

# AN INVERSE ASSOCIATION BETWEEN CALCIUM AND ADIPOSITY IN WOMEN WITH HIGH FAT AND CALCIUM INTAKES

**Objectives:** To assess the association between calcium intake and body composition in African Black and White women.

**Design:** Cross-sectional survey.

**Setting:** Metabolic unit.

**Participants:** A convenience sample of 106 White and 102 Black healthy urban women, 20–50 years old, stratified for body mass index (BMI).

**Main Outcome Measures:** Dietary calcium intake, fat intake, BMI, percentage body fat, fasting plasma glucose and insulin, homeostasis model assessment of insulin resistance (HOMA-IR), oral glucose tolerance test (OGTT), blood pressure.

**Methods:** After an overnight fast, weight, height and blood pressure were measured, subjects underwent a 75-g OGTT, and blood samples were taken. Food frequency questionnaires were completed, and body composition was measured by anthropometry and air displacement plethysmography.

**Results:** Mean calcium and fat intakes were significantly higher in White women (1053.8 mg/day and 103.1 g/day, respectively) than in the Black women (523 mg/day and 69.2 g/day), resulting in higher calcium:fat-intake ratio in White women. After adjustment for age and total energy intake, significant negative correlations were found between calcium intake and fasting insulin ( $r = -.337$ ,  $P = .01$ ) and HOMA-IR ( $r = -.334$ ,  $P = .01$ ) in the White subjects. The calcium:fat ratio correlated negatively with BMI ( $r = -.328$ ,  $P < .012$ ), percentage body fat ( $r = -.336$ ,  $P = .01$ ), fasting insulin ( $r = -.374$ ,  $P = .004$ ), postprandial insulin ( $r = -.328$ ,  $P = .01$ ), and HOMA-IR ( $r = -.365$ ,  $P = .005$ ). In the Black subjects, a significant negative correlation was found between calcium intake and blood pressure.

**Conclusion:** The association between calcium intake and percentage body fat, BMI, fasting glucose, and insulin were significant only with high intake of fat and calcium, which is not characteristic of the habitual diet of African women. (*Ethn Dis.* 2007;17:6–13)

**Key Words:** Adipocytes, Calcium, Dietary Fat, Lipogenesis, Lipolysis, Weight Management

H. Salome Kruger, PhD; Petro H. Rautenbach, MSc; Christina S. Venter, DSc; Hattie H. Wright, PhD; Peter E. H. Schwarz, MD

## INTRODUCTION

The incidence of obesity is increasing in developing countries such as South Africa,<sup>1</sup> and with that increase, chronic diseases associated with obesity, namely diabetes mellitus, coronary heart disease, and hypertension, are similarly increasing.<sup>2</sup> A study of rural and urban Black South African women concluded that approximately one quarter to more than half of the subjects in the different age groups were obese.<sup>3</sup> The prevalence of obesity is higher among Black women than among White women in South Africa.<sup>1</sup> Results from both the coronary artery risk development in young adults (CARDIA) and atherosclerosis risk in communities (ARIC) studies have shown that Black as well as White women should avoid excess adiposity to improve their health.<sup>4</sup>

The optimal dietary composition necessary to promote weight loss and prevent weight gain must be understood to develop practical guidelines for diabetes prevention.<sup>5</sup> While much attention has been focused on macronutrient

---

From the School of Physiology, Nutrition and Consumer Science, North-West University, Potchefstroom 2520, South Africa (HSK, PHR, CSV, HHW); Department of Endocrinopathies and Metabolic Diseases, Medical Faculty Carl-Gustav-Carus, Dresden University of Technology, Fetscherstrasse 74, D-01307 Dresden, Germany (PEHS).

Address correspondence and reprint requests to H. Salome Kruger, PhD; School of Physiology, Nutrition and Consumer Science; North-West University; Potchefstroom 2520; South Africa; +27-18-299-2482; +27-18-299-2464 (fax); vgehs@puk.ac.za

---

*...an emerging body of literature suggests that dietary calcium may play a role in the regulation of body weight and body fat and development of the metabolic syndrome.<sup>7,8</sup>*

---

intake, particularly dietary fat, and body weight regulation,<sup>6</sup> an emerging body of literature suggests that dietary calcium may play a role in the regulation of body weight and body fat and development of the metabolic syndrome.<sup>7,8</sup> High-calcium diets may protect against fat gain by creating a balance of lipolysis over lipogenesis in adipocytes.<sup>9</sup> High calcium intake depresses 1,25-hydroxy vitamin D and parathyroid hormone and leads to decreases in intracellular calcium, thereby inhibiting lipogenesis and stimulating lipolysis.<sup>10</sup> A diet deficient in calcium is associated with higher body weight, and augmenting calcium intake may reduce weight and fat gain or enhance fat loss.<sup>11</sup> Implicit in the hypothesis that a high-calcium diet promotes maintenance of lower body fat mass in humans by enhancing lipolysis is the assumption that high-calcium diets promote greater rates of whole-body fat oxidation.<sup>8</sup> Literature has shown a relationship between calcium intake and body fat percentage,<sup>12</sup> body mass index (BMI),<sup>12,13</sup> and blood pressure.<sup>7</sup> Epidemiologic and limited experimental data from some studies suggest that differences in calcium intake may be associated with changes in body weight