Diet, Obesity, and Political Involvement

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The views expressed are those of the author and may not necessarily reflect the views of the Editorial Board.

Abstract: This essay is an opinion article addressed to the busy practitioner. It provides information on nutrition, diet, nutritional science, and obesity to serve as a reference in teaching his patients on these issues. It is composed by a gastroenterologist who has been engaged in clinical gastroenterology and nutrition, research, and teaching in an academic medical center for 35 years. It also relates the information to conclusions on reasonable involvement of the national government in these topics. Finally, its audience might include the interested, well-educated, lay public. Hence, excessive scientific parlance and referencing have been avoided.

Key Words: nutrition, obesity, diet, nutrients, metabolism

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Any governmental program that mandates certain dietary prescriptions or proscriptions is a restriction of liberty, so that the general good can be advanced, in a quest to provide some beneficial equality. The diminished freedom is evident by a decreased availability of some goods or the implementation of a tax to support the program. Therefore, the reasons should be compelling to justify the restrictions.¹ This essay is written to provide the busy practitioner with material to use in his discussing and teaching his patients about nutritional and dietary issues. Clinical gastroenterologists, nutritionists, and family practitioners would be obvious components of this audience. In addition, the information might be shared with interested, well-educated patients. The author is an Emeritus Professor at a major medical institution. He has practiced clinical medicine for 38 years, served as division chief of gastroenterology for 12 years, and was chief of nutritional support for 30 years. In addition, he was honored by this journal in a featured biography in 2004, and he was presented with the American Gastroenterological Association Distinguished Clinician Award in 2009. He has used the ideas contained herein in teaching medical personnel and patients throughout his career. Examples of nutritional issues are given to clarify the author's point of view and to facilitate the understanding of recommendations given in the concluding section. The essay is written as an opinion editorial for easy reading with the avoidance of too much

scientific parlance. To that end, extensive scientific referencing has been purposely avoided.

DISCUSSION

There is no question that obesity is a major health problem for developed countries, and has recently been identified more frequently in children. It contributes to type 2 diabetes mellitus, arteriosclerosis (including stroke and coronary artery disease), musculoskeletal disorders, and some cancers. It is also a component of the metabolic syndrome comprised of obesity, elevated plasma lipids, arteriosclerosis, type 2 diabetes mellitus, and fatty liver disease. Further, it contributes to diminished mobility in the elderly and in those with musculoskeletal problems. Finally, it is a contributing factor in postoperative morbidity and mortality.

Consequently, there have been many measures advocated to address the problem, including specific diets, exercise programs, dietary medications, and vitamins. There has also been increasing attention to measures to alter the dietary habits in children and teenagers. Even surgical treatment of the morbidly obese has been employed. Despite these efforts, there has been little impact on the problem. Specific diets have also been advocated to promote general "good health," often with little scientific credence or well-documented value demonstrated.

Before developing a set of recommendations that would be useful to address these issues, it is necessary to discuss the nature, physiology, and biochemistry of humans; an understanding of how we ingest and absorb nutrients; our ability to use nutrients to warm our bodies and permit locomotion; the results from excess assimilated fuel and the meaning of energy balance; the basic food stuffs that we ingest, and for what each is required; and how we are related to other animals in our physiology and biochemistry. Along these lines, concepts of adaptability and interchange among the nutrients will be adduced. Finally, discussions of micronutrients, the scientific method to explore efficacy, some nutritional fallacies, and recommendations will be presented.

Nutrient Absorption and Adaptability

Carbohydrates, proteins, and fats have to undergo digestion of the large molecules into small entities to permit passage through the lining cells into the blood stream. Enzymes are proteins present on the lining of the intestine or secreted into the gut lumen to promote digestion. Fats are converted into fatty acids and glycerol; proteins into amino acids or small combinations of amino acids (peptides); and long chain carbohydrates into smaller carbohydrates (such as starch into glucose). The smaller molecules pass through the intestinal wall more easily and are often facilitated in this passage by carrier mechanisms present on the gut membrane. The digestive process is extremely efficient. Under normal circumstances, almost all of the ingested carbohydrate and protein and 95% of the fat are absorbed. There is significant adaptability of the enzymatic and carrier mechanisms to changes in the

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The author declares that there is nothing to disclose.

