



## 肥胖妇女减肥时运动训练强度对脂肪组织激素敏感脂酶基因表达的影响

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## Effect of exercise training intensity on adipose tissue hormone sensitive lipase gene expression in obese women under weight loss

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**摘要** 激素敏感脂酶(HSL)是一种调节脂肪组织分解的酶,能在运动引发的脂肪组织代谢中的慢性变化发挥重要作用。本研究的目的是确定肥胖妇女减肥时,有氧运动强度是否对腹部HSL基因表达有影响。

**方法:** 30位女性(BMI=33.0±0.7 kg/m<sup>2</sup>,年龄58±1岁)分3组各完成为期20周的干预实验:热量限制( $n=8$ );热量限制加中等强度运动(心率储备45%-50%,每周3天, $n=9$ );热量限制加高强度运动(心率储备70%-75%,每周3天, $n=13$ )。各组规定的能量赤字相同:营养不良(仅热量限制状态时每周2800千卡),或者营养不良(每周2400千卡)加运动(每周400千卡)。测量身体组成和最大需氧量,在实验前之后分别采集腹部皮下脂肪组织样本,用实时RT-PCR测量脂肪组织HSL基因表达。

**结果:** 3种干预方式在减少体重、脂肪量、脂肪百分比以及腰部脂肪方面均效果显著( $p < 0.01$ )。3种方式均未改变绝对最大耗氧量,但都增加了相对最大耗氧量( $p < 0.05$ 到 $p < 0.01$ )。同干预实验前相比,只有热量限制加高强度运动使脂肪组织HSL基因表达显著提高( $p < 0.01$ ),这组的HSL基因表达与另外两组有显著差异(只有热量限制 $p < 0.05$ ,热量限制加中等强度运动 $p < 0.01$ )。整体来看,脂肪组织HSL基因表达的变化与绝对最大耗氧量( $r = 0.55$ , $p < 0.01$ )和相对最大耗氧量( $r = 0.32$ , $p = 0.09$ )成正相关。

**结论:** 这些结果支持肥胖妇女减肥过程中有氧运动强度对其脂肪组织代谢中HSL通路有潜在影响。

**关键词:** 腹部肥胖 脂肪组织 饮食 运动强度 激素敏感脂酶 减肥

**Abstract:** Background: Hormone sensitive lipase (HSL) is an enzyme that regulates adipose tissue lipolysis and plays an important role in chronic exercise-induced changes in adipose tissue metabolism. The purpose of this study was to determine whether aerobic exercise intensity influences abdominal adipose tissue HSL gene expression in obese women under weight loss.

**Methods:** Thirty women (body mass index (BMI) = 33.0 ± 0.7 kg/m<sup>2</sup>, age = 58 ± 1 years) completed one of three 20-week interventions: caloric restriction alone (CR only,  $n = 8$ ), CR plus moderate-intensity exercise (CR + moderate-intensity, 45%-50% heart rate reserve (HRR), 3 day/week,  $n = 9$ ), or CR plus vigorous-intensity exercise (CR + vigorous-intensity, 70%-75% HRR, 3 day/week,  $n = 13$ ). Each group had a similar prescribed energy deficit comprised of underfeeding alone (2800 kcal/week for CR only) or underfeeding (2400 kcal/week) plus exercise (400 kcal/week). Body composition and maximal aerobic capacity (VO<sub>2</sub>max) were measured, and subcutaneous abdominal adipose tissue samples were collected before and after the interventions. Adipose tissue HSL gene expression was measured by real time reversetranscriptase polymerase chain reaction.

**Results:** All three interventions reduced body weight, fat mass, percent fat, and waist to a similar degree (all  $p < 0.01$ ). In addition, all interventions did not change absolute VO<sub>2</sub>max, but increased relative VO<sub>2</sub>max ( $p < 0.05$  to  $p < 0.01$ ). Compared to pre-intervention, neither CR only nor CR + moderate-intensity changed adipose tissue HSL gene expression, but CR + vigorous-intensity significantly increased adipose tissue HSL

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gene expression ( $p < 0.01$ ). The changes of HSL gene expression levels in the CR + vigorous-intensity group were significantly different from those in the CR only ( $p < 0.05$ ) and CR + moderate-intensity ( $p < 0.01$ ) groups. In the whole cohort, changes in adipose tissue HSL gene expression correlated positively to changes in absolute ( $r = 0.55$ ,  $p < 0.01$ ) and relative ( $r = 0.32$ ,  $p = 0.09$ )  $VO_2\max$ .

Conclusion: These results support a potential effect of aerobic exercise training intensity on hormone sensitive lipase pathway in adipose tissue metabolism in obese women under weight loss.

Significant points: Hormone sensitive lipase is an important enzyme that regulates lipolysis. The current study reports a role of exercise training intensity in influencing gene expression of this enzyme in abdominal adipose tissue of obese women undergoing dietary weight loss.

Key words: Abdominal obesity Adipose tissue Diet Exercise intensity Hormone sensitive lipase Weight loss

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