BASAL METABOLIC RATE CAN BE ESTIMATED FROM FOUR TISSUE-ORGAN COMPONENTS BY USING DXA REGARDLESS OF AGE AND AEROBIC FITNESS LEVEL IN FEMALE ADULTS

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INTRODUCTION: Basal metabolic rate (BMR) accounts for 60-80% of daily energy expenditure and is influenced by various factors. The question of whether or not a positive relationship exists between BMR and variation of body composition by aging and/or aerobic fitness level of individuals remains unanswered. PURPOSE: The aims of the present study were 1) to compare the BMR measured by expiratory gas exchange (BMRm) and calculated by metabolic rate of dual energy x-ray absorptiometry (DXA)-estimated four tissue-organs (BMRc), and 2) to investigate the effects of aging and aerobic fitness on BMR in healthy young adults and postmenopausal females, who have normal BMI (18.5 =< BMI < 30 kg/m2). METHODS: Healthy young women (n = 118, age: 22.3 ± 2.1 yrs) and healthy elderly women (n = 73, 63.4 ± 6.4 yrs) who passed three years or more after menopause were recruited in this study. Systemic and regional body compositions were measured by DXA. Peak oxygen uptake (VO2peak) was determined by a graded exercise test. The subjects were divided into four groups according to their aerobic fitness level (VO2peak/BW; ml/kgBW/min); Young High Fitness (YH, n = 59); Young Low Fitness (YL, n = 59); Elderly High Fitness (EH, n = 38); and Elderly Low Fitness (EL, n = 35). BMRm was measured after subjects had fasted 12-hr. Upon arrival at the laboratory in early morning, subject rested for over 30 min to reduce previous disturbing influences. BMR was assessed by collecting expired gases during 20 min (10 min x 2 times), and analyzed O2/CO2 by mass spectrometer. Calculation of BMR (BMRc) was based on the sum of four body compartments (Bone mass, adipose tissue mass, skeletal muscle mass, and residual mass) multiplied the corresponding tissue-respiration rate according to previous study. The data are expressed as the mean ± SD. A two-way ANOVA was used to test for interaction effects between the age and aerobic fitness level among mean values for four groups. Statistical significance was defined as p<0.05. RESULTS: Body weights (BW), and fat free mass (FFM) were significantly higher in YH than in YL and EH. The elderly women in low-fitness group (EL) had significantly higher levels of body fatness (%) and lower aerobic fitness level (ml/kgBW/min) than another group. However, no significant difference in BMI and fat mass (FM) were noted in the four groups. Although the BMRm in YH group was 15% higher than another group, BMRm per BW or FFM were not significantly different among the four groups. There was no significant difference between BMRm and BMRc in respective four groups. In addition, a significant relationship between BMRm and BMRc was observed in all subjects (r = 0.758, p < 0.001). A Bland-Altman analysis did not indicate bias in calculation of REE for all subjects (r = 0.137, NS). CONCLUSION: The present investigation suggests that BMR can be estimated from four tissue-organ components by using DXA regardless of age and aerobic fitness level in female adults.

Keywords: Aerobic Power, Ageing, Energy Expenditure

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