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ingestion of nutrients. For example, the enzyme responsible for splitting lactose, the sugar in milk, into glucose and galactose, is “downregulated,” and is in lower concentration, when less lactose (milk) is ingested. This allows for protein synthesis elsewhere. In contrast, iron absorption is facilitated across the intestinal membrane when there is too little iron in the blood. The intestine, then, compensates for variations in nutrient intake. In addition, the avid absorption of most carbohydrates makes some of the claims that certain carbohydrates (starch) are preferred to its constituents (glucose) incredible. Measured blood glucose is identical following the ingestion of an equivalent weight of glucose or starch.

Nutrients and Their Metabolic Handling

An understanding of the categories of nutrients is necessary to grasp concepts of energy balance and obesity. Humans evolved from creatures of the sea, necessitating water and the major minerals, sodium (Na) and chloride (Cl). In a sense, seawater has been transported into our blood and tissue fluids. The cells of our tissues require the other mineral macronutrients: potassium, bicarbonate, magnesium, calcium, and phosphate. There are finely tuned mechanisms involving the gastrointestinal tract, the kidneys, the blood, the tissues, and the membranes of cells, assuring homeostasis. These macronutrients do not contribute to energy balance or obesity, but they are required for survival.

The 3 nutrients contributing to energy balance are proteins, carbohydrates, and lipids (fats). Proteins are comprised of strings of constituent amino acids. Following digestion, the amino acids are transported into the blood stream and body organs, especially the liver, for new protein synthesis. These synthesized proteins provide for our bodies’ structure in cells, tissues, and organs; enzymes; hormones; and other circulating messengers. All of our bodily functions are dependent upon proteins.

Carbohydrates and lipids provide energy for the functioning of the body, including maintenance of heat, movement, and the cellular chemical processes involved in homeostasis. Although there are some dietary carbohydrates and fats that are “essential,” and cannot be synthesized from other nutrients, there is interchangeability among them. The constituents of carbohydrates and lipids enter various intermediary metabolic processes, mostly in the liver, that allow for this interchange and synthesis of new molecules. The metabolism of the constituents of carbohydrates and lipids generates energy for the above-enumerated functions. Excessive ingestion leads to storage as fat.

Digested proteins also enter the intermediary metabolic cycles as their constituent amino acids and can produce energy or can be synthesized into carbohydrates (gluconeogenesis) or fats. Excess proteins are, then, stored as fat. These 3 moieties have specialized uses, their essential functions, which cannot be performed by the other 2, but they are exchangeable from the standpoint of energy production and fat storage.

However, the amounts of energy generation from the 3 are not identical. The measurement used for this is the calorie which is the amount of heat required to raise the temperature of 1 g of water 1°C, usually expressed in kilocalories (kcal) or capitalized, Calories (Cals). 1000 calories equals 1 kcal. The oxidation (burning) of fats produce about 9 kcal/g; proteins and carbohydrates somewhat <4. Therefore, fats are much more energy dense than the other 2. One can see that eating an amount (weight) of fats will allow for over twice the

energy production from an equivalent amount of carbohydrates and protein. In addition, ingestion of fat promotes much more fat storage, when excessive, than equivalent amounts of proteins or carbohydrates.

The interchange among these 3 nutrients by means of cyclical metabolic mechanisms should not surprise us, as nature is replete with cyclical processes, such as the CO₂, issued from the respiration of plants and animals, in the photosynthetic production of carbohydrates and oxygen by chlorophyll-containing plants. The interdependence of plants and animals is evident in this cycle. Another example of a cyclical process is the CO₂-calcium carbonate cycle in the ocean and land, important in climatology theory. The interchangeability of our 3 basic food substances allows for thriving humans in polar regions, which might have 90% of their calories provided by fats (polar bear or seal meat and blubber), and many Asians with 90% of their calories carbohydrate (rice).

