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Editorial

Optimal Exercise Intensity in Obese Individuals

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In obese individuals, it is clearly established that body mass reduction decreases health risks associated with chronic diseases (e.g., type 2 diabetes, arterial hypertension, cardiovascular diseases). Therefore, body mass reduction is encouraged by major health agencies [1]. To achieve this aim and avoid weight regain after weight loss, physical activity (PA) is recommended [1,2]. If a consensus seems to have been found for the minimal training volume (i.e., at least 150 $min.wk^{-1}$ of moderate-intensity PA) [1,2]. more discrepancies appear for the exercise intensities [3]. To optimize the training programs for patients with metabolic disease (e.g., type 2 diabetes, metabolic syndrome and obesity) [2], two exercise intensities have been identified: the crossover point of substrate utilization (COP) and the maximal fat oxidation rate point (Fatoxmax) [4]. These two exercise intensities are slightly different as COP is the exercise intensity at which energy from carbohydrate-derived fuels predominates over energy from lipids [5], whereas Fatoxmax concept defines an individualized exercise intensity corresponding to the point of maximal fat oxidation rate [3]. Consequently, Fatoxmax seems theoretically optimal to reduce body fat [6] and thus especially well-suited for obese patients.

To determine Fatoxmax an indirect calorimetry test must be preformed. This exercise test must always be executed after at least 8-12 hours of fasting. Often, it consists of five submaximal (i.e., 5 stages: 20, 30, 40, 50 and 60% maximal aerobic intensity) 6-min exercise intensities [5]. Consequently, this exercise test is longer than the traditional cardiopulmonary exercise test. During the indirect calorimetry test, the respiratory gas exchanges (i.e., oxygen uptake: VO_2 and carbon dioxide production: VCO_2) must be assessed from respiratory gas analysis system. Therefore, the obese individual breathed in face mask, or mouthpiece to prevent air leakage. Indeed, in line with Brun et al. [7], VO_2 and VCO_2 ($mL.min^{-1}$) in are used to calculate the respective oxidation rate lipids (in $mg.min^{-1}$) by applying the classical stoichiometric equation of indirect calorimetry:

$$\text{Lipid oxidation} = -1.7012 \times VCO_2 + 1.6946 \times VO_2$$

At each exercise intensity (i.e., 20, 30, 40, 50 and 60% maximal aerobic intensity), the value obtained may be then converted into Kcal (i.e., Lipid oxidation × 9). To determine Fatoxmax, the obtained values are indicated on a graph according to the exercise intensity over five stages. From this graph, Fatoxmax corresponds to the individual exercise intensity that elicits the highest value of lipid oxidation [7].

Although some authors have studied the methodological aspects of indirect calorimetry test to optimize the protocol (e.g., using actual vs predicted maximal aerobic intensity [8,9], reducing of stages duration [10]), further studies are always needed.

Recently, Romain et al [11] have performed a meta-analysis to examine if the training programs at Fatoxmax are efficient to improve body composition. This meta-analysis included

15 studies and 279 individuals (mainly obese patients with or without metabolic syndrome or type 2 diabetes). Studies duration was ranged from 2 months to 1 year. The main finding is that training program targeted at Fatoxmax significantly reduces body mass ($p = 0.02$). Moreover, this training modality seems permit to decrease fat mass and improve blood cholesterol profile. Therefore, Fatoxmax may be recommended in obese individuals. Nevertheless, further studies with various exercise protocols (e.g., cranking vs pedalling, exercise alone vs exercise combined to amino acids...) are needed.

Finally, although theoretically Fatoxmax may be optimal exercise intensity for obese individuals, some authors have demonstrated its limitations [12]. For example, Fatoxmax is not accurate exercise intensity, but corresponding rather an intensity range. Moreover, Fatoxmax is influenced by some parameters, such as the diet. Consequently, some authors consider Fatoxmax as a myth, but not reality [12]. The best argument developed by these authors is maybe that high exercise intensities produces higher energy expenditure, and thus higher body mass reduction.

Consequently, further studies are needed to determine the optimal exercise intensity in obese individual.

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