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Influence of 6-Week Pooled Soccer Plyometric and Sprint Training on Speed and Agility amongst Underweight

Syed Ibrahim[1]*, Rajesh Kumar[2], Syed Azhar Ahmed[3]

[1] Physical Education Department, King Fahd University of Petroleum & Minerals, Dhahran, 31261, Saudi Arabia.
[2] Principal, University of Physical Education, Osmania University, Hyderabad, 500007, Telangana, India.
[3] Freelance Physiotherapist, Hyderabad, Telangana, India- 500004.

ABSTRACT

The objective of this inquiry was to know the impact of pooled soccer, plyometric, and sprint drill on speed and agility among underweight males. 26 underweight male subjects were chosen with a BMI (kg/m^2) of less than 18.5. The ages of the subjects ranged from 18-22 years. The physical fitness tests administered before and after the training program was 20m sprint, 40m sprint, and agility. The training plan was engaged for six weeks, 45M per exercise phase, two days per week. The combined workout regime was given as per the schedule, plyometric training combined with sprints for 25 minutes followed by a soccer game for 20 minutes. To compare pre-and post-test, a statistical paired t-test was utilized for all the selected variables. Data was analyzed using SPSS Version 16. The outcome of the current study indicated that the participants had enhanced significantly when prior testing was equated with later testing in 20m, 40m, and agility by (3.41 ± 0.18 vs. 3.18 ± 0.25 Sec; $P < 0.001$), by 4% (6.20 ± 0.46 vs. 5.93 ± 0.36 Sec; $P < 0.001$), and by 3.8% (18.10 ± 0.82 vs. 17.36 ± 0.74 Sec; $P < 0.001$) respectively. It was established that the impact of pooled soccer, plyometric, and sprint drill for underweight participants had shown significant performance in all the chosen fitness components from earlier to later tests, which was very promising and noteworthy.

Keywords: Soccer, Plyometric, Speed, Underweight.

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Corresponding author: Syed Ibrahim
E-mail ✉ sibrahim @ kfupm.edu.sa
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INTRODUCTION

Soccer is a team sport containing different skills and activities such as jumping, tackling, and sprinting. It is the most crowd-pleasing game in the world that is highly acceptable and enjoyable and is performed by the elite and traditional people such as students, staff, the elderly, children, obese, males, females, or underweight [1]. In a soccer match, less than 10m sprints occur every 90 seconds [2-4]. Stolen et al. (2005) found out that 3% of playing stint and 1-11% of the distance moved are taken by sprinting in a match [5]. They also confirmed that most of the sprint bouts are shorter than 30m and about half of the sprints are less than 10m in the distance [5].

Plyometric training is a type of workout including stretching the muscles rapidly and immediately contracting forcefully to develop a rapid movement, and stretch-shortening cycle [6]. Plyometric training enhances the central nervous system activities that in turn improve speed and muscular performance. Jumping and hopping are plyometric exercises that aim to enhance muscular performance in sport [7]. Several studies probed the impact of plyometric drills on speed among male subjects [7-13]. Conflicts occurred between previous studies; some indicated no significant difference between groups [14, 15]. Others found out significant change after training between groups [8-10, 12, 16]. Few studies have applied plyometric training, indicating an improvement in some sport skills such as agility [17-19].

The successful performance of sprinting is one of the main contributors in many sports. Ross et al. (2009) and Markovic et al. (2007) indicated that sprinting contains three phases; acceleration stage, maximum period, and deceleration time [12, 20]. The hip and the knee extensors contracted explosively to accelerate speed are the main body parts contributing to the acceleration phase [12, 20]. The hip and the ankle extensors are the utmost utilized portion of the body in the maximum phase [21, 22]. Few studies confirmed that no training effects were observed between groups after sprint training, at 20m sprint time among male subjects [16]. One study showed significant differences between groups after sprint training at 20m sprint time by 3.1% [12]. Kumar (2015) and Markovic et al. (2007) found out substantial changes among groups in the agility test after sprint training by 1.5% and 4.3%, respectively [6, 12]. An investigation probed the influence of 6-weeks pooled plyometric and sprint exercise on 30m sprints among youth male soccer players at the national level [23]. They indicated no significant differences between groups at 30m sprint time after training.

A person considers underweight if his BMI is below 18.5 kg/m^2 [24]. Underweight is a well-being issue linked with certain medical conditions, including malnutrition, hyperthyroidism [25], cancer [26], tuberculosis [27], T.B, diabetes, HIV/Aids, and depression. Underweight individuals did not get the appropriate attention from the researchers and the scientists [28-30]. In our investigation and review process, we had not found a single study on the influence of 6-weeks pooled soccer, plyometric, and sprint exercise for speed and agility for underweight male participants. The objective of this examination was to know the influence of pooled soccer, plyometric, and sprint exercise on speed and agility amongst underweight males.