Many of the metabolic processes in human cells are also contained in all or most animals. Our earth has undergone many changes that have required adaptable metabolic machinery, and redundant metabolic processes to assist in dealing with the changes. Life is the most enduring characteristic of Earth, expressed by living cells, which have enormous capacity to survive in varied environments, through evolutionary change and adaptability.

The need to store metabolic fuel is determined by the metabolic rate of the organism. If fuel intake exceeds output, storage of fat eventuates. The metabolic rate is comprised of the basal energy expenditure (basal metabolic rate) and the energy required for any additional physical work. The basal metabolic rate assures maintenance of our body heat and all of the physical processes involved in life. One can see that the amount of calories consumed increase with exercise. Conversely, the amount stored as fat is increased with less exercise.

The Influence of Genetics, Hormones, and the Hypothalamus in Weight Control

There is mounting evidence that there are significant genetic determinations of obesity. In our daily observations we can see this relationship. We are a varied and unequal species in many respects, including our body habitus. Although eating rituals may be established through acculturation, it is striking how much parents and their children resemble each other in physical appearance. Further, observations of eating habits of individuals who are obese compared with those who tend to be thin usually show that the obese are much more careful in selecting what and how much they eat than the thin. The thin seem to be able to maintain thin-ness without involving any conscious control.

These homely notions are also supported scientifically. In the 1960s, a trial of overfeeding prison inmates showed that their metabolism sped up during overfeeding, and allowed for rapid weight loss with the return to a regular diet.² In contrast, those overfed who were prone to obesity did not shed their weight as easily with dietary restitution. In addition, biologically identical twin studies show that the tendency to obesity persists in both the twins, regardless whether they are brought up in the same or different households.^{3,4} Recently, these concepts have received more credence in studies implicating a satiety hormonal factor, leptin; a hunger-stimulating hormone, ghrelin; and the hypothalamus.² The upshot of all of these investigations is that obesity may not be under as much conscious control as

was originally thought. This is not to say that it is not under conscious control. It is to stress that those tending to obesity would have to involve more conscious control than those genetically tending to be thin.

Micronutrients and the Recommended Dietary Allowance (RDA)

The micronutrients are vitamins and minerals that are required for optimal expression of life, but are found in relatively small quantities in the body. Excessive ingestion of micronutrients can be stored or excreted from the body. Fat-soluble vitamins, including vitamins A and D, are stored in the liver and can produce harm in excessive amounts. Water-soluble vitamins, such as vitamin C and the B vitamins are generally harmless, even when ingested in large quantities, as the excess is excreted in the urine. However, these water-soluble vitamins, especially pyridoxine, can occasionally be detrimental, particularly when used chronically in high amounts or when associated with kidney failure. Calcium, magnesium, potassium, chloride, and sodium are macronutrient minerals, as they are abundant in the body. Obvious examples of harmful, mineral micronutrients include iron, copper, and manganese when ingested excessively.

A daunting task has been the development of RDAs for micronutrients. This is the amount that prevents a deficiency disease for each nutrient. The difficulties in making the determination can be illustrated by the example of scurvy. British sailors in the 17th and 18th centuries developed bleeding gums and skin lesions, ascribed to diminished intake of vitamin C. They were eventually called limeys as the provision of limes, which have an abundance of vitamin C, prevented the development of scurvy when supplied on the ocean-going ships. One can see the difficulties involved in determining the amount of vitamin C needed to prevent or treat the disease, and translate this into the amount of limes to ingest daily. Ideally, those affected with scurvy could enter a trial involving various daily amounts of vitamin C, and find out the least amount to rectify the problem. Of course, a suitable measurement, such as a bleeding time or a measurement of blood vitamin C, would be necessary to make the judgment objective. Finally, the amount of vitamin C contained in each lime would allow calculation of how much of the RDA is contained in each lime. This calculation would have to take into account the freshness of the limes, as the amount of vitamin C would probably be higher in the fresher limes. From an ethical standpoint, the trial could not be done, as it would be inappropriate to give the scorbutic individuals the low doses of vitamin C.

