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Research on scientific methods of explosive force training in track and field training

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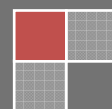
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ABSTRACT

Scientific and reasonable explosion and usage of force can mobilize and release the explosive forces of track and field athletes to the greatest degree. And single training method can not meet requirements physiological basis of explosive force, and only the organic combination of a variety raining modes can explore the potential of track and field athletes more scientifically. This study is to train the athletes through the organic combination of various training methods, and illustrates that through the experimental data and theoretical analysis the training method of combining the fastest speed with minimum load and minimum power with maximum load is the most effective way to explore the explosive force of track and field athletes. In the track and field sports, explosive force is the key factor affecting athletes' performance. Track and field events like the short span, jumping, and throwing particularly ask for explosive force of the athletes, so the explosive force training of the track and field athletes has been paid more and more the attention of coaches and researchers, which the research on explosive force training become a hotspot. This study focuses on the explosive force training of track and field sports enthusiasts in college. By using different training methods as well as combining different training schemes, different training effects are obtained. Then a large number of experiments show the scientific and reasonable training program can largely improve the explosive force of track and field enthusiasts. Some even can quickly improve their explosive force in a short period of time, making gratifying achievements in track and field events or sports. Therefore a good combination of training modes has significant practical value to improve the explosive force of track and field athletes.

KEYWORDS

Track and field sports; Explosive force training; The combination of training methods; Scientific and reasonable training method.



INTRODUCTION

The explosive force plays a crucial role in the track and field sports, and directly affects the athlete's achievement^[1]. How to explore and train the explosive force of athletes has been a problem concerning the coaches and scientific research in the track field. Now, although there are a lot of studies on the athletes' explosive force training in track and field, but few of these studies are further researches^[2]. The testing results of the body composition of the research subject show that, the skeletal muscle content of the research subject has increased, but the percentage of body fat did not significantly reduce. This indicates that eight weeks can improve the control ability of the muscle as well as develop muscle, increasing the absolute content of skeletal muscle. But eight weeks are not long enough to change the fat content in terms of the body fat percentage which may be related to the strength of strength training. With insufficient strength of the training, fat can not be effectively reduced. But according to the theory, the increase of skeletal muscle content, will inevitably lead to the increase of basal metabolic rate. If time is long enough, the percentage of body fat is bound to be reduced. And the research selects the common people who have not got any force training as research subjects. Through the experiment, the muscle strength of these common people has got increased^[3], which is regarded as the result of the improvement of the regulatory ability of the nervous system. And different results may occur if it came to a professional athlete. But, the experimental subjects selected in this study are athletes with professional sports background. And after eight-week strength training, the explosive forces of lower limbs of the research subjects have been significantly improved as the same. Therefore, in addition to the above two reasons, it is believed that vibration training has made great contribution to improve the ability of the nerve system to coordinate muscle and a combination of good training methods have good practical value of improving the explosive force of track and field athletes.

RESEARCH SUBJECTS AND METHODS

The research subjects are 24 male college students who are track and field athletes at the same time with the average age being about 20 years old and a good level of training. First, test the content of skeletal muscle and body fat percentage^[4]. Because the body composition test requires of empty stomach, the test time is set in the morning. And test subjects are asked to do no strenuous exercise before the test and to be topless and barefoot during the test; test environment should have constant temperature and humidity. In the next morning after the training, take another test of the body composition. Standard level of mean significant test selects 0.05, and the training methods and standards are shown in TABLE 1.

TABLE 1 : Strength, content, number and speed of the 5 explosive force trainings

Genre	Strength	Content	Number of group	Training Speed
1	Bare hand	5 times continuous deep jump	3	fast
2	30% mvc	6-10 times weight-bearing deep half squat	3	fast
3	100% mvc	4 times weight-bearing deep half squat	3	fast
4	100% mvc	4 times weight-bearing deep half squat + 3 times jump deep	3	fast
5	100% mvc	4 times weight-bearing deep half squat + 3 times long jump and stride in air	3	fast

TABLE 2 shows the three explosive force levels before and after various explosive force trainings, and the changes of indicators. After eight-week strength training, test results show that the body composition of the research subjects in both the vibration group and control group has changed with increasing content of skeletal muscle but no significantly reduce of the percentage of body fat. It means that the eight week can not only improve the control ability of the muscle but also develop the muscle, increasing the absolute content of skeletal muscle. But eight weeks are not long enough to change the fat content in terms of the body fat percentage which may be related to the strength of strength training. Compared significance test is made about the changing values of various testing indicators before and after the training.

