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Araştırma Makelesi

9-12 YAŞ ERKEK YÜZÜCÜLERDE 8 HAFTALIK PLİOMETRİK ANTRENMANIN SPRİNT YÜZME PERFORMANSINA ETKİSİNİN İNCELENMESİ

EXAMINATION OF THE EFFECT OF AN 8-WEEK PLYOMETRIC TRAINING ON SPRINT SWIMMING PERFORMANCE IN MALE SWIMMERS AGED 9-12 YEARS

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9-12 Yaş Erkek Yüzücülerde 8 Haftalık Pliometrik Antrenmanın Sprint Yüzme Performansına Etkisinin İncelenmesi

ÖZ

Bu çalışmanın amacı; 9-12 yaş arası erkek yüzücülerde, 8 hafta boyunca, yüzme egzersizine ek olarak kombine bir şekilde uygulanan pliometrik egzersizin, sprint yüzme performansı üzerine etkilerini incelemektir. Çalışmaya 20 erkek sporcu gönüllü olarak katılmıştır. Katılımcılar deney grubu (n: 9) ve kontrol grubu (n: 9) olmak üzere iki gruba ayrılmışlardır. Deney grubuna pliometrik egzersiz öncesi adaptasyon için haftalık antrenman programına ek olarak 3 haftalık genel kuvvet egzersizi uygulandıktan sonra 8 hafta boyunca haftalık antrenman programına ek olarak pliometrik egzersiz yaptırılmıştır. Pliometrik egzersiz 72 saat aralıklarla ve haftada 2 gün olacak şekilde uygulanmıştır. Pliometrik egzersizler 2 saatlik antrenman seansının ilk saatine entegre edilerek uygulanmıştır. Kontrol grubu yalnızca haftalık antrenmanlarına devam etmiştir. Yüzücülere 8 haftalık pliometrik egzersiz öncesi ve sonrası 25 m ve 50 m serbest stil yüzme performans ölçümü uygulanmıştır. Çalışmadan elde edilen verilerin değerlendirilmesinde Windows için SPSS 22 paket program kullanılmıştır. Çalışmada testler arasındaki farklılıkların belirlenmesi amacıyla bağımsız örneklem t testi ve eşleştirilmiş örneklem t testi analizi kullanılmıştır Yapılan 8 haftalık antrenman periyodu sonrasında; yüzme antrenmanına entegre edilmiş bir şekilde pliometrik egzersiz uygulayan, deney grubu sporcularının, 25 m serbest stil yüzme ve 50 m serbest stil yüzme performanslarında gelişme gözlemlenmiştir. Yalnızca yüzme antrenmanı uygulayan kontrol grubu sporcularının ise, 25 m serbest stil yüzme ve 50 m serbest stil yüzme performanslarında anlamlı bir farklılık tespit edilmemiştir. Bu çalışmadan elde edilen sonuçlar ergenlik öncesi dönemdeki erkek yüzücülerde pliometrik egzersizin sprint yüzme performansını geliştirdiği belirlenmiştir. Gelecekte yapılacak olan çalışmalarda; ergenlik öncesi dönemdeki yüzücüler üzerinde farklı kuvvet antrenmanlarının, yüzücülerin performansı üzerine etkileri araştırılabilir.

Anahtar Kelimeler: Pliometrik antrenman, kombine antrenman, sprint yüzme, ergenlik öncesi

Examination of The Effect of an 8-Week Plyometric Training on Sprint Swimming Performance in Male Swimmers Aged 9-12 Years

ABSTRACT

The purpose of this study is to observe the effects of combining plyometric exercises with swimming exercises on the sprint swimming performance of male swimmers aged 9–12 over an 8-week period. 20 athletes participated in the study voluntarily, but 2 athletes voluntarily left the study during the testing phase. Participants were divided into two groups: the study group (n = 9) and the control group (n = 9). The study group underwent 3 weeks of general strength training as part of their weekly training programme to adapt before starting plyometric training. After the adaptation period, the group continued with plyometric training for 8 weeks, in addition to their weekly training programme. Plyometric training was applied at 72-hour intervals, twice a week, and was integrated into the first hour of the 2-hour training session. The control group only continued their weekly training. The SPSS 22 package programme for Windows was used to evaluate the data. In the study, independent sample t-tests and paired sample t-tests were used to determine the differences between the tests. 25- and 50-m freestyle swimming performance measurements were taken from swimmers before and after 8 weeks of plyometric training. After the 8-week training period, a significant difference was observed in the 25- and 50-m freestyle swimming performances of the athletes in the study group who incorporated plyometric exercises into their swimming training. No significant difference was found in the 25- and 50-m freestyle swimming performances of the control group athletes who only underwent swimming training. The results obtained from this study showed that plyometric exercise improved sprint swimming performance in pre-adolescent male swimmers. In light of this information, future studies can investigate the effects of different strength training programmes on performance in pre-adolescent swimmers

Keywords: Plyometric training, combined training, sprint swimming, pre-adolescence.

