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Effect of complex and contrast resistance and plyometric training on selected strength and power parameters

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Abstract
The purpose of this study was to evaluate the effects of a complex training program, a combined practice of weight training and plyometrics, and contrast resistance and plyometric training on selected strength and power parameters in young healthy athletes. Thirty young male athletes, aged 19–21 years old, from the Department Of Physical Education and Sports Sciences, Annamalai University were selected as subjects. They were grouped into two with fifteen members of each. Group 1 served with complex training program and Group 2 with contrast training program. Experimental training was given for 3 months duration (4 days/week). Selected strength such as leg strength, back strength, muscular strength, strength endurance and power parameters includes explosive power in terms of vertical and horizontal distances were assessed using appropriate test items. Data were collected before and after training period and statistical analysis was done using paired T- test significantly effective at 0.05 level of confidence. Hence our results support the use of contrast training to improve the upper and lower body explosivity levels in young players. In conclusion, this study showed that more strength conditioning is needed during the sport practice season. Furthermore, we also conclude that contrast training is a useful working tool for coaches, innovative in this strength-training domain, equally contributing to a better time-efficient training.

Keywords: Complex training, Contrast resistance and plyometric training, Strength power

Introduction
Complex training involves the completion of a resistance exercise prior to a plyometric exercise. A classic example is to perform vertical jumps or depth jumps after the completion of a back squat exercise. The term 'complex training' is credited to Verkhoshansky et al. (1973). It is postulated that the resistance exercise will have a performance enhancing effect on the plyometric activity (Ebben and Watts, 1998), resulting in increased power output, increased performance outcome and enhanced efficiency of the SSC behavior.
Complex training is widely used in the practical setting and is a popular training modality. A number of reviews have been written on complex training (Docherty et al., 2004; Ebben, 2002; Ebben and Watts, 1998; Jeffreys, 2008).
Research has found the complex training can be beneficial to athletic performance (Comyns et al., 2007; Evans et al., 2000; Güllich and Schmidtbleicher, 1996; Young et al., 1998), while the opposite has also been reported (Jones and Less, 2003; Scott and Docherty, 2004). A possible explanation for this contradiction in findings is that many variables have an influence on the research outcomes and thus the efficiency of complex training, such as the magnitude and mode of the preload exercise as well as the rest interval between the preload and the plyometric components of complex training. In addition, the gender, training status, training age, strength levels of the participant may influence the potentiating benefits of complex training (Docherty et al., 2004; Robbins 2005).
Contrast training enhances power workout quality – but only if you're already quite strong. When athletes carry out strength-training workouts designed to improve their power, they often choose to work with relatively light resistances, which permit more explosive movements. However, they often alternate light loads with heavy ones, because heavy resistance seems to create a greater activation and preparation for maximal effort in subsequent explosive movements. Some exercise experts have claimed that the power gains associated with programmes combining heavy and light resistance can be as much as three times greater than with conventional programmes using either light or heavy resistance.(Owen Anderson, 2010).
Although there has been general agreement that combining high-resistance work with lighter, quicker movements during training produces optimal gains in power, there has been some debate about exactly how the two types of strength training should be combined within workouts. There are basically two schools of thought: proponents of 'complex training' believe that various sets of groups (complexes) of exercises should be performed in such a way that several sets of heavy-resistance exercise are followed by several sets of lighter-resistance; proponents of 'contrast training', on the other hand, suggest that heavy and light exercises should be alternated, set for set, with a lightning-fast, light-resistance set always following a heavy one. To this contra version, the present study was carried out in young male athletes to evaluate the effect of complex and contrast resistance and plyometric training on selected strength and power parameters.

Methodology
Thirty male athletes were selected randomly as subjects from Department of Physical Education and Sports Science, Annamalai University, They were young and healthy and their age ranges between 19 to 21 years. Selected subjects were divided into two groups with fifteen members of each. Group 1: served as complex training group and
Group 2: served as contrast resistance and plyometric training group. Experimental training program was performed for 4 days /week for 3months.

Training Program

Complex training

This involves performing sets of weight training exercises before sets of related plyometric exercises - eg three sets of 10 half squats, before three sets of 10 jump squats. Such combinations of sets are known as 'complexes (Docherty et al., 2004).

Contrast training

Contrast Training is a workout comprising of one set of a resistance exercise followed by one set of a matched plyometric exercise. For instance, squats followed by squat jumps or bench press followed by plyometric push-ups. This involves alternating sets of first weights then plyometric exercises - eg one set of 10 half squats followed by one set of 10 jump squats, repeated over three sets. (Docherty et al., 2004; Yuri Elkaim etal., 2010).
Selected variables included are strength parameters- leg strength, back strength, muscular and strength endurance. Power parameters include explosive power in terms of vertical distances and explosive powers in terms of horizontal distances were measured. For testing the leg and back strength dynamometers were used, for muscular strength pushups are used, for strength endurance sit-ups will be administered, for explosive power in terms of vertical distances are tested by sergeant jump and for explosive power in terms of horizontal distances are measured by standing board jump.

Statistical analysis

The data will be collected before and after the different strength training programme performed by the experimental subjects. Strength and power variables were assessed before and after 3 months of resistance training practices. The data were collected and analyzed using paired T- test There differences was considered to

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be significant when $p<0.05$. Results showed that better improvement was seen in contrast training.

