It was developed in 1975 by an American athletics coach, Fred Wilt [10].

Plyometric exercises consist in stretching a muscle before executing a fast concentric contraction. This activity is called the stretch-shortening cycle (SSC) [11]. Training with the use of SSC improves the muscle capacity to generate maximum strength in the shortest time. It also positively affects neuromuscular functions, muscle and tendon flexibility, and reduces the risk of injury [9, 11].

An efficient plan of plyometric training shall reflect a given player's individual needs and abilities. Plyometric exercises can be used within the framework of technical-tactical training and as isolated training. Professional literature shows that using unilateral, bilateral and combined plyometric exercises renders the best results in improving the aforesaid parameters [12].

The aim of the research was to learn how plyometric training influences better results in long jump and decreased sprint time for the distance of 5m in a selected group of young players from Akademia Raków Częstochowa football club.

Research questions

There were the following research questions formulated:

1. Has the set of plyometric exercises in supplementary training used in Akademia Raków positively affected the results of long jump without a run-up and shortened 5 m sprint time?
2. Is there a relationship between the length of long jump and 5 m sprint time?

Material and methods

The research was conducted in two groups of players, aged 16 to 18, representing Akademia Raków Częstochowa football club. The first group (1) consisted of 24 players, whose football skills were advanced but speed and lower limbs strength relatively low. The second group (2) was a control group and consisted of 21 players, the remaining members of the training group, whose speed capacity was at a satisfying level.

The research covered the measurement of long jump without a run-up distance and 5 m sprint time. Speed was measured with the help of Fitlight photocell. The jump distance was measured with the measuring tape, the result was registered at an accuracy of 1 cm. During parameter monitoring, a standard test protocol implemented in Akademia Raków was used (repeatable day in a microcycle, testing technique, rest breaks, warm-up before tests). In both groups, there were

3 measuring cycles, every 8 weeks – at the beginning of the season (July 2020), at the beginning of the autumn round (September 2020) and at the end of the round (November 2020).

In the fixed microcycle plan used in Akademia Raków Częstochowa football club, the players from a selected group characterized by lower parameters of speed capacity completed plyometric training as a supplementary training unit. During this training, they performed long, high, lateral and rotational jumps. A given unit included jumps without and with obstacles: both feet landing on both feet, both feet landing on one foot, and one foot landing on one foot. In each set of exercises the level of difficulty grew by increasing the height of hurdles (15 cm, 30 cm, 45 cm, 60 cm) and determining jump distance. There were also both feet and one foot jumps on the vaulting box used. Similarly to hurdle exercises, the height of the vaulting box was increased – 30 cm, 45 cm, 60 cm, 75 cm. In selected sessions, jumps were combined with a short sprint. The intensity of given training could also be increased by increasing the number of repetitions in a series. When a given player maintained a high technical level of exercises performed, the volume was increased by increasing the number of series. A training session consisted of 4–5 exercises, 2–4 series, 6–16 repetitions each. Initial sessions included 50–60 contacts with the ground, and as the number of training sessions grew, training units for technically skilled players consisted of 100–120 contacts with the ground.

Statistical methods used

The test results were presented in the form of average values and standard deviations of registered variables. The normality of distribution was assessed by the Shapiro-Wilk test. The analysis of variance uniformity was performed with the help of the Brown-Forsythe test, and when a statistically relevant difference occurred, post hoc – the relevance of differences between the tested variables was assessed by the T-Student test for related values within each group. While assessing the relevance of differences in the registered variables between the groups, the T-student test was used for independent groups of the same variance. Moreover, the relationship between the length of the jump and the 5 m sprint time was calculated with the help of the Pearson correlation coefficient.

Test results

The characteristics of the tested groups, taking into account age, body weight, height and BMI, are shown in Table 1. Tables 2 and 3 present test results for the aforesaid parameters.

Table 1. Characteristics of the players participating in the testing programme

	Number	Age [years]	Height x±sd [cm]	Body Weight x±sd [kg]	BMI x±sd [pts]	Training time [years]
Group (1)	24	16–18	179±9	70±9	22±2	6–8
Group (2)	21	16–18	182±7	73±10	20±5	
Differences (1) and (2)	—	—	p = 0.131	p = 0.113	p = 0.216	

Source: own research.