INTRODUCTION

Plyometric training consists of rapidly stretching the muscles (eccentric movement), followed by shortening the same muscles and connective tissues (concentric movement). These exercises are high-intensity stretch-shortening exercises used to enhance speed, explosiveness, and power[1]. Plyometric training generally includes exercises that involve movements such as jumping and throwing[2]. Plyometric exercises, which are primarily used in sports that involve sprinting, jumping, and changing direction, can be applied to various parts of the body for both the lower and upper extremities[3 4]. Furthermore, it can be applied to various surfaces and shapes, including sand, water, wood, grass, and gymnastics mats. Plyometric exercises with different application methods are a widely used type of training in swimming[5 6 7].

Swimming, as a competitive sport, is popular worldwide and has been included in the Olympic programme since the first modern Olympic Games in 1896. Today, competitive swimming includes 16 Olympic pool events ranging from 50 to 1500 metres, with race durations varying from approximately 21 seconds to 15 minutes[8]. Swimming, besides being a sport, is a type of exercise that helps people have fun, become physically stronger, and improve their health problems. Swimming, when practiced from a young age, requires regular breathing and harmonious movement of the body. It can provide various benefits, such as increased lung capacity, the development of coordination, and reduced reaction time[9].

There are limited studies investigating the effect of plyometric training on pre-adolescent swimmers. For this reason, it is thought that this study will contribute to the existing literature. Additionally, it is thought that the results of the study will provide valuable information to sprint swimmers and their coaches about increasing their performance and monitoring their development through plyometric exercises in training. The aim of this study is to examine the effects of combining plyometric exercise with swimming exercise for 8 weeks on the performance of male swimmers aged 9–12 years in 25- and 50-m freestyle swimming.

MATERIAL AND METHODS

Research Group

The sample for this research was taken from the Gaziantep Tennis and Swimming Sports Club. The study included 18 male swimming athletes, with an average age of 10.5 years, an average training experience of 4.5 years, and an average of 11 hours of training per week (Table 1). Participants consist of individuals who regularly engage in swimming training and do not have any health issues. Individuals participating in the study and their parents were informed about the study prior to its commencement. Considering the participants' voluntary participation in the study, they were included in the study after providing voluntary consent forms, which also included permission from their parents.

Experimental Procedure

A quasi-experimental design with a pretest-posttest control group was used in the research. 20 athletes participated in the study voluntarily, but 2 athletes voluntarily left the study during the testing phase. Participants were divided into two groups: the study group (n = 9) and the control group (n = 9). In order to prepare the study group for plyometric training, a 3-week general strength training programme was implemented

prior to the weekly training program. Following this, an 8-week plyometric training programme was added to the weekly training regimen. Plyometric training was conducted with a 72-hour interval and 2 days a week. Plyometric training was incorporated into the first hour of the 2-hour training session. The control group only continued their weekly swimming training. There was no difference in training volume between the two groups. For the research, ethics committee approval was obtained with decision number 20 and dated 2021 from the Hatay Mustafa Kemal University Non-Interventional Clinical Research Ethics Committee. This study was conducted in accordance with the Principles of the Declaration of Helsinki.

Study Programme

Table 1. Study Programme

Week 1: Medicine ball throw (500 g) - 3 sets of 10 reps with a 5-minute rest between sets
Week 2: Sit-ups with a medicine ball (3 kg)- 3 sets of 10 reps with a 5-minute rest between sets
Week 3: Bench press with a medicine ball (3 kg) 3 sets of 15 reps with a 5-minute rest between sets
Week 4: Medicine ball throw (3 kg) - 3 sets of 10 reps with a 5-minute rest between sets
Week 5: Bench press with a medicine ball (3 kg) - 3 sets of 15 reps with a 5-minute rest between sets
Week 6: Sit-ups with a 3 kg medicine ball, 3 sets of 15 reps with a 7-minute rest between sets
Week 7: Lying down medicine ball throws (3 kg)- 3 sets of 15 reps with a 7-minute rest between sets
Week 8: Bench press with a medicine ball (3 kg) -3 sets of 15 reps with a 7-minute rest between sets

The exercises in the training plan are considered independently of the warm-up and cool-down exercises. They represent approximate durations, as the repetitions in the training will be taken into account.

Data Collection

Before the study, information on the athletes' age, sports experience, weekly training duration, and weekly training frequency was collected. Additionally, height and weight measurements were taken. All training and measurements were carried out at a pool temperature of 27°C. Performance measurements for 25- and 50-m freestyle swimming were conducted before and after the 8-week study.