TABLE 2 : Increasing values of testing indicators before and after various explosive force trainings

Genre	standing long jump (m)	30m running (s)	anaerobic power (kg./s)
bare-hand deep jump	\bar{x} 0.048 S 0.0029	\bar{x} 0.12 S 0.0060	\bar{x} 8.65 S 0.021
30% mvc deep half-squat	\bar{x} 0.05 S 0.0031	\bar{x} 0.10 2 0.0064	\bar{x} 8.65 S 0.21
100% mvc deep half-squat	\bar{x} 0.137 S 0.0029	\bar{x} 0.18 S 0.0062	\bar{x} 48.12 S 1.87
100% mvc deep half-squat + bare-hand deep jump	\bar{x} 0.189 S 0.0043	\bar{x} 0.19 S 0.0070	\bar{x} 55.34 S 1.44
100% mvc deep half-squat + long jump and stride in air	\bar{x} 0.181 S 0.0034	\bar{x} 0.19 S 0.0087	\bar{x} 54.03 S 1.21

EXPERIMENTAL PROCESS AND ANALYSIS OF THE RESULTS

Through the practice of track and field training in many years, it is shown that single strength training is not suitable for improving the explosive force, and especially the effect of fast practice with small and medium load is not obvious^[5]. But according to the theory, the increase of skeletal muscle content, will inevitably lead to the increase of basal metabolic rate. If time is long enough, the percentage of body fat is bound to be reduced. This study verifies that by vibration training, the explosive force of human lower limbs can be improved, and the reasons may have the following several points: first, the joint of vibration training at the beginning of strength training can improve the ability of the nervous system on regulating the muscles which has no exact explanation on the mechanism. But some hypotheses have made related interpretation. Through vibration training, synchronization of human motor units is improved and the synergistic effect of different body muscle groups is facilitated, which inhibits the working of antagonistic muscles. This hypothesis can not only explain the effect of vibration training on improving the explosive force of human lower limbs, but also shows that vibration training can improve CMJ performance. Secondly, some researches select the common people who have not got any force training as research subjects. Through the experiment, the muscle strength of these common people has got increased, which is regarded as the result of the improvement of the regulatory ability of the nervous system. But different results may occur if it came to a professional athlete. But the experimental subjects selected in this study are athletes with professional sports background. And after eight-week strength training, the explosive forces of lower limbs of the research subjects have been significantly improved as the same. Therefore, in addition to the above two reasons, it is believed that vibration training has made great contribution to improve the ability of the nerve system to coordinate muscle. Different from daily training, vibration training can improve the coordinating ability of the body more effectively, and improve the explosive force and absolute power. So in explosive force training, only with continuous breakthrough of the limitation of "muscle reserve" and "speeding force" can the explosive force really got improved, namely obtaining good explosive force. The indexes of the body situation of the two experimental groups is shown as TABLE 3.

TABLE 3 : The indexes of the body situation of the two experimental groups

Group(n=8)/indexes	age(year)	Height(cm)	Weight(kg)
Experimental group1	18.75±1.58	189.88±7.28	85.75±8.43
Experimental group2	19.38±1.77	191.50±8.09	86.25±7.32
P value	0.55	0.45	0.87

From TABLE 3, the P value of age statistical results of experimental group q is 0.55 which is bigger than 0.05. The joint of vibration training at the beginning of strength training can improve the ability of the nervous system on regulating the muscles which has no exact explanation on the mechanism. But some hypotheses have made related interpretation. Through training, synchronization of human motor units is improved and the synergistic effect of different body muscle groups is facilitated, which inhibits the working of antagonistic muscles. And P value of the weight is 0.87 which is bigger than 0.05, indicating that difference between the weights of the two groups is not significant.

