

DETAILED DESCRIPTION OF THE STUDY “MARCIALONGA SCIENCE”

This document shows the details of the study **MARCIALONGA SCIENCE**, that will be held at the next Marcialonga of January the 25th, 2015.



PRINCIPAL AIM

The study **MARCIALONGA SCIENCE**, leaded by CeRiSM (Research Center Sport Mountain and Health, University of Verona, Italy) in collaboration with the Marcialonga Organizing Committee and the Military Group Fiamme Gialle, aims to evaluate the extent of muscular fatigue in upper and lower limbs after a classic long-distance cross-country skiing race. To complete this type of evaluation, the researchers propose other test before and during the competition, in order to monitor the level of physiological effort sustained during the race.

GENERAL DESCRIPTION OF THE STUDY

Each athlete will participate to the study voluntary.

After contacting the CeRiSM to make the appointments (e-mail: marcialongascience@cerism.it or phone: 0464 483503), the athlete will perform a maximal incremental test on snow at the Cross-Country Stadium of Lago di Tesero, from January the 19th to January the 23rd. This test will allow researchers to characterize each athlete from a physiological point of view, measuring the maximal oxygen uptake and the exercise intensities at which the two thresholds occur.

From January the 19th to January the 23rd, the athletes will also perform a test for the determination of the neuromuscular properties of two skeletal muscles (one in the upper and one in the lower limb) through a non-invasive electromyographic analysis, at the Cross-Country Stadium of Lago di Tesero.

During the race, the athlete will be asked to record their own heart rate and the skiing techniques used all over the race.

Immediately after the competition, the athlete will perform a second neuromuscular test with the same characteristics of the first one, to determine the level of specific muscular fatigue after the race.

At the first meeting, the athlete will subscribe the informed consent to participate to the study (www.cerism.it/progetti/marcialongascience/eng).

DETAILED DESCRIPTION OF EACH TEST

• MAXIMAL INCREMENTAL TEST

- **Specific aims.** To determine the maximal oxygen consumption, the ventilatory, lactic and electromyographic thresholds. The heart rate values relating to the exercise intensities at which the two threshold occur will be provided to the athlete, for training purposes.
- **Procedures.** The athletes will be prepared in a room of the Cross-Country Stadium. Electrodes will be positioned on the skin the athletes for the analysis of the activity of eight muscles. Markers will be attached on the clothes, at the level of the principal joints, for a biomechanical evaluation of the double poling technique. Finally, the athletes will wear a heart rate monitor, a mask and a metabolimeter, for the analysis of heart rate and pulmonary gas exchanges.
After warm-up, the athlete will perform 5 sub-maximal trials of about 5 minutes at different speeds, using the double poling technique. At the end of each trial, a sample of blood will be taken from the ear lobe, to determine the lactic acid concentration. After an adequate period of rest, the athletes will perform an incremental test to exhaustion, using the double poling technique, to determine the maximal oxygen uptake. At the end, other three sample of blood will be taken. Kinematic and electromyographical measurement will be also recorded during these tests.
- **Location.** Cross-Country Stadium of Lago di Tesero. “Team leaders” room (near the finish line) and track.
- **Date.** From January the 19th to January the 23rd, by appointment.

• PRE-RACE NEUROMUSCULAR TEST

- **Specific aims.** To determine the force and the muscular activity of the *vastus lateralis* and *triceps brachii* muscles, during maximal voluntary isometric contractions (MVC). To provide an index of neuromuscular fatigue.
- **Procedure.** A set of surface electrodes will be applied on the athlete’ skin, over the belly of *vastus lateralis* (lower limb) and *triceps brachii* muscles (upper limb), right side of the body. *Vastus lateralis* muscle will be tested first; the subject will be anchored on a special chair through inelastic belts, with 90° of flexion at hip and knee joints. 3 MVC for *vastus lateralis* muscle will be required, by executing maximal knee extensions. To test the triceps brachii muscle, the athletes will be anchored on another special chair, with fixed angles of shoulder and elbow.

3 MVC for *tricipes brachii* muscle will be required, by executing maximal elbow extensions. During each MVC, the athletes will be asked to reach the maximum level of force as rapid as possible and a high frequency double electric stimulation of the muscle will be supra-imposed. Moreover, after each MVC, three more electric stimulations will be applied to the relaxed muscle. At the end of the neuromuscular protocol, a short questionnaire will be submitted to the athlete, to evaluate the rate of perceived exertion.

- **Location.** Cross-Country Stadium of Lago di Tesero, “Team Leaders” room (in front of the finish line).
- **Date.** From January the 19th to January the 23rd, by appointment.

- **RACE MONITORING**

- **Specific aims.** To monitor and evaluate the physiological effort sustained during the race. To monitor the skiing techniques adopted during the different part of the path.
- **Procedure.** The athletes will record their own heart rate during the entire competition, by using a personal heart rate monitor. The relative file will be downloaded at the end of the race by the researchers. Moreover, the athletes will be asked to wear an accelerometer to monitor the skiing techniques adopted during the different parts of the path.
- **Location.** Entire Marcialonga path.
- **Date:** January the 25th, during the race.
-

- **POST-RACE NEUROMUSCULAR TEST**

- **Specific aim.** See pre-race neuromuscular test.
- **Procedure.** See pre-race neuromuscular test.
- **Luogo.** Palacongressi of Cavalese. The athletes will be accompanied to the Palacongressi by authorized people.
- **Date.** January the 25th, after the race. This test must be performed within 20 minutes from the end of the race. Maximal collaboration is then required to the athletes for the validity of this test.