Table 2. Long jump without a run-up results

	Test I x±sd [cm]	Test II x±sd [cm]	Test III x±sd [cm]	Test I and II p	Test II and III p
Group (1)	229±17	240±15	246±11	p = 0.000	p = 0.000
Group (2)	239±14	242±14	244±13	p = 0.055	p = 0.165
Difference relevance between (1) and (2)	p = 0.012	p = 0.315	p = 0.338	—	—

Source: own research.

Table 3. 5 m sprint time results

	Test I x±sd [s]	Test II x±sd [s]	Test III x±sd [s]	Test I and II p	Test II and III p
Group (1)	1.228±0.58	1.096±0.68	1.041±0.61	p = 0.000	p = 0,000
Group (2)	1.105±0.52	1.077±0.58	1.042±0.4	p = 0.029	p = 0.008
Difference relevance between (1) and (2)	p = 0.000	p = 0.000	p = 0.164	—	—

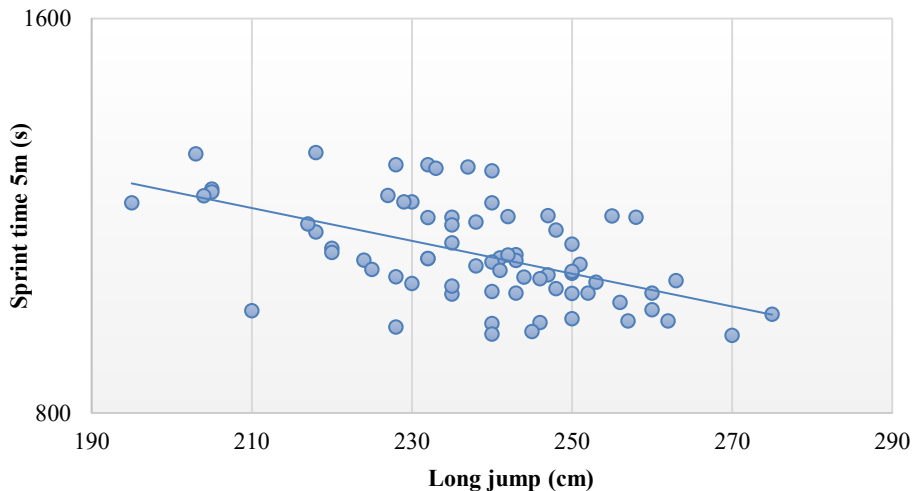
Source: own research.

The performed analysis pertaining to the distribution of the tested variables in both groups shows that the normality of distribution can be assumed. A one-factor analysis of variance in group (1) showed the occurrence of statistically relevant differences between subsequent tests both for long jump without a run-up ($F = 8.6311$; $p = 0.00045$) and speed test ($F = 56.8166$; $p = 0.000$). In the control group, the one-factor variance analysis showed lack of differences for long jump without a run-up between subsequent tests ($F = 0.5823$; $p = 0.5617$), whereas the differences for 5 m average sprint time results turned out to be statistically relevant ($F = 6.8488$; $p = 0.002$).

In group (1) a statistically relevant increase in average long jump length values (by 11 cm) was noted, and a decrease in average values of sprint time (by 0.132 s) was noted in test II in comparison to test I. The next test (III) showed further improvement in long jump without a run-up results and sprint time results in comparison to the results obtained in test II, and this difference was also statistically relevant. However, average results improvement was smaller. The average length of long jump without a run-up was 6 cm longer, whereas the 5 m sprint time decreased by 0.055 s in average.

In the control group there was no significant increase in long jump without a run-up length neither in test II in comparison to test I, nor in test III in comparison to test II. On the other hand, both cases show statistically relevant shortening of 5 m sprint time.

Test I, performed before the implementation of a supplementary session of plyometric training in group (1), shows statistically relevant worse average results both for long jump without a run-up and registered 5 m sprint time in group (1) in comparison to the control group. Once the first training cycle was over (test II), there were no statistically relevant differences between both groups. Similarly, once the next training cycle was completed (test III), there were no statistically relevant differences between the averages of the analysed variables in both groups.



Graph 1. The relation between the results of long jump without a run-up and 5 m sprint time

Source: own research.

Moreover, there was a statistically relevant ($p < 0.001$) relationship between the length of long jump and shortened 5 m sprint time (Graph 1). The Pearson correlation coefficient equalled -0.53 .

