

Perspectives 3 On Obesity

The following is a tri-point perspective from a basic researcher, a clinical researcher and a clinician-in-practice on the following question: What are the best dietary approaches for obesity treatment?



Randy J. Seeley, Ph.D.



Barbara J. Rolls, Ph.D.



*Donald D. Hensrud,
M.D., M.P.H.*

BASIC RESEARCHER VIEW

Can animal models provide information about dietary approaches for obesity?

Randy J. Seeley, Ph.D.

Department of Psychiatry, University of Cincinnati

The daunting increase in obesity underscores the need for additional research that focuses upon how different aspects of the diet impact energy balance over time. Experiments using non-human animal subjects have a number of advantages in trying to address this important set of issues. First, the simple act of measuring one side of the energy equation, calorie intake, accurately is exceedingly difficult in free-living humans over durations beyond one or two meals. Second, assuring that free-living humans comply with a particular dietary regimen is also quite difficult. Third, both the history and genetic make-up of humans involved in dietary studies is highly variable and such individual differences are difficult to study without extremely large numbers of experimental subjects. All three of these points can be addressed by the use of non-human animals, particularly rodents in well-designed experiments.

Despite these clear advantages of animal studies, there are numerous limitations of using non-human animals to explore these dietary issues. The most obvious limitation is that the physiology of humans and other animals could differ significantly. While this difficulty is omnipresent, other more practical problems probably are of greater concern. First, while compliance can be assured in these animal studies, it is difficult to use animal models to assess how difficult compliance may be for humans on the same regimen. For example, it is clear that feeding rodents relatively unpalatable diets results in sustained lower body weights. However this would be a difficult dietary strategy

to advocate for humans where palatable food is highly sought after. Second, the overwhelming majority of studies examining the effect of diet composition on energy balance limits food choice to a single nutritionally complete food item. While the experimenter can be assured that the subjects are consuming what the experimenter intends them to consume, humans in developed countries are

hydrate diets to induce weight loss. Several clinical trials have now shown that in a period of 6 months, very low carbohydrate diets produce weight loss approximately double that of more typical low-fat dietary regimens²⁻⁵. In contrast, in several rodent studies have observed no appreciable weight loss. While such discrepancies could be due to differences in the degree of

A reasonable body of rodent literature points to the fact that diets with a lower glycemic index and less insulin secretion results in less body weight gain than higher glycemic index diets.

typically faced with a dizzying array of food choices every day. These problems can be illuminated by two examples.

A reasonable body of rodent literature points to the fact that diets with a lower glycemic index and less insulin secretion results in less body weight gain than higher glycemic index diets. Unfortunately the degree to which this is predictive of the body weight response to these diets in humans is limited by the fact that the carbohydrates that induce insulin secretion are rarely consumed in isolation and thus the rate at which carbohydrates appear in the blood stream can be highly variable. Thus the degree to which the glycemic index of the human diet predicts the demand for insulin secretion is far less clear in humans than in the rodent experiments designed to model these phenomena.

A second example comes from the recent work aimed at evaluating the effectiveness of very low carbo-

hydrate restriction necessary to produce ketosis between the two species, another possibility is that very low carbohydrate diets greatly reduce the variety of foods typically consumed by humans. However, in the rodent situation, the animal goes from having one single food to consume to a different single food to consume and therefore the animal has experienced no change in the number of food options available. The important point here is not that there is any direct evidence that changes in food choice underlie the effects of very low carbohydrate diets but rather that it is difficult to address these types of potentially important issues in the animal models. Thus while it would be attractive to test a number of proposed “fat” diets in animal models, efficacy in these rodent models is subject to both false positives and false negatives.

In general the animal models support the contentions forwarded by the companion pieces to this one.

