

Research article

## The Effect of Two Different Concurrent Training Programs on Strength and Power Gains in Highly-Trained Individuals

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### Abstract

The effects of concurrent strength and endurance training have been well studied in untrained and moderately-trained individuals. However, studies examining these effects in individuals with a long history of resistance training (RT) are lacking. Additionally, few studies have examined how strength and power are affected when different types of endurance training are added to an RT protocol. The purpose of the present study was to compare the effects of concurrent training incorporating either low-volume, high-intensity interval training (HIIT, 8-24 Tabata intervals at ~150% of  $VO_{2max}$ ) or high-volume, medium-intensity continuous endurance training (CT, 40-80 min at 70% of  $VO_{2max}$ ), on the strength and power of highly-trained individuals. Sixteen highly-trained ice-hockey and rugby players were divided into two groups that underwent either CT ( $n = 8$ ) or HIIT ( $n = 8$ ) in parallel with RT (2-6 sets of heavy parallel squats, > 80% of 1RM) during a 6-week period (3 sessions/wk). Parallel squat performance improved after both RT + CT and RT + HIIT ( $12 \pm 8\%$  and  $14 \pm 10\%$  respectively,  $p < 0.01$ ), with no difference between the groups. However, aerobic power ( $VO_{2max}$ ) only improved after RT + HIIT ( $4 \pm 3\%$ ,  $p < 0.01$ ). We conclude that strength gains can be obtained after both RT + CT and RT + HIIT in athletes with a prior history of RT. This indicates that the volume and/or intensity of the endurance training does not influence the magnitude of strength improvements during short periods of concurrent training, at least for highly-trained individuals when the endurance training is performed after RT. However, since  $VO_{2max}$  improved only after RT + HIIT and this is a time efficient protocol, we recommend this type of concurrent endurance training.

**Key words:** Endurance, exercise; HIIT, performance, resistance, squat.

### Introduction

Performance in most sports depends on the interplay between several physiological factors. A challenge for coaches and athletes is to find the right combination and work load of exercises during training to promote a long-term optimization of all these factors. This is an important part of the periodization process, which is the division of training into phases with different objectives to promote performance and to avoid excessive fatigue and overtraining (Smith, 2003). Even though the objective during one such phase could be strength improvements via resistance training (RT), most athletes need to simultaneously train other physical capacities to avoid a decline in performance. Combining resistance and endurance exercises is especially challenging because several studies have shown that muscle hypertrophy and gains in strength and power are

often blunted when endurance exercises are added to a RT program (Bell et al., 2000; Dudley and Djamil, 1985; Fyfe et al., 2016; Hakkinen et al., 2003; Hickson, 1980; Kraemer et al., 1995; Sale et al., 1990). The mechanisms underpinning this interference effect are not well understood but likely comprise a combination of factors affecting both acute and chronic fatigue as well as the exercise induced anabolic response (Coffey and Hawley, 2017). Examples of such factors may include reduced neural activation; accumulation of metabolites such as inorganic phosphate,  $H^+$  and ammonia; and depletion of ATP, creatine phosphate and muscle glycogen (Leveritt et al., 1999).

Power is the feature most negatively affected by concurrent training, and studies show that just a few relatively short endurance sessions per week are enough to blunt power (Hakkinen et al., 2003; Mikkola et al., 2012). Muscle hypertrophy and strength seem to be less negatively affected, and a low-to-moderate volume endurance training (2–3 sessions/wk, 20–60 min/session) is associated with no or only minor blunting effects (Hakkinen et al., 2003; Lundberg et al., 2013; Shaw et al., 2009; Tsitkanou et al., 2016). However, even minor blunting effects may be detrimental for elite athlete performance, and moreover, if long and/or frequent endurance sessions are added to a RT program there is a large body of evidence showing that muscle hypertrophy and strength will be compromised (Hickson, 1980; Jones et al., 2013; Kraemer et al., 1995). For example, Hickson (1980) observed a strong blunting effect on one-repetition maximum (1RM) squat progression when running exercises (40 min, 6 sessions/wk) were added to a 10-week RT program.

