

# Dietary Macronutrient Intake Impacts Plasma Adiponectin Levels

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JM Kocarnik

Over time, chronically elevated systemic inflammation contributes to many chronic diseases, including cardiovascular disease, cancer, and type 2 diabetes. Dietary fat intake has long been assumed to contribute to chronic systemic inflammation, but the effects of dietary macronutrient composition on inflammatory biomarkers have not been clearly established. While dietary fat might increase inflammation through increased fat mass, inflammatory effects independent from changes in body weight have also been suggested. In order to better measure these associations, Drs. Xiaoling Song, Mario Kratz, and colleagues in the Public Health Sciences Division evaluated changes in inflammatory biomarkers among participants on different diets in a randomized controlled feeding study. As recently reported in the *European Journal of Nutrition*, the researchers found that adiponectin concentrations were substantially lowered in individuals consuming a low-fat high-carbohydrate diet compared to those consuming a moderate-fat diet.

Systemic inflammation can be measured through circulating biomarkers such as C-reactive protein (CRP), interleukin-6 (IL-6), and the soluble tumor necrosis factor receptors I and II (sTNFR1 and sTNFR2). In addition to these four biomarkers of systemic inflammation, adiponectin levels can also be used as a marker of adipose tissue inflammation. An adipocyte-derived hormone with anti-inflammatory and insulin-sensitizing effects, adiponectin is inversely associated with adiposity. Increased body fat is associated with low-grade chronic adipose tissue inflammation. As this inflammation suppresses the secretion of adiponectin from adipocytes, decreased adiponectin levels can be considered a marker of increased adipose tissue inflammation.

To evaluate the effects of dietary macronutrient composition on inflammation biomarker concentrations, the researchers conducted a secondary analysis of samples available from the Fatty Acids Marker Evaluation (FAME) study. This randomized controlled feeding trial consisted of 92 individuals assigned to one of three diets. Two of these were eucaloric diets, consisting of sufficient calories to maintain body weight, while a third diet provided 33% fewer calories. These diets differed in macronutrient content (see figure), consisting of either moderate-fat (36% fat, 46% carbohydrate) or low-fat high-carbohydrate (18% fat, 64% carbohydrate) intake. Plasma biomarker concentrations were measured at baseline, and then again after 6 weeks of the assigned diet.

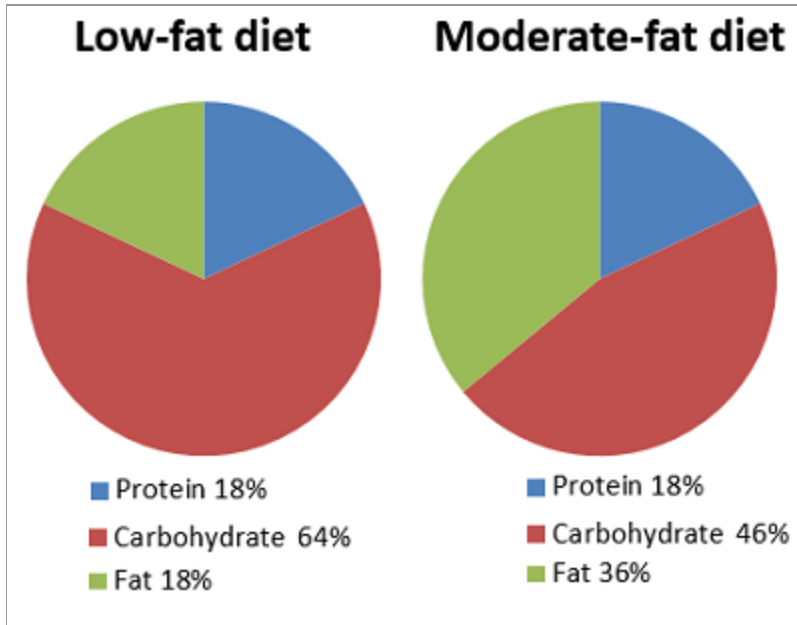
After 6 weeks on these diets, the researchers found no differences in these biomarkers for systemic inflammation. For adipose tissue inflammation, the authors did find that adiponectin concentrations tended to be increased in those who lost weight, as expected. After adjusting for weight change, however, the authors found that adiponectin levels were significantly reduced, by about 10%, in those eating low-fat diets compared to the moderate-fat diet ( $p=0.008$ ). "This may be of concern because plasma adiponectin concentrations are inversely associated with the risk of type 2 diabetes, coronary heart disease, hypertension, and a variety of cancers," said lead author Dr. Xiaoling Song.

This surprising finding should motivate future research of long-term macronutrient intake on inflammatory biomarkers. Said Dr. Song, "it is not clear whether the reduction in fat intake per se, the increase in carbohydrates, or a shift in the fat-to-carbohydrate ratio was the cause of the decreased adiponectin concentrations. This again demonstrates the difficulty in studying the effects of specific dietary components. However, although there were differences in carbohydrate quality between diets (i.e. the amount of fiber and added sugars were higher in the low-fat diet than those in the moderate-fat diet), our diets mimicked the carbohydrate choices that free-living individuals are likely to make when consuming moderate vs. low fat diets in the real world. Therefore, our results are relevant to real world situations, and do raise a new concern for the health effects of consuming very-low fat diets."

Other researchers from the Public Health Sciences Division contributing to this project were Ms. Yvonne Schwarz, Pamela Yang, and Xiaojun Hu, as well as Drs. Mark Kestin and Johanna Lampe.

Citation:

[Song X, Kestin M, Schwarz Y, Yang P, Hu X, Lampe JW, Kratz M](#). 2015. A low-fat high-carbohydrate diet reduces plasma total adiponectin concentrations compared to a moderate-fat diet with no impact on biomarkers of systemic inflammation in a randomized controlled feeding study. *Eur J Nutr*. doi: 10.1007/s00394-015-0841-1 [Epub ahead of print].



*Image provided by Dr. Xiaoling Song*

Macronutrient content (percent of total energy intake) in FAME Study diets.