Data Analysis

Statistical analyses of the data obtained from this study were performed using the SPSS 22.0 programme (SPSS Inc., 2021; Chicago, Illinois, USA). Descriptive analyses were conducted to determine means and standard deviations. The Shapiro-Wilk test was applied to check whether the data exhibited a normal distribution. As the data followed a normal distribution, the Independent Samples T-Test and Paired Samples T-Test were used to determine the differences between the tests. The statistical results were evaluated at the significance level of $p<0.05$.

RESULTS

Table 1. Anthropometric and Demographic Characteristics of the Participants

	N	Minimum	Maksimum	Average	Sd
Age	18	9,00	12,00	10,94	0,99
Height	18	131,10	168,50	146,78	9,92
Weight	18	25,10	55,20	41,57	8,56
Sports Age	18	1,00	8,00	4,50	1,97
Weekly Training Duration	18	6,00	22,00	11,00	3,51
Weekly Training Number	18	3,00	11,00	5,55	1,75

According to Table 1, the average age of the participants was calculated as 10.94 ± 0.99, the average height as 146.78 ± 9.92 cm, and the average weight as 41.57 ± 8.56 kg. The average sports age was calculated as 4.50 ± 1.97 years, the average weekly training duration was 11.00 ± 3.51 hours, and the average weekly training number was 5.55 ± 1.75.

Table 2. Comparison of 25 And 50 m Freestyle Swimming Pre-Test Results of Study and Control Groups

	Group	N	Average	Sd	t	p
Pretest 25 m	Study	9	17,11	2,15	-2.00	0.06
	Control	9	19,11	2,06		
Pretest 50 m	Study	9	38,44	4,74	-2.23	0.04*
	Control	9	43,51	4,88		

*p<0.05

According to the results of the independent samples t-test analysis conducted to compare the pre-test results of the study and control groups in 25-m freestyle swimming, no significant difference was detected (p>0.05). The pre-test results of the study and control groups for the 50m freestyle swimming were analyzed. A significant difference was observed between the pre-test results of the study group and the control group (p <0.05).

Table 3. Comparison of 25 and 50 m Freestyle Swimming Post-Test Results of Study and Control Groups

	Group	N	Average	Sd	t	p
Post test 25 m	Study	9	16,13	2,29	-2.49	0.02*
	Control	9	18,61	1,88		
Post test 50 m	Study	9	36,57	4,69	-2.63	0.01*
	Control	9	42,32	4,57		

*p<0.05

According to Table 3, a significant difference was found between the post-test results of the study group and the control group for the 25 m freestyle (p<0.05). A significant difference was found between the post-test results of the study group and the control group in the 50 m freestyle swimming (p<0.05).

Table 4. Comparison of the Control Group's 25 and 50 m Freestyle Swimming Pre-Test and Post-Test Results

Control Group	N	Average	Sd	t	p
Pretest 25 m	9	19,11	2,06	1.50	0.17
Post test 25 m	9	18,61	1,88		
Pretest 50 m	9	43,51	4,88	1.84	0.10
Post test 50 m	9	42,32	4,57		

*p<0.05

According to the analysis of the pre-test and post-test results for the control group's 25 m freestyle swimming, no significant difference was found between their post-test time and pre-test time (p>0.05). According to the analysis of the pre-test and post-test results for the control group in the 50m freestyle swimming, no significant difference was found between the post-test time and the pre-test time (p>0.05).

Table 5. Comparison of the Study Group's 25 and 50 m Freestyle Swimming Pre-Test and Post-Test Results

Study Group	N	Average	Sd	t	p
Pretest 25 m	9	17,11	2,15	6.97	0.00*
Post test 25 m	9	16,13	2,29		
Pretest 50 m	9	38,44	4,74	5.15	0.00*
Post test 50 m	9	36,57	4,69		

*p<0.05

According to the analysis comparing the pre-test and post-test results of the study group's 25 m swimming, a statistically significant difference was found in the post-test time compared to the pre-test time for freestyle swimming ($p<0.05$). According to the analysis comparing the pre-test and post-test results of the study group's 50m swimming, a statistically significant difference was found in the post-test time compared to the pre-test time ($p<0.05$).

DISCUSSION

In the current literature, there are few studies investigating the effect of plyometric exercise on the performance of pre-adolescent swimmers in short distance swimming. The data obtained from this study observed that combining plyometric exercise with swimming training for 8 weeks improved the 25 m and 50 m freestyle swimming performances of male swimmers aged 9–12 years old. In a study examining the effect of strength training on swimming performance, researchers observed that combining strength training with swimming training was more effective in improving athletes' performance compared to those who solely trained in swimming[8]. In a study investigating the optimal training load to enhance swimmers' performance, it was observed that low-load strength training improves swimmers' performance similarly to medium- and high-load strength training[10]. As a result of another study investigating the effects of strength training on swimmers' performance, it is believed that low-intensity, high-speed resistance training programmes are the most effective method for improving performance[11]. These studies, which demonstrate the positive effects of strength training on the performance development of swimmers, align with the findings of our study.