In recent years, high-intensity interval training (HIIT) has become a very popular form of endurance training among both athletes and recreationally-active individuals. The popularity of HIIT can be attributed to the fact that it is time efficient and provides performance and health improvements that are similar to those gained from more traditional low/medium-intensity, long-duration continuous training (Francois and Little, 2015; Gibala et al., 2006; Milanovic et al., 2015). Since it is well established that high-volume endurance training has a negative impact on muscle hypertrophy, strength and power (Hickson, 1980; Jones et al., 2013; Kraemer et al., 1995), HIIT might be a better choice during training periods when these outcomes need to be prioritized. However, a potential problem with the HIIT approach is that even if the duration is short, the high intensity of this training might have a negative impact on strength and power due to its potential peripheral fatiguing effect. This is supported in acute studies where HIIT

performed prior to RT reduced force generating capacity and RT volume (Bentley et al., 2000; de Souza et al., 2007). The mechanisms behind this effect is not well known but altered neuromuscular recruitment patterns, accumulation of metabolites and reduced substrate availability have been suggested (Ratamess et al., 2016). Interestingly, a recent study examining the long term effect of concurrent training did not find a larger attenuating effect of HIIT compared with moderate-intensity continuous training on strength and power gains (Fyfe et al., 2016). Therefore, reducing training volume rather than intensity seems more important for avoiding the potential interfering effects of concurrent training.

Most concurrent training interventions have been studied in untrained or moderately-trained individuals. Individuals with long-term experience in strength and power training might respond differently to the addition of endurance training to their routine. Therefore, the objective of the present study was to examine the effects of two different concurrent training programs on strength and power gains in individuals with a long history of RT. We hypothesized that the addition of high-volume CT to a six-week RT program would have a blunting effect on strength and power compared to the effect of low-volume HIIT.

## Methods

### Participants

Sixteen male former high-level athletes (ice-hockey and rugby players,  $27.3 \pm 5.0$  years) participated in the study. They were still active athletes who trained regularly but competed sporadically. The participants were considered for inclusion if they were 1) currently undergoing strength training four times or more per week, 2) had more than five years of experience with regular strength training, and 3) included squats in their weekly training routine. The participants were considered to be highly-trained based on their long history of elite-training and excellent performance in the 1RM parallel squat exercise ( $1.7 \pm 0.3$  kg/kg body mass), which was in line with that of international rugby players and power athletes (Baker and Newton, 2008; Zourdos et al., 2016). The participants were assigned to groups that performed either squat RT followed by CT (RT + CT;  $n = 8$ ) or squat RT followed by HIIT (RT + HIIT;  $n = 8$ ). The exercise order, i.e. performing RT first, was based on previous findings that sequencing strength training prior to endurance training appears to be beneficial for lower body strength gains (Murlasits et al., 2018). The two groups were matched for 1RM squat strength and  $VO_{2\max}$ . Two subjects, one in the RT + CT group and one in the RT + HIIT group, interrupted their training and were excluded from the study.

The participants were instructed to maintain their normal diet throughout the intervention, to record food intake during the 24 h preceding the pre-tests, and to duplicate the same diet before post-tests. Performance enhancers such as caffeine and creatine, as well as alcohol, were not allowed during the intervention period.

The participants were informed about the possible risks and discomforts involved before giving their written consent to participate in the study. The study was approved

by the Regional Ethics Committee of Stockholm, Sweden.

### Testing

Pre- and post-tests were performed in a rested state (no training > 48 h before the tests) and at the same time of day for each subject. Four familiarization sessions were performed before the pre-tests, which included both heavy parallel squats and HIIT on a cycle ergometer. The test order was as follows: anthropometric measurements (weight, height and body fat), counter-moment-jump vertical height (CMJ), 1RM parallel squat, maximal lactate steady-state workload (MLSS) and  $VO_{2\max}$  (Haff and Triplett, 2016). The duration of all the tests performed in one session was ~2 h. Body fat was calculated from skinfold thickness measured with calipers (Harpenden, Baly International CTD, West Sussex, UK) as described by Durmin and Womersley (1974).

### CMJ test

The participants performed a general warm-up before testing that consisted of light cycling at 100 W for 8 min. CMJ performance was then assessed using an optical measurement system (Optojump, Microgate, Bolzano-Bozense, Italy). The system has been demonstrated to have a strong validity and test-retest reliability for the estimation of vertical jump height (Glatthorn et al., 2011). The participants performed three maximal unloaded jumps with 30 s of passive recovery between each effort. If the third jump was higher than the previous two, the subject performed an additional fourth jump. If this effort was higher than the third a fifth jump was added, and so on, until no further improvements were observed. The best jump was used to determine maximal vertical jump height. Jumps were initiated from a standing starting position, with the hands placed on the hips throughout the jump. The jump depth was self-selected, and the participants were instructed to accelerate as quickly as possible from their lowest position to achieve maximal jump height.