TABLE 4 : The survey results of the four physical quality indexes of the two groups' subjects

Index/group (n=8)	Experimental group1	Experimental group2	P value
Standing jump(SJ) (m)	2.90±0.08	2.88±0.11	0.34
Counter movement jump(CMJ) (m)	2.99±0.09	2.97±0.10	0.49
Jump with auxiliary running (m)	3.21±0.08	3.23±0.07	0.55
half squat 1RM (kg)	142.50±11.65	141.24±14.82	0.83

TABLE 4 shows that the P value of the experimental group 1 in the index of SJ is 0.34 which is bigger than 0.05. Some researches select the common people who have not got any force training as research subjects^[6]. Through the experiment, the muscle strength of these common people has got increased, which is regarded as the result of the improvement of the regulatory ability of the nervous system. And different results may occur if it came to a professional athlete. But, the experimental subjects selected in this study are athletes with professional sports background. And after eight-week strength training, the explosive forces of lower limbs of the research subjects have been significantly improved as the same. Therefore, in addition to the above two reasons, it is believed that vibration training has made great contribution to improve the ability of the nerve system to coordinate muscle. Different from daily training, vibration training can improve the coordinating ability of the body more effectively, and improve the explosive force and absolute power. In addition, during the vibration training, another possible reason of the improvement of the explosive force of lower limbs is the change of blood circulation made through vibration training. The body's blood circulation gets strengthened through the vibration training which effectively promotes the function of hormones of the body, and improves muscle strength.

TABLE 5 : Difference test of the two groups on the four physical quality testing indexes after the experiment

Index	Group	Pre-experiment	After the experiment(the 8 th week)	T value	P value
Standing jump(SJ) (m)	experimental group 1	2.90±0.08	2.95±0.08	-15.15	0.00<0.01
	experimental group 2	2.88±0.11	2.92±0.01	-13.13	0.00<0.01
Counter movement jump(CMJ) (m)	experimental group 1	2.99±0.09	3.03±0.09	-11.19	0.00<0.01
	experimental group 2	2.97±0.10	3.03±0.11	-9.20	0.00<0.01
Jump with auxiliary running (m)	experimental group 1	3.21±0.08	3.29±0.08	-9.71	0.00<0.01
	experimental group 2	3.23±0.07	3.33±0.09	-7.77	0.00<0.01
half squat 1RM	experimental group 1	142.50±11.65	157.5±11.33	-7	0.00<0.01

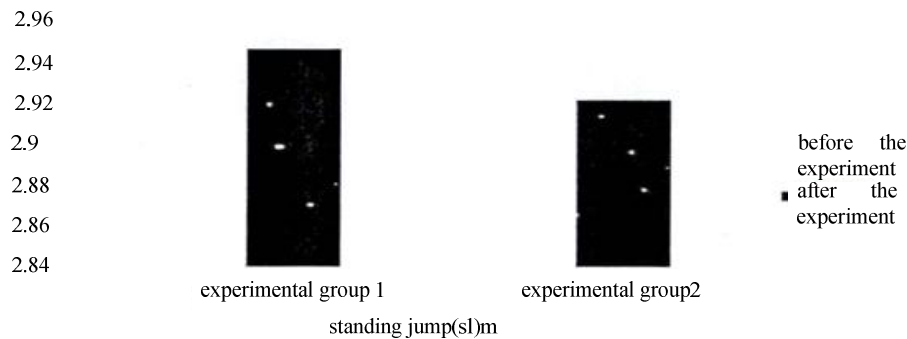


Figure 1 : Comparison of standing jump (SJ) results before and after the experiment

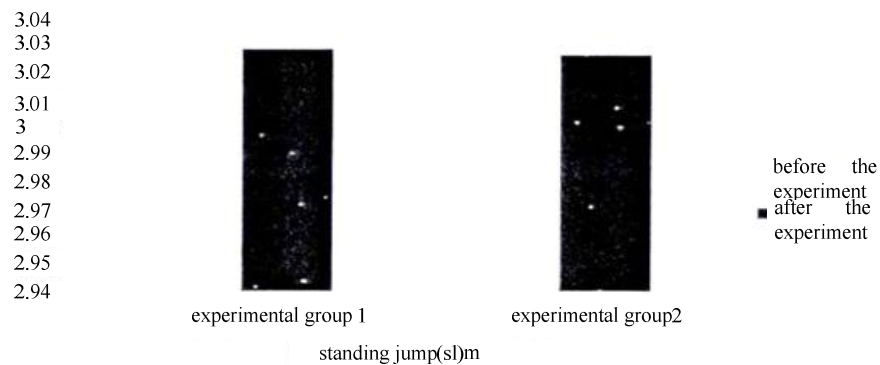


Figure 2 : Comparison of counter movement jump (CMJ) results before and after the experiment

From TABLE 5, Figure 1 and Figure 2, it can be seen that research subjects in both experimental groups need to test their body composition on standing jump(SJ), counter movement jump (CMJ) and jump with auxiliary running before and after the experiment^[7]. In the body composition test, the using instrument is body composition instrument Inbody310, which is produced in South Korea, and mainly used to test contents of skeletal muscle and body fat percentage. Because the body composition test requires of empty stomach, the test time is set in the morning. And test subjects are asked to do no strenuous exercise before the test and to be topless and barefoot during the test; test environment should have constant temperature and humidity. In the next morning after the training, take another test of the body composition.