Diets lower in saturated fats and in caloric density promote less weight gain overall⁶. However, simple changes in caloric density without significant changes in diet composition are accurately compensated for under most conditions. Giving rodents access to multiple types of highly palatable food also results in more weight gain than do diets of limited choice. While such data support the use of these dietary regimens in humans, the critical questions that can now be asked using rodent models is what genes and proteins contribute to this propensity to gain weight on varied, palatable, calorically dense diets. The powerful ability to alter the mouse genome has made rapid advances in this arena possible. As a consequence, these kinds of basic research tools will not only help us identify potentially useful dietary

regimens but will help us understand why specific individuals are more susceptible to weight gain when exposed to modern diets. Armed with this knowledge, our ability to design therapeutic options that encompass both dietary and non-dietary interventions for obese patients (or those at risk for developing obesity) will increase. **EM**

REFERENCES

- ¹ Pawlak, DB, JM Bryson, GS Denyer and JC Brand-Miller. High glycemic index starch promotes hypersecretion of insulin and higher body fat in rats without affecting insulin sensitivity. *J Nutr*, 2001. 131(1): p. 99-104.
- ² Brehm, BJ, RJ Seeley, SR Daniels and DA D'Alessio. A randomized trial comparing a very low carbohydrate diet and a calorie-restricted low fat diet on body weight and cardiovascular risk factors in healthy women. *J Clin*

Endocrinol Metab, 2003. 88(4): p. 1617-23.

- ³ Westman, EC, J Mavropoulos, WS Yancy and JS Volek. A Review of Low-carbohydrate Ketogenic Diets. *Curr Atheroscler Rep*, 2003. 5(6): p. 476-83.
- ⁴ Samaha, FF, N Iqbal, P Seshadri, KL Chicano, DA Daily, J McGrory, T Williams, M Williams, EJ Gracely and L Stern. A low-carbohydrate as compared with a low-fat diet in severe obesity. *N Engl J Med*, 2003. 348(21): p. 2074-81.
- ⁵ Foster, GD, HR Wyatt, JO Hill, BG McGuckin, C Brill, BS Mohammed, PO Szapary, DJ Rader, JS Edman and S Klein. A randomized trial of a low-carbohydrate diet for obesity. *N Engl J Med*, 2003. 348(21): p. 2082-90.
- ⁶ Woods, SC, RJ Seeley, PA Rushing, DA D'Alessio and P Tso. A controlled high-fat diet induces an obese syndrome in rats. *Journal of Nutrition*, 2003. 133: p. 1081-1087.

CLINICAL RESEARCHER VIEW

Evidence-based dietary strategies for weight management

Barbara J. Rolls, Ph.D.
The Pennsylvania State University

With the surge in the incidence of overweight and obesity, effective dietary strategies for weight management are needed. On the surface the issue is clear-cut, simply reduce energy intake below energy expenditure; however, there is much debate and controversy over the optimal way that this should be achieved. While it is unlikely that there will ever be a single dietary strategy that fits everyone, health professionals have a responsibility to communicate to the public which strategies are considered both safe and effective.

Until recently both the scientific community and proponents of popular diets for weight loss have emphasized macronutrient intake.

This emphasis was reflected in an evidence-based report published by the National Institutes of Health in 1998 that assessed the data from 48 randomized, controlled trials of weight-loss diets². The report found that lower-fat diets (20 percent to 30 percent of calories) promoted

of weight loss. The emphasis on fat reduction in the 1998 report was related to the fact that most of the clinical trials meeting the criteria for inclusion focused on the fat content of the diet. Since then, the emphasis has shifted to restricting carbohydrates and increasing protein. The

Another important shift in focus has been away from the macronutrient composition of the diet towards dietary factors that affect hunger and satiety.^{3,4}

weight loss, but that this was due to a spontaneous reduction in caloric intake. Indeed the evidence indicated that a decrease in energy intake was the most important component

verdict is not yet in on how these alterations in the proportions of macronutrients affect long-term weight loss and health.

