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CASE REPORT

Physiological Adaptation of a Mature Adult Walking the Alps

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Research on endurance locomotion has mainly focused on elite athletes rather than common middle-aged subjects. Our report describes the physiological and hematological adaptation of a healthy, active 62-year-old man who trekked alone along a 1300 km/3 month course of Alpine paths (Via Alpina). The following procedures were conducted: pre- and post-trekking and fortnightly field anthropometry (total and lean body mass), functional tests (isometric maximal voluntary force, spontaneous walking speed, relative metabolic cost, and peak oxygen consumption) and clinical chemistry/hematological measurements with laboratory instruments; daily self-administered effort measurements using portable devices along the route (walked distance, ascent, descent, time, metabolic consumption, and cost). Despite the tough trekking route, the subject completed the trek without any worsening of his performance, or any significant health or functional problems. In addition, his peak oxygen consumption increased by 13.2%. His successful adaptation may be attributed to his constant, repeated middle-intensity and extensive exercise and lengthy exposure to high altitude. The clinical chemistry/hematological measurements documented his physiological adaptation. In conclusion, we show how an active, middle-aged man can successfully face endurance trekking, not only without any harm to his health or functions but also with an increase in his capacity to support specific effort.

Key words: physical endurance, walking, middle-aged, physiological adaptation

Introduction

Both endurance walking and running are used in basic life functions, such as retrieving food, colonizing new habitats, mating, and escaping hazards.[1–3] Walking and running have been included in modern exercise recommendations by several authoritative guidelines.[4] It is widely acknowledged that the study of extremes helps us understand general biological phenomena. Extreme conditions, including endurance performances, refer to long-distance racing,[1,5–10] challenging environmental conditions (eg, desert, mountain, and polar expeditions[1,5,8,9,11]), and strenuous physical activity (eg, man-hauling[1,8,11]). Investigations into endurance methods in extreme conditions have included walking,[1,8] running,[1,5,7–9] swimming,[9] cycling,[1,6,7,12] kayaking,[9] and multi-discipline races.[9] The research into extreme endurance locomotion has involved both able-bodied and disabled subjects.[6]

Traditionally, these studies tend to enlist top athletes. However, studying the physiological characteristics of amateurs may reveal traits which may benefit nonelite athletes. The aim of this investigation is to describe the physiological changes that were recorded in a 62-year-old man who trekked a very long distance (> 1300 km) following the mountain path route that is known as the Via Alpina.[13]

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Methods

THE SUBJECT

The subject is an Italian male, aged 62, with a body mass of 75 kg, height 178.5 cm, and BMI of 23.5 (pre-trekking measurements). He is retired and physically active, mainly performing downhill skiing, open water (sea) swimming, and trekking. Testing procedures were ex-

Figure. Trekking course as marked waypoints (light blue flags; image saved with Google Earth 5.1.3533.1731).

plained to the subject and he gave informed consent. While trekking, he did not change his already healthy eating habits, but rather adjusted his calorie intake to match his increased caloric demands.

EQUIPMENT

The subject carried all his equipment in a rucksack on the route depicted in the Figure. Besides the necessary amount of water and food for each daily or multi-day stage (depending on each arrival venue, mostly lodges or villages), he carried clothing, a few personal items (eg, for personal hygiene), a tent, a sleeping bag, a mobile phone, a laptop with an internet key, and the portable measuring devices (see PROCEDURES) with all their accessories. The rucksack mass varied from 14 to 29 kg and its exact weight was always taken into account for making the specific calculations. The subject covered the route with the Nordic Walking gait, a worldwide method of walking aided by thrusts from hand-held poles that are similar to cross-country skiing poles.[14]

PROCEDURES

Three sets of measurement procedures were conducted to follow the subject's progressive effort and the effects on his health and performance:

1) Pre- and post-trekking laboratory measurements: anthropometry (total and lean body mass), force (knee extensor and elbow flexor isometric maximal voluntary contractions), spontaneous walking speed and relative metabolic cost, peak oxygen consumption, a broad panel of clinical chemistry (Modular System, Roche Diagnostics GmbH, Mannheim, Germany), and hematological tests (ADVIA 2120TM, Bayer Diagnostics, Newbury, UK), as described in Tables 1 and 2. Pre-trekking laboratory measurements were taken 5 days before departure and post-trekking measurements were taken 10 days after arrival.
2) Approximate fortnightly field measurements: same as the pre- and post-trekking measurements except for peak oxygen consumption (the last field measurement was performed 2 days after completing the route).
3) Daily field self-administered measurements including metabolic energy consumption and metabolic cost of transport in addition to walked distance, ascent, descent, and time.

Laboratory and field measurements

Body mass was measured using an electronic scale. In order to estimate the lean mass, a total of 7 skin folds (chest, midaxillary, triceps, subscapular, abdomen, suprailiac, and thigh) were measured with a skin fold caliper (Gima, Gessate, Italy) on the right side of the body.[15] All measurements were taken by the same trained examiner. An average of 2 tests was used for analysis and, when the measurements differed by more than 1.0 mm, a third measurement was taken and the