MATERIALS AND METHODS

Subjects

A group of 26 male underweight students from KFUPM, aged between 18 to 22 years partook in this research work as participants. The selection of subjects depends on a BMI less than 18.5 kg/m^2. The subjects were educated not to perform any soccer game, plyometric, and sprint exercise outside this study. All subjects were encouraged to apply sprint training with maximum speed and the plyometric exercises with maximum height and short foot contact time. Subjects were asked to land on their tosses when landing. Besides, subjects were given guidelines to retain their daily nutritional intake to the end of the study. All subject's questions were answered and the procedures, the threats, and the gains allied with the investigation were explained.

Procedures

Before the start of training, subjects were weighed on (Balance- Seca -Germany) to the nearest 0.1 kg in their shorts and shirt. Stadiometer was used to measure the height close to a cm. The four sites on the body that constituted the biceps, triceps, abdominal, and subscapular were selected to measure the skin folds with the help of a Harpenden Skinfold caliper [31]. Fat-free mass was estimated by multiplying the body mass of % body fat then deducting the outcome from the figures of body weight. Body Mass Index was estimated by dividing the body weight (in kg) over the height (in m^2). The adaptation phase took place before one week of the start of testing to familiarize subjects with the testing, and the procedures of training. The training program was employed for 6 weeks, 2 days each week for 45M per training session. Plyometric training combined with sprints performed for 25 minutes and followed by a soccer game for 20 minutes. Physical fitness tests such as 20m sprint, 40m sprint, and agility were performed before and after training. The physical characteristics; age, height (H), Body Mass (BM), Body Mass Index (BMI), % Body Fat (%BF), Free Fat Mass (FFM) were also estimated at the start and conclusion of the training. The plyometric exercises that were used in the training program were three; single-leg hops, double leg hops, and frog jump.

All subjects were demonstrated to apply the three drills (5 reps x 3 sets) in the W 1 and then increase it to (10 reps x 3 sets) in the W 5. In the preceding week of the exercise, the load and volume were decreased for reducing stress in muscles before the post-assessment tests (4 reps x 2 sets). After each set of plyometric and sprinting exercises, a resting period was given to all subjects in which ranged between 30 – 60 seconds and 60 – 120 seconds between combined drills. The sprinting was performed immediately following each plyometric drill for 40m (double leg hops x 3 sets), 30m (single leg hops x 3 sets), and 20m (frog jumps x 3 sets).

Data Analysis

Data was analyzed using mean, SD, and t-test (paired) to match the start and end measures for all physical characteristics and fitness test variables for all subjects. The significance level was P < 0.05. Calculation of the data was completed by utilizing SPSS (Version 16, SPSS).

RESULTS AND DISCUSSION

Table 1. The Physical Characteristics (mean ± SD) Calculated at Start and the End of Exercise Regime

Components	N	Tests	Underweight Training Group Mean ± SD	Sig. (2-tailed)
Age (y)	26	Pre	18.50 ± 0.51	
Height (cm)	26	Pre	171 ± 0.05	
Body Mass (kg)	26	Pre	50.63 ± 4.61	P < 0.001
	26	Post	52.94 ± 4.90	
BMI (kg/m^2)	26	Pre	17.06 ± 1.11	P < 0.001
	26	Post	17.92 ± 1.34	
Body Fat (%)	25	Pre	9.60 ± 2.56	P > 0.05
	25	Post	9.98 ± 3.04	
Free Fat Mass (kg)	25	Pre	45.48 ± 3.83	P < 0.001
	25	Post	47.27 ± 3.62	

Pre: start of training, Post: end of the training, N: number of subjects, SD: standard deviation, kg: kilograms, Sig: significant (P < 0.05), P > 0.05: not significant

It can be seen from **Table 1** that underweight subjects increased their BM significantly after training by 4.5% (50.63 ± 4.61 vs. 52.94 ± 4.90 kg; P < 0.001) when the end-test was equated with start-test. A noteworthy rise in BMI after training by 5% (17.06 ± 1.11 to 17.92 ± 1.34 kg/m^2; P < 0.001) was shown in **Table 1**. There are also significant increases in FFM after training by 3.9% (45.48 ± 3.83 to 47.27 ± 3.62 kg; P < 0.001) from pre- to post-test. The %BF showed no change after training (9.60 ± 2.56 to 9.98 ± 3.04 %; P > 0.05) when the start-test mean value was compared with an end-test.

Table 2. Represents Two Speed Distances Calculated at the Beginning and Conclusion of the Test

Components	N	Tests	Underweight Training Group Mean ± SD	Sig. (2-tailed)
20m Sprint (Seconds)	26	Pre	3.41 ± 0.18	P < 0.001
	26	Post	3.17 ± 0.25	
40m Sprint (Seconds)	24	Pre	6.19 ± 0.45	P < 0.001
	24	Post	5.92 ± 0.35	

Pre: before training, Post: after training; SD: Sig: significant (P < 0.05), N; the number of subjects, m: meter

The paired t-test revealed significant improvement in 20 sprint time mean values after training by 7% (3.41 ± 0.18 to 3.17 ± 0.25 Seconds; P < 0.001 and 40 m sprint time by 4.3% 6.19 ± 0.45 to 5.92 ± 0.35 Seconds; P < 0.001) respectively, as seen in **Table 2**.