Another important shift in focus

has been away from the macronutrient composition of the diet towards dietary factors that affect hunger and satiety^{3,4}. The reasoning is that since weight-loss is achieved through caloric reduction, adherence is more likely if hunger is controlled. A number of short-term studies have shown that the energy density (kcal/g) of the diet affects both the amount consumed and how satisfied people feel. The dietary component that has the biggest impact on the energy density of foods is water, which adds weight but no calories and therefore decreases the energy density. Fat increases the energy density of foods, since at nine kcal/g its energy density is more than twice that of carbohydrates and protein (both have four kcal/g). A number of studies have demonstrated that people tend to eat a consistent weight or volume of food over a day or two and that they are relatively insensitive to the calorie content. Thus, if people eat foods low

in energy density, they spontaneously eat fewer calories and they feel just as full and satisfied. If people eat foods high in energy density, they have to restrict portions to avoid excessive caloric intake. Other dietary factors that have been shown to enhance satiety are increases in fiber and protein. Using satiety and energy density as a guide to food choices leads to the foods that health professionals encourage: vegetables, fruits, whole grains, legumes and lean protein^{3,4}.

A recent evidence-based report from the World Health Organization and the Food and Agriculture Organization of the United Nations¹ found that the only convincing dietary factor associated with decreasing the risk of weight gain and obesity was a high intake of dietary fiber. The only convincing dietary factor that increased this risk was a high intake of energy-dense micronutrient-poor foods. The key to weight management is prevention

of weight gain and this will require innovative strategies to reduce the energy density of the diet. **EN**

REFERENCES

- ¹ *Diet, Nutrition and the Prevention of Chronic Diseases*. Geneva, Switzerland: World Health Organization, 2003 (WHO Technical Report Series, No. 916).
- ² *National Institutes of Health. Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults*. NIH Publication No. 98-4083. Bethesda, MD: Department of Health and Human Services, National Institutes of Health, National Heart, Lung and Blood Institute, 1998.
- ³ *Rolls B and Barnett RA. The Volumetrics Weight-Control Plan: Feel Full on Fewer Calories*. New York: Quill, HarperCollins Publishers, 2000; HarperTorch, 2003.
- ⁴ *Rolls BJ and Bell EA. Dietary approaches to the treatment of obesity*. In: Jensen MD, ed. *Medical Clinics of North America*. Philadelphia: W.B. Saunders Company, 2000:401-418.

CLINICIAN-IN-PRACTICE VIEW

3 What Are the Best Dietary Approaches for Obesity Treatment?

Donald D. Hensrud, M.D., M.P.H.

Any dietary program used to treat obesity should be safe and nutritionally adequate, effective and practical and sustainable long-term.¹ When treating an obese patient, there are many different options for physicians to consider to reduce energy intake. At this point, no one dietary program has emerged as clearly more successful, which is why so many different options exist. For this reason the approach should be individualized for each patient.

Very-low calorie diets (VLCD),

which contain 800 kcal/day or less, are one option for doctors to consider. However, I do not use them in my practice because although VLCD are associated with faster initial weight loss, long-term results are no greater than more conservative treatment because of more rapid weight regain. Combining a VLCD with a behavioral program or pharmacotherapy has not led to better results.²

Meal replacements, a second option, contain 200-400 kcal/day and are nutritionally adequate. A

recent meta- and pooling analysis of six studies reported that meal replacements are slightly more effective than standard energy restricted diets.³ Advantages of meal replacements include convenience, cost and that they are a specified number of calories. I use them in select patients within the context of an overall, ongoing program.

Low-carbohydrate diets, such as Atkins, are currently popular and appear to lead to greater weight loss over six months.⁴ However, a long-term, randomized trial reported that

weight loss after one year was not significantly different from a calorie-controlled, low-fat diet.⁵ In these studies, the dropout rate was approximately 40 percent among all groups, indicating long-term adherence to any dietary program is challenging. In addition, the types of foods consumed on low-carbohydrate diets are not always consistent with other evidence that suggests a diet high in plant products from vegetables, fruits and whole grains and low in saturated fat is optimal to prevent hypertension, cancer and hypercholesterolemia and coronary artery disease. My two main questions regarding low-carbohydrate diets are: Can people stay on them long-term? And if they can what are the long-term health risks? While studies to date haven't shown excessive morbidity from low-carbohydrate diets, case reports are accumulating and long-term health effects haven't been adequately evaluated.⁶