Discussion

Plyometric training contains natural forms of movement performed in everyday activities, such as jumps and leaps, which use the SSC system to generate muscle power [6]. Using the form of movement that teenagers find natural, watching proper technique and following the rules of programming of training positively influences the development of young sportspeople in many sports disciplines [2].

The group (1) players participating in the research displayed a high level of technical and tactical skills (they compete in the Central League), but they were selected for supplementary training in order to improve the strength of their lower limbs and their speed. The test results of the footballers from Akademia Raków Częstochowa football club show that supplementary plyometric training combined with football training positively influenced the improvement of the results for the tested variables for all the players. The efficiency of the training used was confirmed by the statistical analysis showing significant improvement in average results. Before the commencement of supplementary training, the players from group (1) reached 229 ± 17 cm on average, which constituted 95.8% of long jump without a run-up of the players from the control group (the average result was 239 ± 14 cm), and average results of both groups differed, which was statistically relevant (see Table 2). After the first 8 weeks of supplementary training in group (1), average results in both groups converged (respectively 240 ± 15 cm and 242 ± 14 cm in group 1 and 2), and differences proved statistically irrelevant (see Table 2). The situation repeated after the next 8 weeks of training (see Table 2). Exactly the same relationship could be noticed in average 5 m sprint time results (see Table 3). The data show that already a period of 8-week supplementary plyometric training used in group (1) made it possible to even out the level of the variables tested in relation to the control group, and the original programme of plyometric training used in Akademia Raków Częstochowa football club proved its efficiency (see Tables 2 and 3).

The positive influence of plyometric training in football training has been also confirmed by other research. The data presented by Meylan and Malatest [11] show that using plyometric exercises led to a significant decrease in 10 m sprint time, better agility and higher countermovement jumps (CMJ). The authors point to other benefits linked to this training method, among all, the fact that it can be used easily in any area and low equipment costs [11]. Professional literature contains numerous research pertaining to the relationship between the length of long

jump and sprint time [5, 17]. The test results pertaining to high jump (CMJ) and 5m sprint obtained by Chelly et al. [4] are similar to the ones presented in this paper. They noticed a significant growth of speed in the distance of 5 m and higher jumps after the implementation of plyometric training for young footballers, with the use of hurdle jumps and long jumps. They also assumed that plyometric exercises should find their place in all-year training programmes. Other authors who noticed improvement in sprint time after an 8-week plyometric training programme are Rimmer and Sleivert [15]. The efficiency of short-term plyometric training is also confirmed by the research conducted by Asadi et al. The authors point out that using such exercises twice a week efficiently improves strength and sprint time of young footballers [1]. Many authors dealing with the aforesaid training method think that plyometric exercises in football training significantly improve lower limb strength and shorten sprint time [2, 12, 16].

Conclusions

1. Using a selected set of plyometric exercises in supplementary football training in Akademia Raków Częstochowa football club improved long jump without run-up results and decreased 5 m sprint time.
2. The players participating in the supplementary training obtained similar results to those in the control group already after 8 weeks of training.
3. The research showed statistically relevant relationship between the length of long jump without run-up and 5 m sprint time.
4. The results obtained confirm numerous opinions presented in professional literature about positive effect of plyometric training on the improvement of strength and speed of young footballers.

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Deklaracja braku konfliktu interesów

Autor deklaruje brak potencjalnych konfliktów interesów w odniesieniu do badań, autorstwa i/lub publikacji artykułu *The effects of supplementary plyometric training on the development of selected motor skills of young football players from Akademia Raków Częstochowa football club*.

Finansowanie

Autor nie otrzymał żadnego wsparcia finansowego w zakresie badań, autorstwa i/lub publikacji artykułu *The effects of supplementary plyometric training on the development of selected motor skills of young football players from Akademia Raków Częstochowa football club*.

Declaration of Conflicting Interests

The author declared no potential conflicts of interests with respect to the research, authorship, and/or publication of the article *The effects of supplementary plyometric training on the development of selected motor skills of young football players from Akademia Raków Częstochowa football club*.

Funding

The author received no financial support for the research, authorship, and/or publication of the article *The effects of supplementary plyometric training on the development of selected motor skills of young football players from Akademia Raków Częstochowa football club*.
