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| Title | The effect of calcium supplementation on fat metabolism during recreational exercise |
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| Publication date | 2009-09-01 |
| Original Citation | Bradley, J.L., Woods, T., Murphy, S., Keane, L., O'Brien, N.M. 2009. The effect of calcium supplementation on fat metabolism during recreational exercise. In UCC (University College Cork), Proceedings of the 39th annual research conference in Food, Nutrition and Consumer Sciences. |
| Type of publication | Conference item |
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| Download date | 2026-11-16 05:57:48 |
| Item downloaded from | https://hdl.handle.net/10468/190 |



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# THE EFFECT OF CALCIUM SUPPLEMENTATION ON FAT METABOLISM DURING RECREATIONAL EXERCISE.

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## ABSTRACT

Evidence has emerged suggesting dietary calcium can modulate energy metabolism. Studies have linked whole body fat oxidation during free living activities to both acute and habitual calcium intake. The aim of this study was to examine the relationship between acute calcium intake and whole body fat oxidation during simulated recreational activity. Thirty min following ingestion of 800mg calcium supplement or placebo, fat metabolism was monitored during 45min of treadmill walking. Expired air was sampled throughout by online metabolic spirometry (Cosmed CPET, Italy) and analysed for metabolic fuel using indirect calorimetry. The results showed a single, acute calcium supplement of 800mg had no effect on fat metabolism compared to the placebo condition during walking. Contrary to findings from 24 hour studies monitoring calcium intake and macronutrient oxidation, this suggests single acute calcium supplementation protocols are not enough to increase energy metabolism or influence fat metabolism. Evidence suggests that calcium intake increases energy metabolism via whole body systemic changes. Increased energy metabolism and fat oxidation may only occur when recreational exercise is combined with habitual calcium supplementation.

## INTRODUCTION

Analysis of the National Health and Examination Survey reported an inverse relationship between body weight and calcium intake[1]. This relationship has been developed further to show higher rates of whole body fat oxidation over a 24 hour period with higher acute calcium intake[2,3]. The aim of this study is to examine the relationship between acute calcium intake and whole body fat oxidation during simulated recreational activity using a commercially available calcium-rich supplement.

## MATERIALS AND METHODS

Ten female subjects ([mean ± SD] age: 21.6 ± 1.0years; weight: 64.1 ± 6.4kg; height: 166.6 ± 5.6cm) visited the Human Performance Laboratory (Mardyke Arena, UCC) on three occasions. Before each visit the subjects completed a food frequency questionnaire to assess habitual calcium intake. Thirty min prior to the exercise protocol on each occasion subjects ingested 500ml of 800mg calcium dissolved in water/MiWadi™ or placebo (MiWadi™ drink). The first visit involved a sub-maximal incremental exercise test on a treadmill (Powerjog GX100) to determine the peak fat oxidation rate of the subject (using indirect calorimetry[4] adapted from Nordby et al.[5]). The treadmill speed was held constant throughout at between 4-7km/h and the gradient increased by 1% each stage. On visits 2 and 3 subjects ingested either the placebo or calcium supplement 30min prior to exercise. They then carried out a 45min bout of exercise at the peak fat oxidation intensity identified in the first visit. Heart rate (Polar S610i heart rate monitor) and metabolic fuel (via indirect calorimetry using a Cosmed CPET metabolic cart) were analysed throughout.

## RESULTS AND DISCUSSION

Fat oxidation was analysed over the whole 45min bout of exercise and from each 15min through the 45min exercise period. No significant difference was seen from the effect of calcium supplementation ($p>0.05$). There was no relationship between total calcium intake (habitual intake plus the 800mg supplement) and rate of fat oxidation. Habitual calcium intake assessed by the food frequency questionnaire showed a wide range of individual calcium intakes from the diet. However this showed no relationship to the change in fat oxidation following the supplement condition.

Dietary calcium from both supplemental and dairy sources has been shown to increase fat oxidation at rest[6], during free-living activities that included periods of exercise[2,3] and during periods of calorie deficit[7]. In the present study the calcium supplement showed no evidence of increasing fat metabolism compared to a placebo (Miwadi™) condition. Several mechanisms have been proposed that suggest a relationship between calcium intake and energy metabolism (summarised in Harris[8]). These include a reduction in intestinal fat absorption and

suppression of 1,25-dihydroxyvitamin D (calcitrol) that inhibit fatty acid synthesis and promote lipolysis. All of these mechanisms rely on systemic changes in the body occurring over an extended duration. The present study used an extended period of exercise (45min). However, previous studies have measured fat oxidation at rest over much longer periods (2-6 hours) and those measuring fat oxidation during free-living activities correlated prandial calcium intake and fat oxidation over 24 hour periods. The mechanisms proposed above may only become apparent over these longer durations.

## CONCLUSION

The calcium supplement showed no evidence of increasing fat metabolism compared to a placebo (Miwadi™) condition and suggests single acute calcium supplementation protocols are not enough to increase energy metabolism or fat oxidation. These changes may only occur when recreational exercise is combined with habitual calcium supplementation.

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