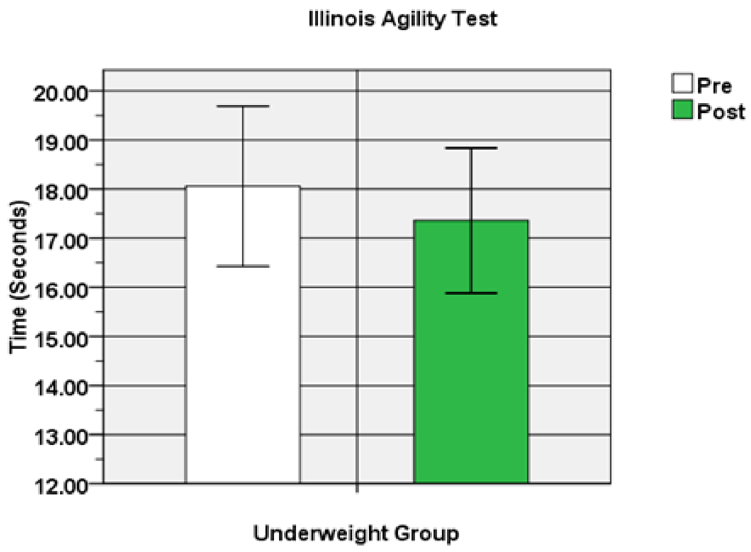

Figure 1. Illinois Agility Test Means (± SD) Calculated at Pre- and Post-exercise

Figure 1. Indicated that underweight subjects significantly decreased their agility mean values after training by 3.8% (18.05 ± 0.81 to 17.35 ± 0.73 Seconds; $P < 0.001$) when pre-test was equated with a post-test.

The present research work evaluated the impact of pooled soccer, plyometric, and sprint exercise regime on speed and agility among underweight males. The key results of this investigation revealed that after six weeks of combined workout, underweight participants improved their physical characteristics (BM, BMI, and FFM) and fitness variables (20m sprint, 40m sprint, and agility) significantly. These results are interesting because the underweight subject's body mass increased by 2.31kg and FFM by 1.79 kg. However, the % BF increased slightly by 0.520 kg insignificantly. This is evident that underweight subjects gain more muscle mass which may enhance muscle power and lead to an improvement in speed and agility. Substantial hypertrophy can be brought by the execution of plyometric exercise alone [32].

The result of 20m sprint time was in agreement with several previous studies [12, 13, 33, 34]. However, one study was not in agreement with this finding which found out that training groups have similar sprint time values after training [35]. Thomas correlated the impact of 2 plyometric exercise packages on power and agility in young football players. The conflict between Thomas and our study may be due to the use of similar plyometric drill techniques; drop jumps and countermovement jumps [35], small sample size (12 subjects in both groups) [36], and different subject types (trained soccer players) by Thomas. 20m sprint represents the acceleration period; in this stage, the hip and the knee extensors were the main body parts used mostly by the subjects to accelerate speed [21, 37]. The underweight subjects' trained 12 training sessions by plyometric drills (single leg hops, double leg hops, and frog jumps) and uses short sprint bouts such as 20m and 30m. These exercise approaches strengthen the hip and knee extensors and participated in influencing the exercise benefits of enhanced accomplishment amongst the underweight subjects. The other reason may be the reduction in ground interaction times from < 200 milliseconds at acceleration stage to < 100 milliseconds at maximum speed [38]. The result of the 40m sprint in our study was analogous to the outcomes of several previous investigations that studied the effects of different training regimens [8, 10, 15, 16, 34, 39]. Mero et al. (1992) and Wiemann & Tidow, (1995) established that the hip and ankle extensors were the chief contributing parts of the body in the maximum phase (40m sprint) which may advance power by sprinting and plyometric exercise regime [21, 22].

Agility is the ability of the body to modify the pathand is influenced by acceleration and deceleration stages of speed [38]. The result of Illinois agility time is in agreement with the earlier research works [6, 12, 17, 18, 35, 40]. Investigation of two studies established the influence of plyometric exercise intervention on the Illinois agility test [17, 18]. The enhancement in agility can be credited to better motor recruitment of neural adaptation [18], muscle hypertrophy [32], and Knee extensor strength [21, 37]. The development of coordination between the CNS signals and proprioceptive feedback brings neural adaptation [19].

CONCLUSION

It is established that 6 weeks of pooled soccer, plyometric, and sprint excise intervention induce outstanding training effects on 20m, 40m sprint, and agility performances by showing greater improvement from pre- to post-test among underweight male participants.

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ETHICS STATEMENT: Hereby, I , Syed Ibrahim consciously assure that for the manuscript "Influence of pooled Soccer plyometric and spring training on speed and agility of underweight", the following is fulfilled:

1) This material is the authors' own original work, which has not been previously published elsewhere.
2) The paper is not currently being considered for publication elsewhere.
3) The paper reflects the authors' own research and analysis in a truthful and complete manner.
4) The paper properly credits the meaningful contributions of co-authors and co-researchers.

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