ISOINERTIALEXERCISE DOES NOT CAUSE CLINICALLY SIGNIFICANT MUSCLE DAMAGE: A PILOT STUDY

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INTRODUCTION

Eccentric exercise has often been associated with skeletal muscles structural damage and athletes may experience signs and symptoms such as limited range of motion and muscle soreness of the muscles across the joint. The isoinertial modality provides additional eccentric load (1). To our knowledge, no previous study has investigated the effect of isoinertial exercise, which consists of both concentric and eccentric muscular actions, on exercise-induced muscle damage. Aim of the present study is to measure changes in exercise-induced muscle damage and soreness as result of one isoinertial concentric-eccentric maximal exercise session.

METHODS

Six healthy amateur football and gaelic football players (3 males, 3 females, age 21.7±0.7 years, mean±SD; height 173.6±8.6 cm;weight 70.3±11.2 kg;training volume 3.5±1.7 sessions/week) volunteered in this study. DOMS was assessed using a Graphic Pain Rating Scale, GRPS, (2). Serum Creatine Kinase (CK) was measured from blood samples using kits for Randox Daytona Analyzer (Randox Laboratories Ltd., Co. Antrim, UK). CK and Delayed Onset Muscle Soreness, (DOMS) were assessed at baseline, 24 hours, 48 hours and 72 hours after a training session consisting of 4 sets of 7 maximal repetitions of a standing-semisquat exercise using a flywheel equiment (Desmotec, Italy), starting with the knees flexed. The inertial mass of the flywheel was 1.8 kg and its radius 0.143 m.A similar training session performed 2/3 times a week for 5 weeks has improved strength and increased muscles's size (3).

RESULTS

Baseline CK levels ranged from 71 to 303 IU/l (n=6, 136±95.6 IU/l). Peak CK, i.e. the highest values measured in samples collected 24, 48 and 72hours after the training session, was 204.0±88.0 IU/l, significantly higher than baseline CK (p=0.029). Values as Mean ± Standard Deviation. All the participants did not experience DOMS ("no pain" in the GPRS scale) after the training session.

DISCUSSION

Isoinertial training does not cause a clinically significant muscle damage and athletes undergoing such a training do not experience DOMS. In conclusion, isoinertial training using a flywheel device is safe and it stimulates muscles in a way similar to other forms of training.

ACKNOWLEDGMENT

Javier Monedero and Paul O'Connor for helping with blood sample analyses.

REFERENCES

1. Norrbrand, L., Pozzo, M. & Tesch, P. A., 2010. Flywheel resistance training calls for greater eccentric muscle activation than weight training. *European Journal of Applied Physiology,*Volume 110, pp. 997-1005.
2. Kuligowski, L. A., Lephart, S. M., Giannantonio, F. P. & Blanc, R. O., 1998. Effect of Whirlpool Therapy on the Signs and Symptoms of Delayed-Onset Muscle Soreness. *Journal of Athletic Training,* 33(3), pp. 222-2283.
3. Tesch, P. A., Ekberg, A., Lindquist, D. M. & Trieschmann, J. T., 2004. Muscle hypertrophy following 5-week resistance training using a non-gravity dependent exercise system. *Scandinavian Physiol Soc.,* Vol.180, pp. 89-98.

CARDIOPULMONARY RESPONSE DURING ONE SESSION OF MAXIMAL ISOINERTIAL TRAINING

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INTRODUCTION

The use of the flywheel resistance training has been shown to provide an increased eccentric muscle loading (1) and improve strength (2). Little research has been carried out on the effects the flywheel strength training session has on the cardiopulmonary system (3).The aim is to assess cardiopulmonary responses in amateur footballers undertaking isoinertial training.

METHODS

8 healthy male amateur footballers (age 19.5±2.3 years, weight 73.6±5.2 kg, height 180.4±5.2 cm) participated in this study. The inertial mass of the flywheel was 1.8 kg and its radius 0.143 m (Desmotec, Italy). The subjects performed 4 sets of 7 maximal repetitions, as per protocols shown to be effective to improving strength (2). After a familiarisation session, they were told to bend their knees down to 90 degrees flexion, stop the flywheel and extend at maximum speed, starting from a semi squat position. They were allowed to rest for 30 seconds between sets. Cardiopulmonary parameters were measured continuously throughout the test, oxygen uptake (VO_2) and carbon dioxide (CO_2) measured breath by breath by a portable gas analyser (Cosmed K4, Italy). The HR was measured by a heart rate monitor (Polar, Finland) throughout the test and blood lactate samples was taken from the earlobe at the end of the session and 3 and 5 minutes post completion of the four sets of exercise (LT-1710, Arkray, Japan). The highest value of lactate concentration was included in the present report.