Apart from the studies examining the effect of plyometric exercise on swimmer performance, many different exercise types are included. Plyometric long jump training: In a study examining the effects of swimming on kinetics, kinematics, and starting performance, it was observed that kinetic and kinematic parameters improved and the starting performance of swimmers increased as a result of gradual plyometric long jump training for 9 weeks[12]. As a result of a 6-week study comparing the effects of vertical jump training and maximum strength training on swimmers' sprint and starting performance, it was observed that athletes performing maximum strength training showed improvement in their sprint and starting performances. However, no improvement was observed in athletes performing vertical jump exercises[13]. The results of our study were found to be dissimilar to those of the other study, primarily due to differences in research methodology.

In a separate study, researchers applied jumping exercises in combination with swimming training during a short-term (17-day) altitude camp. They observed an improvement in the athletes' squat jump and swimming starting performances[14].

Similar to the land training in our study, it was observed that the short-distance sprint performances of swimmers improved as a result of a 9-week study. This study involved water resistance exercises as well as bench press and medicine ball throwing exercises[15]. The results of these studies, in which plyometric exercise improved swimmers' short-distance performance, are similar to the results of our study, where plyometric exercise improved performance in 25 and 50 m swimming events.

In a study conducted on pre-adolescent boys, it was observed that the athletes' short-distance swimming performance improved as a result of integrating plyometric exercise into the first hour of their normal swimming training, 2 days a week for 8 weeks[16]. A similar study conducted on pre-adolescent girls showed that plyometric exercise improved the performance of swimmers[17]. The results of these two studies, which have similar training duration and volume as our study, also yield similar findings. In a study examining the effect of plyometric training on freestyle somersault rotation and the performance of swimmers, no significant difference was found between the plyometric training group and the normal swimming training group when the results of freestyle somersault rotation and 50 m swimming time were examined[18]. It is believed that the disparity between our study results and the study results in question may be attributed to the longer duration of training and the implementation of plyometric exercises targeting the lower extremities. It was observed that the starting and returning performances of adolescent swimmers improved as a result of integrating plyometric exercises into their swimming training twice a week for 6 weeks[19]. The results of this study, in which plyometric exercise improved the performance of swimmers, are similar to the results of our study. As a result of a 10-week study that included explosive-oriented exercises, such as throwing medicine balls and jumping, in pre-adolescent male swimmers, researchers observed an improvement in the swimmers' 50m swimming performance[20]. The results of this study are similar to the results of our study.

Bench press, full squat, countermovement jumping, countermovement jumping with free-arm movement, and medicine ball throwing exercises were implemented once a week, in addition to swimming training, in an 8-week study. The study observed an improvement in the swimmers' performances in the 50- and 100-m short-distance swimming events[21]. The results of this study, in which plyometric training improved the short-distance performance of swimmers, are similar to ours. In another study examining the effects of strength training on land on swimming return performance, it was concluded that plyometric strength training is an effective method for improving swimming return performance[22]. As a result of an 8-week study examining the effect of plyometric exercise combined with swimming training on the performance of male and female swimmers aged 10–13 in 15 m, 25 m, and 50 m freestyle swimming, an improvement was observed in their short-distance swimming performance[23]. In a separate study conducted on athletes aged 10–13, it was observed that plyometric exercise improved short-distance times in all swimming styles[24]. The results of these studies, which have a similar training duration and volume to our study, are consistent with our study results. Considering the studies that have been done, it appears that strength training has positive effects on swimmers' short-distance performance. These results are similar to the findings of our study, which investigated the impact of plyometric exercise on the performance of 9–12-year old male swimmers in short-distance swimming. As a result of a study, it was observed that plyometric jump training

can improve the physical fitness and sport-specific performance parameters of water sports athletes, such as swimming[25].

When examining the studies in the literature, it appears that strength training is generally important for the performance development of swimmers, despite some inconsistent results with our study. It is believed that plyometric strength training, specifically, has a significant impact on the performance improvement of swimmers. As a result of our study, it has been observed that combining plyometric exercise with swimming training for 8 weeks significantly improved the 25 m and 50 m freestyle swimming performances of male swimmers aged 9–12 years old. It is believed that the results obtained from this study provide valuable information for short-distance swimmers and coaches. In future studies, it is thought that it may be useful to investigate the effect of plyometric exercises on the performance of pre-adolescent swimmers in different swimming styles, as well as the effect of plyometric exercises on long-distance swimming performance.

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