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Determining the Culprit: Stress, Fat, or Carbohydrates

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To the Editor

The article by Kiecolt-Glaser *et al.* (1) suggests that a high-fat diet in the setting of depression or recent life stressors leads to weight gain via decreased metabolic rate and increased hormonal influences on fat storage. This study gives insight into an interesting relationship between stress and energy expenditure, but we believe that the label “high-fat” may perpetuate a negative, and not necessarily true, association with this type of diet and weight gain. Carbohydrates are another class of macronutrients that are implicated in slowing metabolism and leading to obesity. A controlled crossover study by Ebbeling *et al.* (2) showed that there was a sustained decrease in metabolic rate in patients on a low-fat, high-carbohydrate diet compared with a high-fat, low-carbohydrate diet. Additionally, a recent randomized trial by Bazzano *et al.* (3) comparing calorie-unrestricted versions of these two diets concluded that the high-fat, low-carbohydrate diet might provide a better avenue for weight reduction and have certain metabolic risk factor advantages.

In regard to hormonal influences on metabolism, it is plausible that an increase in cortisol may be attributed to stressors or depression and may partially contribute to weight gain. However, it is the insulin increase in response to caloric intake that should be implicated in the metabolic changes seen in the participants in the study by Kiecolt-Glaser *et al*. Cortisol exerts its metabolic effects in adipose tissue through two main enzymatic pathways. In the presence of insulin, cortisol increases the activity of lipoprotein lipase, which leads to fat accumulation in visceral adipose tissue (4). Conversely, if insulin is not present in sufficient quantities, cortisol activates hormone-sensitive lipase, which causes fatty acid mobilization (5). The presence of insulin is the key factor in determining if cortisol promotes fat storage or fat utilization. Insulin quantity is directly related to the glycemic load of the meal, not the fat content. A study by Yost *et al.* (6) showed that lipoprotein lipase activity in adipose tissue increased more with a long-term high-carbohydrate diet compared with a high-fat diet. These results suggest that habitual dietary carbohydrate intake may lead to greater subcutaneous fat storage than dietary fat intake.

In the study by Kiecolt-Glaser *et al.*, the stress and depression questionnaires that were used focused on the past 24 hours rather than the present. The diet of the participants during this

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Disclosures

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time period had a fairly high carbohydrate content, approximately 55%. Because this is the time frame during which the stress actually occurred, it is arguable that prior day dietary composition may have had a greater impact on the metabolic parameters measured than the actual high-fat study meal did. The article by Yost *et al.* (6) suggests that adipose tissue undergoes a preparation period in response to total body nutrient substrate. By examining biopsy specimens of adipose tissue, these investigators showed that the mechanisms that regulate fat storage are affected by long-term diet macronutrient composition rather than single meal composition.

For these reasons, we believe carbohydrate intake, particularly long-term carbohydrate intake, should be considered a culprit in decreased metabolic rate and weight gain. Perhaps a follow-up study could examine both high-carbohydrate and low-carbohydrate research meals in the setting of both high-carbohydrate and low-carbohydrate prestudy meals, while still measuring stressors, to examine further the relationship among stress, dietary intake and weight gain.

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