EFFECT OF MAXIMAL AND SUB MAXIMAL STRENGTH TRAINING ON CYCLING ENDURANCE PERFORMANCE

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INTRODUCTION

Recent studies indicate that a combination of maximal strength training with endurance training, concurrent training, can be beneficial for endurance athletes. It increases both short- and long-term endurance performance without increase in body mass[1]. Therefore, concurrent strength and endurance training should enable cyclists to improve all components of road races. However, there is a lack of research showing that maximal strength training is more beneficial than the most common type of strength training in cycling, sub maximal strength training.

PURPOSE

The aim of the study was to compare the effects of a maximal and sub maximal strength training program on cycling performance in elite cyclists.

METHODS

17 highly trained cyclists (20.0 ± 1.6 years old) followed a MAXimal (n=9) or SUB maximal (n=8) strength training program 2x per week, 2x 4 weeks with 1 recovery week between blocks concurrent to cycling training on the bike, which was kept similar in duration and intensity.

MAX training: <5 repetitions at RM, 3 - 5 min recovery;

SUB training: 8 - 12 repetitions at <75% 1RM, 45s - 1 min recovery.

Testing: On SRM ergometer (Jülich, Germany).

Sub maximal test: 6 min 60%, 6 min 80% and 3 min 90% of maximal heart rate.

Power Profile Test: 2x6s, 15s, 30s, 60s, 240 and 600s maximal effort, with increasing recovery (see figure 1).

Analysis: Between-group effects, meaningful difference of 6% and 3% for P80% and P90% respectively; 1% for time trial performance for total work (TW) and critical power (CP). Students T-test for within-group differences.

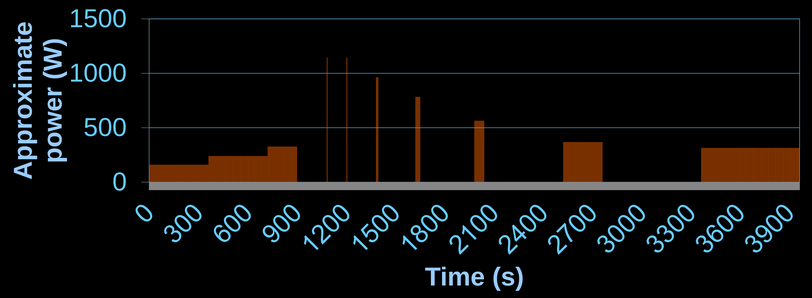

Figure 1. Graphical display of the cycling tests. Graph shows approximate power.

RESULTS

There were "likely positive" between-group differences for mean changes in the P90% (6.3%; 90% confidence limits, ±6.3) in favour of the sub maximal training group. Between-group differences for mean changes in P80%, W and CP were "unclear". T-tests revealed significant improvements in TW (p=0.019 and 0.030) and CP (p=0.022 and p=0.028) for the sub maximal and maximal group respectively from pre- to post-test and in P90% for only the sub maximal group (p=0.011). See figure 2.

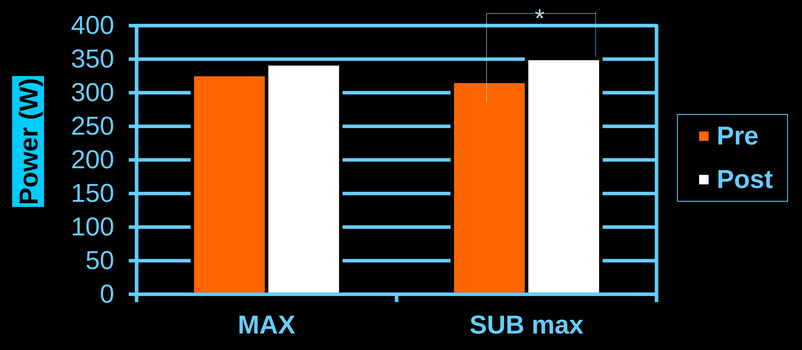

Figure 2. Power output at 90% maximal heart rate. "Likely positive" between-group difference for mean changes.

* p=0.011

DISCUSSION

We found that sub maximal strength training, when performed concurrent to cycling endurance training, results in a greater improvement in sub maximal cycling performance than maximal strength training. Earlier studies showed that replacing a portion of endurance training with sub maximal strength training compared to only endurance training could maintain high intensity cycling performance[2], while recent studies suggest that adding heavy-resistance strength training improves endurance cycling performance[1,3]. Although concurrent strength and endurance training have a negative effect on each other[4], the combination increases cycling performance more than one type of training alone.

CONCLUSION

Our study suggests that cycling endurance training can best be combined with sub maximal strength training instead of maximal strength training to increase cycling performance.

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