### 1RM parallel squat test

Lower-body strength was assessed via 1RM testing using the parallel-back squat exercise. The participants performed five warm-up sets as follows: 10 repetitions at 20 kg, 5 repetitions at 40% of predicted 1RM, 5 repetitions at 60% of predicted 1RM, 3 repetitions at 80% of predicted 1RM, and 2 repetitions at 90% of predicted 1RM. The rest periods between the sets were 2, 3, 3 and 5 min, respectively. The participants then performed sets of 1 repetition of increasing weight to determine their 1RM. Five minutes of rest were provided between each attempt. The participants were required to reach a parallel thigh/floor position or deeper for the attempt to be considered successful, as determined by two test supervisors (certified strength and conditioning specialists). An attempt was deemed successful only when the two supervisors reached consensus.

### MLSS and $VO_{2\max}$ tests

MLSS was determined during incremental submaximal exercise (5 min of cycling, 90 RPM, at each step: 100, 150, 200, 250 W, etc. until reaching a Borg scale score  $\geq 17$ ). The participants completed 4–6 steps, such that the total duration of the test was  $\leq 30$  min. Capillary blood samples

were collected from the fingertip during the 1-min periods of rest between each step and analyzed for lactate using an automated analyzer (Biosen 5140, EKF Diagnostics, Barleben, Germany). The gas composition of expired air and HR were measured continuously using the Oxycon Pro (Erich Jaeger GmbH, Hoechberg, Germany) and Polar Electro Oy (Kempele, Finland) systems, respectively. MLSS was determined based on the  $D_{\max}$  method as previously described (Cheng et al., 1992). The submaximal MLSS test was followed by 10 min of pedaling at 100 W before the  $VO_{2\max}$  test was initiated at a workload corresponding to the last completed 5-min step of the MLSS test. Thereafter, the workload was increased by 20 W each minute until fatigue was reached (drop in cadence to  $< 50$  RPM).  $VO_{2\max}$  was calculated as the highest recorded mean oxygen uptake during the last 60 s of the test. The criteria for attaining  $VO_{2\max}$  (RPE  $\geq 18$ , RER  $\geq 1.1$ , and a plateau in  $VO_2$  with increasing workload) were met for all participants. Time to exhaustion during the  $VO_{2\max}$  test (TTE- $VO_{2\max}$ ) was defined as the time point when the cadence involuntarily dropped to below 50 RPM. A capillary blood sample was collected immediately after the test to measure peak lactate levels (BL- $VO_{2\max}$ ). The Oxycon Pro system used for the gas exchange measurements is known for its high validity and reliability (Foss and Hallen, 2005).

### Training

The training interventions lasted 6 weeks and the participants performed 3 concurrent strength and endurance workouts per week, i.e. for a total of 18 training sessions. No additional lower body strength or endurance training was allowed. Three subjects had to perform 1-2 additional training sessions during week 7 to reach a total of 18 sessions, giving a training compliance of 100%. All exercise sessions were supervised by members of the investigative team who were certified strength and conditioning specialists. Each strength training session was initiated with 10-min cycling at 100 W, followed by 4 sets of parallel squats with a light to medium loading (40–80% of 1RM). Thereafter the participants performed 5x2 reps,  $\geq 90\%$  1RM (Mondays and Fridays) or 2x5 reps,  $\geq 80\%$  1RM (Wednesdays) of parallel squats. The loading was self-selected (above 90% respectively 80% of 1RM) and all sets were performed to failure or close to failure. If the first set/sets were not close to failure the loading was increased. Three minutes of rest was allowed between light to medium loading sets and 5 min between heavy loading sets. Approximately 15 min after the strength training session, the RT + CT group performed 40–80 min of continuous cycling (Monark 828 E, Monark Exercise, Varberg, Sweden), and the RT + HIIT group performed 4–20 min of high-intensity interval cycling (Monark Ergometric, Peak Bike 894 E, Monark Exercise, Varberg, Sweden). The duration of the CT sessions was increased from 40 min during weeks 1–2 to 60 min during weeks 3–4 and 80 min during weeks 5–6. The intensity was set to 70% of  $VO_{2\max}$  and was kept constant throughout the intervention. The HIIT protocol was increased from one block of eight Tabata intervals (8  $\times$  20 s separated by 10 s rest) during weeks 1-2 to two blocks during weeks 3-4 (2  $\times$  8  $\times$  20 s) and three blocks during weeks 5–6 (3  $\times$  8  $\times$  20 s). The intensity was set to 150% of

$VO_{2\max}$  during the first training session; if a participant was able to complete all intervals, a 10-W increase was added during the following session. The RT + HIIT group, therefore, experienced a progression in both duration and intensity, whereas the RT + CT group experienced a progression in duration only.