RESULTS

The average (± standard deviation) values recorded in our athletes during an isoinertial training session were as follows: Heart rate was 126.5 ± 18.4 beats per minute, VO_2 (mlO_2/min/kg) was 22.65 ± 2.60, respiratory quotient was 0.92 ± 0.08, blood lactate concentration was 2.53 ± 1.36

DISCUSSION

According to our preliminary data an isoinertial intermittent training session elicits cardiopulmonary responses within the aerobic range of metabolic intensities. Further research will focus on cardiopulmonary responses to different isoinertial masses and protocols.

REFERENCES

1. Norrbrand, L., Pozzo, M. & Tesch, P. A., 2010. Flywheel resistance training calls for greater eccentric muscle activation than weight training. *European Journal of Applied Physiology,* Volume 110, pp. 997-1005.
2. Tesch, P. A., Ekberg, A., Lindquist, D. M. & Trieschmann, J. T., 2004. Muscle hypertrophy following 5-week resistance training using a non-gravity dependent exercise system. *Scandinavian Physiol Soc.,* Vol.180, pp. 89-98.
3. Berg HE & PA Tesch. Oxygen uptake during concentric and eccentric resistive exercise using a new gravity-independent ergometer. Proc. 4th European Symposium on Life Sciences in Space (ESA SP-307, Nov 1990).

ENHANCED POWER AFTER A 4-WEEK SUBMAXIMAL ISOINERTIAL TRAINING: A PILOT STUDY

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INTRODUCTION

The use of intermittent isoinertial maximal training has been shown to provide a form of eccentric overload exercise (1) and to improve strength (2) with minimal volume (4 sets of 7 maximal reps, 2-3 times a week for 5 weeks). Little research has been carried out on the effects of isoinertial training at submaximal intensity.

METHODS

Nine healthy male (n=8) and female (n=1) participants (age 35.4±8.4 years, weight 71.9±7.9 kg, height 173.9±6.4 cm, BMI 23.7±1.7 kg/m2) volunteered and signed an informed consent to take part to the study, which was carried out according to the Declaration of Helsinki. The inertial mass of the flywheel was 1.8 kg and its radius 0.143 m (D11, Desmotec, Italy). The exercise was a semisquat movement performed so that concentric and eccentric phases were coupled in a closed kinetic exercise. As participants were "harnessed" just above the hip joint, the muscles moving the ankle, knee and hip joints were loaded concentrically and eccentrically at each repetition. After testing at baseline (peak power, Wpeak, and average power, Wmax) in order to set training intensities, subjects were asked to train twice a week for 4 weeks. Each session consisted of 8 to 14 sets of 5 repetitions at progressively increasing fractions of the maximum power output: in week 1 70% of Wmax, 90% of Wmax in week 4. Participants were provided a visual feedback using D.Soft, the D11 dedicated software, so that they were allowed to see and adjust in real-time their power output during the training sessions. Participants were allowed to rest for 30 seconds between sets. Analysis was carried out using Prism 6 Statistical Software (paired T-test), significance was set at 0.05.

RESULTS

At baseline Wpeak was 737.1±423.9 W (mean ± standard deviation). After 8 sessions over 4 weeks of high intensity intermittent isoinertial training Wpeak significantly (p=0.0003) increased from 737.1±423.9 W to 1063.7±459.8 W, mean of differences 486.9 W, 95% CI 299.4 to 674.4 W) and Wmax significantly (p=0.0010) increased from 521.2±297.3 W to 861.3±383.3 W, mean of differences 448 W, 95% CI 244.3 to 651.7.

DISCUSSION

Our results show that a 4-week low-volume (twice a week) isoinertial training programme performed at submaximal intensities (80% Wmax) is useful to enhance power output. Further research is needed to clarify the mechanisms of adaptation.

REFERENCES

1. Norrbrand, L., Pozzo, M. & Tesch, P. A., 2010. Flywheel resistance training calls for greater eccentric muscle activation than weight training. *European Journal of Applied Physiology,* Volume 110, pp. 997-1005.
2. Tesch, P. A., Ekberg, A., Lindquist, D. M. & Trieschmann, J. T., 2004. Muscle hypertrophy following 5-week resistance training using a non-gravity dependent exercise system. *Scandinavian Physiol Soc.,* Vol.180, pp. 89-98.