In this study, instrument used in the test is vertical jumping test instrument, which belongs to the national physique monitoring system, and can be used to measure the height. Before the test, subjects in the study are asked to conduct the jogging to warm up, and warm up time is about 10 minutes. After warm up, the subject can start the test. Each subject takes three tests with interval of 20 seconds, and the best score is to be recorded. After training, body composition test and CMJ test are both carried out in the next morning to monitor and observe the changes of physical quality, and the analyzed results are shown in Figure 3:

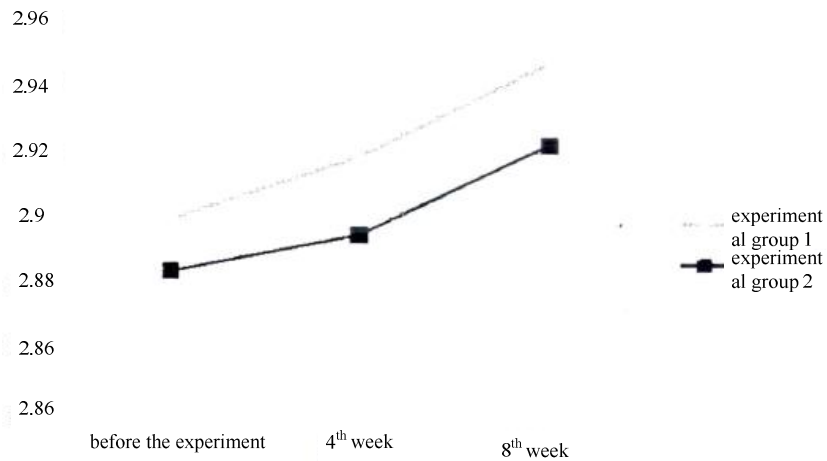


Figure 3 : The change of average score of standing jump (SJ) during experiment process

Two kinds of combination training are both with “the greatest strength training +30% the maximum load and fast speed” training mode, and the two training methods have different maximum force load. This study selects professional athlete to receive strength training which lasts eight weeks. After the training, the scores of vibration group and control group have significant improvement, which means that the athletes' explosive force of lower limbs has been obvious improved. Besides, it also means that with scientific and reasonable training method, even professional athletes still can further strengthen the explosive force of their lower limbs through strength training. The test results of the body composition of the research subjects show that, the skeletal muscle content of the research subjects has increased, but the percentage of body fat does not significantly reduce. It means that the eight week can not only improve the control ability of the muscle but also develop the muscle, increasing the absolute content of skeletal muscle. But eight weeks are not long enough to change the fat content in terms of the body fat percentage which may be related to the strength of strength training. With insufficient strength of the training, fat can not be effectively reduced. But according to the theory, the increase of skeletal muscle content, will inevitably lead to the increase of basal metabolic rate. If time is long enough, the percentage of body fat is bound to be reduced.

This study verifies that by vibration training, the explosive force of human lower limbs can be improved, and the reasons may have the following several points: first, the joint of vibration training at the beginning of strength training can improve the ability of the nervous system on regulating the muscles (Figure 4) which has no exact explanation on the mechanism. But some hypotheses have made related interpretation. Through variation training, synchronization of human motor units is improved and the synergistic effect of different body muscle groups is facilitated, which inhibits the working of antagonistic muscles that forms the slow force sending dynamic stereotype.