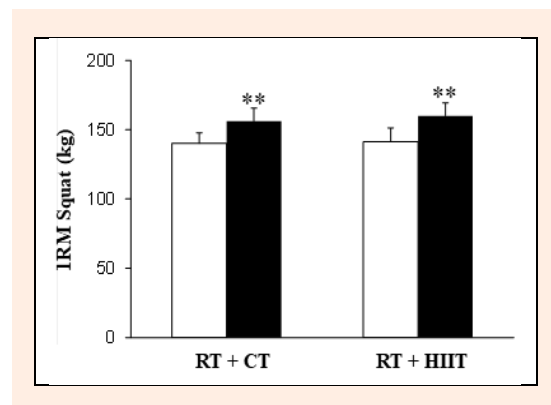
### Statistical analyses

Data are presented as the mean  $\pm$  SD. Repeated-measures analysis of variance (2  $\times$  2 mixed ANOVA) was used to test the interaction between time (pre- and post-training) and intervention (RT + CT and RT + HIIT group). Within-group differences were assessed using paired t-tests. The effect size (ES) was calculated as the mean difference between the pre-training and the post-training values divided by the standard deviation of the pre-training values. The following scale was used to categorize the magnitude of effect as proposed by (Rhea, 2004) for highly-trained individuals:  $< 0.25$  = trivial; 0.25-0.5 = small; 0.5-1.0 = moderate;  $> 1.0$  = large. Statistical significance was determined at  $p < 0.05$ . All statistical analyses were performed using STATISTICA (StatSoft, Inc, Tulsa, Oklahoma, USA).

## Results

### Body composition

Body mass and lean body mass increased slightly in the RT + HIIT group (1.3  $\pm$  1.4%,  $p = 0.035$  and 1.2  $\pm$  1.3%,  $p = 0.032$  respectively) whereas only lean body mass increased in the RT + CT group (1.2  $\pm$  1.5%,  $p = 0.044$ ) (Table 1). The percent body fat remained unchanged in both groups.



**Figure 1. Effect of 6 weeks of training on leg strength (1RM in parallel squats).** Values are reported as the mean  $\pm$  SD. RT + CT: resistance training followed by continuous endurance training (n = 8); RT + HIIT: resistance training followed by high-intensity interval training (n = 8). \*\* $p < 0.01$  vs. pre-training.

### Strength and CMJ performance

Maximal strength, measured as 1RM for parallel squats, increased in both the RT + CT group (11.5  $\pm$  7.8%,  $p = 0.006$ ) and the RT + HIIT group (14.4  $\pm$  10.1%,  $p = 0.001$ ) (Figure 1). The effect size was moderate for both groups (0.75 and 0.66 respectively). CMJ vertical height was unaffected by training in both groups (RT + CT: 41.4  $\pm$  4.5 cm pre-training and 40.1  $\pm$  4.1 cm post-training,  $p = 0.15$ ; RT + HIIT: 40.6  $\pm$  6.2 cm pre-training and 40.7  $\pm$  4.8 cm post-training,  $p = 0.89$ ).

### Endurance-related parameters

Both the absolute and relative  $\text{VO}_{2\text{max}}$  increased in the RT + HIIT group ( $4.4 \pm 2.8\%$ ,  $p = 0.001$  and  $3.1 \pm 1.6\%$ ,  $p = 0.003$  respectively) but not in the RT + CT group. Time to exhaustion during the  $\text{VO}_{2\text{max}}$  test increased in both groups (RT + CT:  $12.5 \pm 15.8\%$ ,  $p = 0.045$ ; RT + HIIT:  $19.7 \pm 12.4\%$ ,  $p = 0.002$ ) (Table 2). Maximal lactate steady-state

workload also increased in both groups (RT + CT:  $12.5 \pm 8.7\%$ ,  $p = 0.005$ ; RT + HIIT:  $5.5 \pm 5.2\%$ ,  $p = 0.022$ ). Blood lactate levels after the  $\text{VO}_{2\text{max}}$  test remained unchanged in the RT + CT group but increased in the RT + HIIT group ( $11.5 \pm 9.8\%$ ,  $p = 0.015$ ). No between-group differences were observed for any of the endurance-related measures.