Another popular diet option for physicians and patients to consider is a low-fat diet. These lead to modest weight loss, but if the only focus is on fat and greater non-fat calories

It is important for doctors to help patients understand the common features of a dietary program that promotes weight loss and improved health

are consumed, weight loss will not result. There is interest in a low-glycemic index diet to promote weight loss. At this point, however, there is only limited evidence of clinical effectiveness. There is some overlap among different programs. For example, a low-fat diet, a low-glycemic index diet and a low-energy dense diet may contain common features such as being high in fiber.

Short-term studies suggest that consuming low-energy dense foods can lead to lower energy intake and weight loss.⁷ In addition, the types of foods consumed on a low-energy dense diet are consistent with other

dietary recommendations to maintain good health.

It is important for doctors to help patients understand the common features of a dietary program that promotes weight loss and improved health, including:

- A reduction in total caloric intake to a deficit of 500-1,000 kcal/ day.
- Generous amounts of fresh or frozen vegetables and fruits (not fruit juice or dried fruit that is higher in energy density),
- Moderate amounts of whole grain products,
- Lean sources of protein and
- Low intake of saturated fat, sugar and other refined carbohydrate.

Additionally, when fat is consumed, monounsaturated fats would be the best choice for cardiovascular health. Controlling portion size (except for vegetables and fruits), especially when eating in restaurants and snacking is necessary as these factors have been associated with increased energy intake.

It is challenging for physicians to address obesity and recommend dietary therapy with the limited amount of time available in a typical patient appointment. I try and perform a brief baseline assessment of diet, activity and behavioral habits to arrive at individualized dietary recommendations. A physician's role should be to provide motivation and general recommendations, then refer an obese patient to a Registered Dietitian for more detailed counseling.

Dietary recommendations should be practical. However, people often underestimate their ability to change

dietary habits. Old recipes should be modified and new ones incorporated. Process goals, which are specific, measurable and realistic should be utilized. Examples include eating one-half the usual portion of meat, eating one more serving of vegetables each day, or eating breakfast regularly. The evidence and my experience shows that patients who keep dietary records are more successful at weight management.

As a physician, I encourage my patients to approach a dietary program as a lifestyle change that will be sustainable, instead of 'going on a diet', which implies a temporary, negative and restrictive change in eating. Eating well, eating healthfully and reducing calories are not mutually exclusive when using creative strategies to apply the above suggestions. **EN**

REFERENCES

- ¹ Weinsier RL, Wadden TA, Ritenbaugh C, Harrison GG, Johnson FS, Wilmore JH. Recommended therapeutic guidelines for professional weight control programs. *Am J Clin Nutr* 1984;40:865-72.
- ² Mustajoki P, Pekkarinen T. Very low energy diets in the treatment of obesity. *Obes Rev* 2001;2:61-72.
- ³ Heymsfield SB, Van Mierlo CA, Van Der Knaap HC, et al. Weight management using a meal replacement strategy: meta and pooling analysis from six studies. *Int J Obes Relat Metab Disord* 2003;27:537-49.
- ⁴ Samaha FF, Iqbal N, Seshadri P, et al. A low-carbohydrate as compared with a low-fat diet in severe obesity. *N Engl J Med* 2003;348:2074-81.
- ⁵ Foster GD, Wyatt HR, Hill JO, et al. A randomized trial of a low-carbohydrate diet for obesity. *N Engl J Med* 2003;348:2082-90.
- ⁶ Stevens A, Robinson DP, Turpin J, Groshong T, Tobias JD. Sudden cardiac death of an adolescent during dieting. *South Med J* 2002;95:1047-9.
- ⁷ Rolls BJ, Bell EA. Dietary approaches to the treatment of obesity. *Med Clin North Am* 2000;2:401-18.