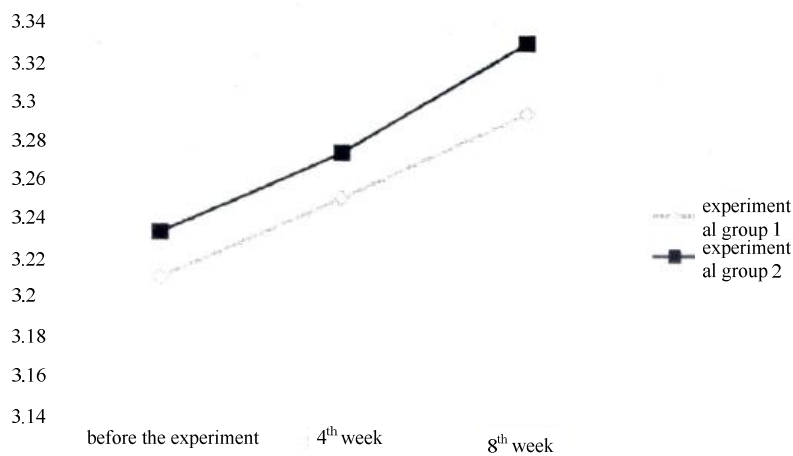


Figure 4 : The change of average score of jump with auxiliary running during experiment process

The maximum strength training and jump with 30% 1RM weight is bound to take after the maximum load training. This hypothesis can not only explain the effect of vibration training on improving the explosive force of human lower limbs, but also shows that vibration training can improve performance. Secondly, some research selects the common people who have not got any force training as research subjects. Through the experiment, the muscle strength of these common people has got increased, which is regarded as the result of the improvement of the regulatory ability of the nervous system. And

different results may occur if it came to a professional athlete. But, the experimental subjects selected in this study are athletes with professional sports background. And after eight-week strength training, the explosive forces of lower limbs of the research subjects have been significantly improved as the same. Therefore, in addition to the above two reasons, it is believed that vibration training has made great contribution to improve the ability of the nerve system to coordinate muscle. Different from daily training, vibration training can improve the coordinating ability of the body more effectively, and improve the explosive force and absolute power.

In addition, during the vibration training, another possible reason of the improvement of the explosive force of lower limbs is the change of blood circulation made through vibration training. The body's blood circulation gets strengthened through the vibration training which effectively promotes the function of hormones of the body, and improves muscle strength. OUYANG Xiuxiong selected 22 normal students in the colleges and universities to study, and respectively use the vibration frequency of 30Hz and 50Hz to do the experiment. And the experimental results show that in 5 minutes, skin blood flow of both the two groups of subjects have significantly increased, and both are rapid elongate and contract movements with maximum strength exercises and light load of.

Seeing from the training effect, the training has a very significant effect on improving the scores of four indexes of physical quality. And from the domestic and foreign existing research results, in the study of vibration training, the most important thing to diversify the training program is the selection of the frequency and amplitude^[7]. Because during the vibration training, whether human nerve system and muscle can bear load is determined by the frequency and amplitude. And amplitude in the range of 2-4mm is mostly used in the selection of the amplitude. But in the study of vibration training, few of them are about different amplitude. In the selection of vibration frequency, a large number of researches show that vibration frequency in 30-50 can achieve the best effect of training muscles. The present research selects the frequency of 30Hz, with the amplitude of 2mm, and the training scheme is appropriate. It can fully satisfy the need of the explosive force and absolute strength of lower limbs even for track and field athletes with a professional sport background which indicates that the second method is than the first one.

The index of half squat 1RM reflects the maximum strength of human lower limb which refers to the highest force value showing in muscles overcoming the resistance through maximum free contraction. Some researches select the common people who have not got any force training as research subjects. Through the experiment, the muscle strength of these common people have got increased^[3], which is regarded as the result of the improvement of the regulatory ability of the nervous system. And different results may occur if it came to a professional athlete. But, the experimental subjects selected in this study are athletes with professional sports background. And after eight-week strength training, the explosive forces of lower limbs of the research subjects have been significantly improved as the same. Therefore, in addition to the above two reasons, it is believed that vibration training has made great contribution to improve the ability of the nerve system to coordinate muscle. Different from daily training, vibration training can improve the coordinating ability of the body more effectively, and improve the explosive force and absolute power.

CONCLUSION

This study focuses on the explosive force training of track and field sports enthusiasts who are college and university students. By using different training methods as well as combining different training schemes, different training effects are obtained. And a large number of experiments show the scientific and reasonable training program can largely improve the explosive force of track and field enthusiasts. Some even can quickly improve their explosive force in a short period of time, making gratifying achievements in track and field events or sports. Therefore a good combination of training modes has significant practical value to improve the explosive force of track and field athletes.

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