**Table 1.** Effect of training on body composition. Values are reported as the mean ( $\pm$  SD).

	Group	Pre	Post	ES (rating)
Body mass (kg)	RT+CT	79.3 (10.4)	80.1 (9.3)	.07 (trivial)
	RT+HIIT	83.1 (10.9)	84.2 (11.2)*	.10 (trivial)
Lean body mass (kg)	RT+CT	68.6 (7.4)	69.3 (6.9)*	.11 (trivial)
	RT+HIIT	71.5 (7.6)	72.4 (8.1)*	.12 (trivial)
Fat (%)	RT+CT	13.3 (3.5)	13.3 (2.6)	.00 (trivial)
	RT+HIIT	13.7 (3.4)	13.7 (3.2)	.02 (trivial)

RT + CT, resistance training followed by continuous endurance training ( $n = 8$ ); RT + HIIT, resistance training followed by high-intensity interval training ( $n = 8$ ); ES, effect size. \*,  $p < 0.05$  vs. pre-training.

**Table 2.** Effects of training on endurance-related variables. Values are reported as the mean ( $\pm$  SD).

	Group	Pre	Post	ES (rating)
$\text{VO}_{2\text{max}}$ (L/min)	RT+CT	4.1 (.6)	4.3 (.5)	.25 (small)
	RT+HIIT	4.4 (.3)	4.6 (.4)**	.58 (moderate)
$\text{VO}_{2\text{max}}$ (mL/min/kg)	RT+CT	52.3 (5.5)	53.5 (3.9)	.22 (trivial)
	RT+HIIT	53.4 (3.8)	55.1 (4.0)**	.43 (small)
TTE- $\text{VO}_{2\text{max}}$ (s)	RT+CT	323 (45)	361 (50)*	.84 (moderate)
	RT+HIIT	344 (52)	410 (59)**	1.27 (large)
BL- $\text{VO}_{2\text{max}}$ (mmol/L)	RT+CT	15.3 (1.7)	15.6 (1.4)	.19 (trivial)
	RT+HIIT	14.7 (1.6)	16.3 (1.4)*	1.04 (large)
MLSS (W)	RT+CT	204 (37)	229 (33)**	.65 (moderate)
	RT+HIIT	230 (24)	243 (26)*	.52 (moderate)

RT + CT, resistance training followed by continuous endurance training ( $n = 8$ ); RT + HIIT, resistance training followed by high-intensity interval training ( $n = 8$ ). TTE- $\text{VO}_{2\text{max}}$ , time to exhaustion during the  $\text{VO}_{2\text{max}}$  test; BL- $\text{VO}_{2\text{max}}$ , blood lactate level after the  $\text{VO}_{2\text{max}}$  test; MLSS, maximal lactate steady-state workload; ES, effect size. \*,  $p < 0.05$  vs. pre-training; \*\*,  $p < 0.01$  vs. pre-training.

## Discussion

The results of the present study suggest that highly strength-trained individuals can improve their maximal strength by concurrently undergoing resistance and endurance training. Furthermore, the volume and/or intensity of the endurance training does not appear to influence the magnitude of this improvement because similar gains were observed for the RT + CT and RT + HIIT groups.

Our findings did not support our hypothesis. We hypothesized that high-volume CT would have a blunting effect on strength gains compared to the effect of low-volume HIIT. This hypothesis was informed by a meta-analysis by Wilson and colleagues that demonstrated a negative relationship between endurance training volume and gains in muscle hypertrophy, strength, and power (Wilson et al., 2012). The weekly length of the endurance training sessions in the RT + CT group was  $\sim 3$  hr, on average. This is a relatively high volume compared with that used in other concurrent training studies (Fyfe et al., 2016; Hakkinen et al., 2003; Kuusmaa et al., 2016; Lundberg et al., 2013; Shaw et al., 2009; Tsitkanou et al., 2016), and indicates that individuals with a long history of RT can improve strength even when high-volume endurance training is combined with RT.

