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ORIGINAL ARTICLE

Differences in correlates of energy balance in normal weight, overweight and obese adults



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KEYWORDS

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Summary

Purpose: The purpose of this study was to examine differences in total daily energy expenditure (TDEE), energy expenditure in various intensities, as well as total daily energy intake (TDEI) and diet quality in normal weight, overweight and obese men and women. Further, the association of energy expenditure and energy intake with body fatness was examined.

Methods: The cross-sectional analysis included 430 adults (27.7 ± 3.8 years; 49.3% male). Body weight and height were measured according to standard procedures and percent body fat (BF) was assessed via dual X-ray absorptiometry. Energy expenditure was determined via the SenseWear Armband. Energy intake and the Healthy Eating Index (HEI) were calculated based on multiple 24-h recalls.

Results: Weight adjusted TDEI and TDEE were significantly lower in overweight and obese adults compared to their normal weight peers ($p < 0.001$) and obese women had a lower HEI ($p = 0.006$). Overweight and obese adults further displayed a higher proportion of energy expenditure spent in sedentary and in light activities ($p < 0.001$), while the proportion of energy expenditure in moderate-to-vigorous physical activity (MVPA) was lower compared to their normal weight peers

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($p < 0.001$). The inverse relationship between BMI or BF and MVPA was stronger than the positive association between BMI or BF and the proportion of energy expended in sedentary or light pursuits ($r_{MPA} = -0.45$ to -0.67 / $r_{MVPA} = -0.51$ to -0.66 vs. $r_{\text{sedentary}} = 0.33$ to 0.52 / $r_{\text{light}} = 0.36$ to 0.47 ; $p < 0.001$).

Conclusions: These findings emphasise the importance of MPA and bouts of MVPA regarding the maintenance of a normal body weight.

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Introduction

Sixty-nine percent of adults in the U.S. are considered to be overweight, including 36% who are obese [1]. These prevalence rates reflect a progressive upward shift in the distribution of BMI across all populations. Excess body weight has been associated with an increased risk for chronic diseases including cardiovascular disease, diabetes, many forms of cancer, and numerous musculoskeletal problems [2,3]. Further, it puts a significant economic burden on the society by contributing to significant medical costs [4,5].

An imbalance between energy intake and energy expenditure is the primary etiologic factor for the development of overweight and obesity. The regulation of energy balance, however, does not occur on a daily basis and relatively small discrepancies between energy intake and energy expenditure can have profound long-term effects on body weight and body composition [6]. While there is a genetic component to the accumulation of excess weight, environmental and behavioural changes have been suggested as the predominant contributor to the obesity epidemic [7].

Throughout the last decades there has been a decline in energy expenditure in various aspects of daily living [8,9] along with a change in dietary intake [10]. Despite a considerable amount of research on the regulation of energy balance there remains little information on differences in patterns of energy expenditure and dietary intake in normal weight, overweight and obese adults and on potential differences in the regulation of energy balance in different weight categories. A better understanding of how energy balance is achieved at different body weights could help in the development, implementation and evaluation of intervention programmes focusing on weight loss and weight maintenance, and more importantly on prevention of weight gain in the first place.

Several studies have examined the association between time spent at different intensities of

physical activity (PA) and BMI [11–16]. These studies showed an inverse association between time spent in moderate-to-vigorous physical activity (MVPA) while the association between time spent sedentary or in light activity and BMI was less consistent and differed for men and women [12,14,16]. It has also been suggested that 45–60 min of MVPA per day are necessary to prevent a normal weight person from becoming overweight or obese [17]. Body weight and body composition, however, are determined by the balance of energy expenditure and energy intake rather than time spent in different intensities of PA. The present study, therefore, investigates potential differences in energy expenditure and energy intake among adults in different weight categories. Specifically, the purpose of this study was to examine differences in total daily energy expenditure (TDEE) and the proportion of energy expenditure in sedentary, light and MVPA as well as total daily energy intake (TDEI) and diet quality in normal weight, overweight and obese men and women. Further, the association between body fat percentage and these correlates of energy balance was examined.

Methods

Study design

The present analyses were performed using baseline data from a large observational study of primary and secondary determinants of weight change. The energy balance study's extensive methodology and demographics have been published previously [18]. Briefly, 430 (49.3% male) healthy adults aged 21–35 years with a BMI of 20–35 kg/m² provided baseline data. The age distribution of the participants included an evenly distributed range of young adults to early middle age.

Exclusion criteria were designed to select a broad group of healthy individuals with no major acute or chronic conditions who had not made any

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