Soyfoods and the Protein Leverage Hypothesis

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Could a higher protein diet be a key to solving the obesity epidemic? If so, soyfoods have a role to play given their high protein content. Approximately 25 to 45 percent of the calories in traditional soyfoods are derived from this macronutrient (see table). Likewise, many of the soy-based meat alternatives made from soy ingredients like soy protein isolate and concentrate are high in protein.

According to recent data from the CDC, the number of Americans who are obese continues to increase. In 2017-2018, the age-adjusted prevalence of obesity among U.S. adults and children/adolescents was 42.4%[1] and 19.3%, respectively.

The cornerstone of many popular diets aimed at weight loss involve markedly altering macronutrient intake. Think of low-carbohydrate diets like the Atkin's[2] and Paleo[3] diets and low-fat diets promoted by the likes of Pritikin[4] and Ornish.[5] Despite their popularity, diets varying in carbohydrate and fat content appear to result in similar and only modest weight loss.[6]

On the other hand, intriguing evidence suggests that diets containing a higher percentage of calories from protein may promote long-term weight loss. The biological basis for this proposed effect was articulated by Simpson and Raubenheimer[7] in 2005 in what they referred to as the protein leverage hypothesis (PLH).

The PLH isn't based on the observation that dietary protein appears to be more satiating than carbohydrate or fat.[8] That attribute of protein may be an advantage, but it is not a component of the PLH. Rather, underlying the PLH, is the premise that because of the body's strong propensity to regulate the amount of protein eaten, humans are at risk of obesity when the proportion of protein in the diet falls as a result of dilution in the food supply by calories derived from nonprotein sources such as fats and carbohydrates. The original insight for this hypothesis was the observation that during the emergence of the global obesity epidemic, absolute protein consumption remained remarkably stable, whereas energy intake increased.[9]

Recent work by Lieberman et al.[10] provides support for the PLH. In brief, they found that the protein intake of the U.S. population and multiple international populations, regardless of demographic and lifestyle factors, was consistently ?16% of total energy. Furthermore, the interquartile range of protein intake distribution for the U.S. population was (3.73 ± 0.11% kcal), which was only 41% of carbohydrate intake distribution (9.18 ± 0.20% kcal) and 58% of fat intake distribution (6.40 ± 0.14% kcal). Lieberman et al.[10] concluded that their findings suggest that "biological control mechanism(s) tightly regulate protein intake and, consequently, influence intake of other macronutrients and food constituents."

Why might the human appetite system have evolved to regulate protein intake? According to Simpson,[11] it is because of the need to balance the costs of eating too little protein against the cost of eating too much. The need to avoid consuming too little protein is self-evident. In fact, there is no biological requirement for carbohydrate whereas the adequate intake of the essential fatty acid linoleic acid is £17 g/d (females, 12 g/d; males, 17 g/d) and for the essential fatty acid alpha-linolenic acid it is £1.6 g/d (females, 1.1; males, 1.6 g/d).[12] In contrast, adults require 0.8 g protein per kg body weight per day. That works out to be about 60 or 70 g of protein for the typical American.

But are there concerns about eating too much protein? The National Academy of Sciences (NAS, Institute of Medicine) acknowledges that diets ranging in protein content from 10 to 35% of calories are compatible with good health. The lower end of that range represents an intake close to the RDA intake level, which indicates consuming considerably more protein than the RDA is not associated with adverse effects, at least in the opinion of the NAS.

Simpson[11] cites two articles as evidence of a potentially harmful effect of excessive protein intake. One of which argues that low-protein high-carbohydrate diets are associated with an increased lifespan in ad libitum-fed insects and mice (and thus high protein intakes could decrease longevity)[13] and the other argues that high-protein diets increase risk of developing prediabetes and type 2 diabetes.[14]

In conclusion, the PLH is supported by considerable data. Adding soyfoods to the diet can help to increase the protein content of the diet in a healthful way as soybeans, in addition to providing high quality protein,[15] provide healthful fat.[16]

Protein and Caloric Content of Selected Soyfoods (per 100 g)

Food	USDA nutrient database #	Protein	Kcal	% protein
Tofu, firm	16277	9.08	80	45.4
Tempeh	16114	20.29	192	42.3
Soymilk	16235	2.88	41	28.1
Edamame	11212	11.91	121	39.4
Soynuts	16111	43.32	449	38.6
Miso	16112	12.79	198	25.8
Natto	16113	19.4	211	36.8
Burger*	Not applicable	19.0	240	31.7

Source: USDA Nutrient Database

*Data from Impossible Foods company website based on serving size of 113 g.

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