It is important to point out that a variety of concurrent training protocols have been tested in the literature. Endurance and RT can be performed on different days or on the same day, in different training sessions or within the same training session. Also, RT can be performed before or after endurance training. In the present study, RT was followed by endurance training within the same training session. This exercise sequence could in part explain why a relatively large strength improvement was observed in both the RT + CT and RT + HIIT groups. Most studies showing negative effects on strength have used the opposite exercise sequence, i.e., endurance training before RT (Bell et al., 1988; Bell et al., 2000; Dudley and Djamil, 1985; Fyfe et al., 2016; Hickson, 1980; Kraemer et al., 1995; Sale et al., 1990), and it has been suggested that performing endurance training before RT might interfere with force production and reduce the amount of load that can be lifted during RT (Bruce W. Craig, 1991; Leveritt et al., 1999). A recent study confirmed this 'acute fatigue hypothesis' by showing that strength performance is negatively affected by previous endurance exercise (Ratamess et al., 2016). Therefore, the recommendation that followed was that the intra-session exercise sequence should consist of RT followed by endurance training.

The results of the present study show that athletes

can combine RT with different modes of endurance training and still show substantial progression in lower body strength. However, this observation does not seem to apply to power, because we did not observe any improvement in CMJ performance in the RT + CT or RT + HIIT group. Heavy-load squat training alone is associated with increased CMJ performance (Hartmann et al., 2012; Helgerud et al., 2011), and our results therefore suggest that power gains were compromised when endurance training was added to the RT program. This finding is consistent with those of previous studies on less-trained individuals (Chtara et al., 2008; Fyfe et al., 2016). However, it should be pointed out that the RT program used in the present study was performed to failure or close to failure. This is an effective program for improving strength and to some degree power (Davies et al., 2016; Hartmann et al., 2012; Helgerud et al., 2011; Hoffman et al., 2009). However, “non-failure” protocols have been shown to be more efficient for power improvements (Pareja-Blanco et al., 2017) and it can therefore not be ruled out that the absence of CMJ performance increments was a consequence of how the RT program was designed.

Aerobic power ( $\text{VO}_{2\text{max}}$ ) only improved in the RT + HIIT group, even though the average time spent on the HIIT cycling sessions was substantially lower than the time spent on the CT sessions (12 vs. 60 min). This finding confirms the results of previous studies showing that recreationally active individuals obtain similar or larger improvements in  $\text{VO}_{2\text{max}}$  and muscle oxidative capacity after low-volume HIIT than after high-volume CT (Burgomaster et al., 2008; Tabata et al., 1996). HIIT therefore also seems to be a more efficient training strategy for highly-trained individuals.

The present study was a relatively short training intervention (only 6 weeks), and it is possible that a longer training period is needed to observe differences between the RT + CT and RT + HIIT groups. For example, in the classic study by Hickson and colleagues, there was no negative effect of endurance training on strength gains during the first five weeks of concurrent training, but a large negative effect was found from weeks six to ten (Hickson, 1980). In particular, experienced athletes may be able to continue to improve their strength during short periods of concurrent training due to their high level of stress tolerance. However, in the long term even this group might be negatively affected by the opposing mechanisms of adaptation and/or difficulties in fatigue management (Coffey and Hawley, 2017). Another limitation of the present study was that it did not include a control group that performed only strength training. It is therefore possible that both the RT + CT and RT + HIIT protocols would have blunted strength gains compared to a resistance-only protocol. However, any potential blunting effect was probably small considering that the 1RM squat improvements in the present study (12–14%) are comparable to the improvements observed in other studies of highly-trained individuals performing RT alone. For example, experienced resistance-trained American football players demonstrated a 10–14% increase in 1RM parallel squats after a seven-week training period (Hoffman et al., 2009), and power lifters increased their 1RM parallel squats by 8–11% after a six-

week supervised training period (Zourdos et al., 2016).

## Conclusion

In conclusion, the present findings suggest that individuals with a long history of RT can improve their lower body maximal strength after a short period of concurrent resistance and endurance training and that the type of endurance training does not seem to influence this improvement. However, since HIIT is very time efficient, and  $\text{VO}_{2\text{max}}$  improved only in the RT + HIIT group, we recommend that HIIT be incorporated when concurrently training for strength and endurance.

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### Key points

- Lower body maximal strength is improved after concurrent strength and endurance training in highly trained individuals.
- The magnitude of this strength improvement is not influenced by the type of endurance training, i.e. HIIT or CT.
- HIIT improves VO<sub>2</sub>max and is more time efficient than CT.
- HIIT is recommended to athletes when concurrently training for strength and endurance.

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