Results

Table -1: Effect of complex and contrast training on leg and back strength, muscular strength and strength endurance in athletes

Groups	Leg strength	t ratio	Back strength	t ratio	Muscular strength	t ratio	Strength endurance	t ratio
Complex training	50.3±0.06		45.2±0.26		43.5±0.23		36.3±0.32	
Contrast training	55.2±0.29	67.28	48.3±0.29	219.2	46.10±0.28	143.11	38.25±0.29	240.55

Data represents mean± SD from 15 subjects in each group.
Group comparison: Group 2 with 1.
(The table value required for significance at0.05 level of confidence with df 14 is 1.761 respectively)
There is a significant relationship among paired groups. $p<0.05$

Table-2 Effect of complex and contrast training on explosive power in terms of vertical and horizontal distances in athletes

Groups	Explosive power in vertical distances	t ratio	Explosive power in horizontal distances	t ratio
Complex training	60.33±0.34		254.3±0.4	
Contrast training	63.5±0.3	24.41	260.2±0.35	39.48

Data represents mean± SD from 15 subjects in each group.
Group comparison: Group2 with 1.
(The table value required for significance at0.05 level of confidence with df 14 is 1.761 respectively)
There is a significant relationship among paired groups.$p<0.05$

Table 1 and 2 shows the effect of complex and contrast training on leg, back strength, muscular strength, strength endurance and explosive power in terms of (vertical and horizontal distances) in athletes.
The levels of strength and power parameters in contrast training group was found to be effect when compared to complex training group. The results show the significant relationship between paired groups.

Discussions

Resulted data produced better effect in contrast trained athletes gained in strength and power parameters. As it turned out, in our study, the complex workout produced worse jump-squats during the first set of jump-squatting than the traditional and contrast workouts, possibly due to a fatigue effect associated with the prior completion of three sets of heavy-load 3RM half-squats.
As mentioned, heavy-load exercise may facilitate explosive movements, but it cannot do so if the heavy-load work is extensive enough to induce significant muscular fatigue. In a related study carried out by Verkhoshansky (1973), novice track-and-field athletes who utilised heavy loads before carrying out 'speed-strength' exercises achieved less improvement in explosive strength over the course of a 12-week training programme than those who put the explosive work before the heavy loads.
Interestingly enough, the difference in power performance during the different squat-training methods in the Australian study depended on the athletes' strength levels, so the 11 subjects were 'median-split' (with the median athlete 'thrown out') into two groups, with the five athletes with the highest 1RM values in one group and the five with the lowest in the other. 1RM averaged 116kg for the low-strength groups and 139kg for the high-strength athletes. After this split, statistical analysis revealed that the higher-strength group achieved a greater improvement in jump-squat performance with the contrast workout than with the traditional method, but no such difference was observed in the lower-strength athletes. In our study, we found that alternate sets of training improved the strength and explosive power than complex training. It is also said that contrast training worked well with the strong athletes but not the weaker ones. Thus, if one is attempting to construct a contrast workout in order to enhance power development, it is very important that quite high resistances be used for the slower, heavy-load interludes.

Conclusion

The present study revealed the beneficial effect of contrast training. It is also concluded that this type of training is much useful for athletes to prepare for their competition.

References

Comyns, TM, Harrison, AJ, Hennessy, LK, and Jensen, RL. (2007). Identifying the optimal resistive load for complex training in male rugby players. Sports Biomech, 6, 59-70.

Docherty, D, Robbins, D, and Hodgson, M. (2004). Complex training revisited: A review of its current status as a viable training approach. Strength Cond J, 26, 52 –57.

Ebben, WP and Watts, PB. (1998). A review of combined weight training and plyometric training modes: Complex training. Strength Cond J, 20, 18-27.

Ebben, WP. (2002). Complex training: a brief review. Journal of Sports Science and Medicine, 2, 42-46.

Evans, AK, Hodgkins, TD, Durham, MP, Berning, JM, and Adams, KJ. (2000). The acute effects of a 5RM bench press on power output. Medicine and Science in Sport and Exercise. 32(5), S311.

Güllich, A, and Schmidtbleicher, D. (1996). MVC-induced short-term potentiation of explosive force. New Studies in Athletics. 11(4), 67-81.

Jones, P., and Lees, A. (2003). A biomechanical analysis of the acute effects of complex training using lower limb exercises. J Strength Cond Res. 17, 694 - 700.

Owen Anderson http://www.pponline.co.uk/encyc/strength-training-resistance-exercises-improve-strength-and-power-109

Robbins, DW. (2005). Postactivation potentiation and its practical applicability: a brief review. J Strength Cond Res, 19, 453-458.

Scott, SL and Docherty, D. (2004). Acute effects of heavy preloading on vertical and horizontal jump performance. J Strength Cond Res, 18, 201–205.

Verkhoshansky, Y and V. Tatyan, (1973). Speed-strength preparation of future champions. Logkaya Atletika, 2, 2-13.

Young, WB, Jenner, A, and Griffiths, K. (1998). Acute enhancement of power performance from heavy load squats. J Strength Cond Res, 12, 82–84.

Yuri Elkaim, BPHE, CK, RHN.(2010). What is Contrast Training and how can it help you? http://www.myfitteru.com/contrast-training-workout.html. www.myFitterU.com