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## summary

The type of calorie you consume (i.e., carbohydrate, protein, fat) may have a significant effect on the amount and nature of the body weight alteration.

The classic energy balance paradigm is rather straightforward. Body weight gain occurs if energy intake exceeds energy expenditure. Conversely, body weight loss occurs if energy expenditure exceeds energy intake (2). However, recent data suggests that the type of calorie you consume (i.e., carbohydrate, protein, fat) has a significant effect on the amount (i.e., body weight change) and nature (i.e., body composition change) of the body weight alteration. According to a recent review (3), individuals may improve body composition to a greater extent on a restricted carbohydrate diet compared to standard weight-loss diets. The following column will examine recent studies that have shown that the classic energy balance paradigm should be re-examined and that perhaps the notion of “counting calories” as part of a

weight-loss or weight-gain strategy is simplistic at best.

In a study published in *Metabolism* (4), investigators had 12 healthy normal men switch from their habitual diet (48% carbohydrate) to a ketogenic or carbohydrate-restricted diet (8% carbohydrate). They remained on this diet for 6 weeks. Fat mass decreased by 3.4 kg, whereas lean body mass increased 1.1 kg. Furthermore, serum insulin decreased 34% with a concomitant 11% increase in total thyroxine (T4) and a 13% increase in free T4 index. Thus, without a change in total energy intake, subjects lost body fat, gained lean body mass, and experienced a reduction in serum insulin.

A study by Layman et al. (1) examined the efficacy of two weight-loss diets with different macronutrient ratios in adult women (age range, 45 to 56 years). The initial baseline diet was approximately 1959 calories (50% carbohydrate, 16%

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protein, and 34% fat). The women were assigned to one of two groups. Both groups consumed the same number of calories (~1660 kcal); however, the protein group consumed 41% carbohydrate, 30% protein, and 29% fat, whereas the carbohydrate group consumed 58% carbohydrate, 16% protein, and 26% fat. The treatment duration was 10

weeks. The protein group lost more body weight than the carbohydrate group (7.53 kg [protein group] versus 6.96 kg [carbohydrate group]). The protein group also lost more fat than the carbohydrate group (5.60 kg versus 4.74 kg). Moreover, the protein group lost less lean

body mass than the carbohydrate group (0.88 kg versus 1.21 kg). Interestingly, both groups experienced a reduction in serum cholesterol (~10%); however, the protein group also had a 21% reduction in triacylglycerols.

The intriguing aspect of the investigations by Volek et al. (4) and Layman et



al. (1) is that the macronutrient ratios differed significantly. One study used a very-low-carbohydrate approach (8% carbohydrate), whereas the other had a more “balanced” approach (approximately 40% carbohydrate and 30% each of protein and fat). A common factor with these diets is the restriction of carbohydrates. However, body composition improved on both types of restricted carbohydrate diets. One might speculate that a carbohydrate intake no higher than 40% may be needed to elicit these favorable body composition alterations. It should be noted that restricted carbohydrate diets differ dramatically from the recommendations of the American Heart Association and the American Dietetic Association.

Furthermore, it has been suggested that production of ketone bodies is problematic during severe carbohydrate restriction. When you severely limit your caloric or carbohydrate intake, your body breaks down fat and makes ketones. Thus, ketone body production is an indicator of accelerated lipid metabolism (i.e., lipolysis and fat oxidation). Ketones thus serve as an alternative fuel source. Normally, the body regulates ketone levels sufficiently to meet the fuel needs of the body. There is currently no data to indicate that the ketone body production seen in restricted carbohydrate diets is unhealthy.

It is evident that macronutrient ratio (as well as total calorie intake) can profoundly affect body weight, body composition, and serum markers of health and hormonal function. It is likely that a restricted carbohydrate diet (assuming calories are held constant) may be a more effective way to improve body composition and perhaps reduce cardiovascular disease risk. The mechanism for the enhanced weight loss (i.e., fat loss and lean body mass sparing) may be related to appetite suppression, shunting of nutrients away from fat storage *vis-à-vis* modulating serum insulin, and the thermic effect of protein.

How does the current data apply to an athletic population? Clearly, body composition (i.e., maximizing lean body mass gain and fat mass loss) is an important variable in many athletic events. In sports that require an athlete to compete within a certain weight class (e.g., boxing, wrestling, mixed martial arts, and so forth), it would make sense to follow a chronic dietary strategy that could maximize fat loss and lean body mass gain. In other sports in which low body fat levels are a prerequisite (e.g., gymnastics, running, and so forth), sports nutritionists may wish to reexamine their current dietary strategies to determine if they are optimal for maintaining a lean physique.

In conclusion, the current energy balance paradigm is too simplistic. In addition to total energy intake, sports nutritionists must be aware of the ramifications of macronutrient alterations *vis-à-vis* body composition as well as health parameters. Future research should examine how different macronutrient ratios, as it applies to carbohydrate restriction, affects body composition, athletic performance, and health. ♦

## References

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