Similar problems arise in determining the RDA for all micronutrients. One approach to this has utilized blood levels for a micronutrient, relating this to some effect on the body. One can screen a large, healthy, population and find the average and variance of the micronutrient, then compare this to a group that has some defect, presumably due to a diminished store of the micronutrient. Then a difficult translation to the amount of the micronutrient required to promote restitution of the blood level would be required.

The body has exquisitely controlled mechanisms for the absorption and excretion of nutrients, such as the efficient excretion of excess (Na) and water-soluble vitamins; and the variable absorption of iron (Fe), dependent upon bodily stores of Fe. There may be similar control mechanisms involving all of the micronutrients. Further, most plant and animal cells that we ingest contain

micronutrients, although in variable amounts, allowing for micronutrient assimilation from most things that we eat. It is noteworthy that a baby can live on milk alone for over a year. Presumably, humans could live on eggs alone, which might contain all of the necessary micronutrients.

Special Nutritional Problems; Gluten; Food Allergy; Food Intolerance; Aspartame

Gluten is a general term for some of the proteins found in wheat, barley, and rye, and is responsible for celiac disease (CD), a relatively common malady, affecting around 1% of those of northern European ancestry, and present worldwide at a lower incidence. Although its most common presentations currently are iron deficiency or nonspecific gastrointestinal complaints, it can present with neurological symptoms, severe diarrhea, weight loss, nutritional deficiencies, menstrual irregularity and infertility, liver abnormalities, and a skin disorder. It is diagnosed by blood studies and by biopsy of the intestinal epithelium and is cured by the observance of a diet that avoids gluten.

Our most common gastrointestinal disturbance is the irritable bowel syndrome (IBS), which may have the same symptoms as CD. However, most patients with IBS do not have CD. Current investigations are underway to see if a subgroup of IBS patients is intolerant to gluten-containing diets, without having CD. This information has been expanded by many who have promulgated avoidance of gluten for a host of different symptoms with little or no evidence supporting the contentions. Studies of symptom relief from dietary gluten withdrawal in IBS are much more difficult to accomplish successfully when compared with studies in CD. In CD, there are specific markers that can be measured objectively. Further, CD is potentially life threatening, making the incentive to accomplish the study higher than in a similar study on IBS patients. Although IBS may be responsible for many symptoms, its improvement cannot be gauged easily by objective measurements, and it does not pose a risk of death. When compared with our paradigmatic example of limes, vitamin C, and scurvy, one can realize that a reliable study of gluten withdrawal in IBS would be much more difficult to accomplish.

There are food intolerances in normal individuals, often more prominent in those with IBS. Many of these are idiosyncratic, and do not lend themselves to general therapeutic dicta. Although food allergy has been suggested as being responsible for these intolerances, classic allergic mechanisms, presenting clinically with a skin rash or trouble breathing, are relatively uncommon.

It is not uncommon to read in the lay literature concerns about the use of aspartame, an artificial sweetener, much sweeter per amount than glucose, fructose, or sucrose. Some have claimed that allowing too much sweeteners in children has promoted excessive consumption of sweet foods to the exclusion of other more "nutritionally replete" foods. The scientific evaluation of this proposal is discussed in the following section, but it should be stressed that aspartame is comprised of a dipeptide of 2 amino acids, aspartic acid, and phenylalanine, which are found in most proteins. It is nearly completely digested into its component amino acids, although a small amount is absorbed as the dipeptide. There might be rare intolerances to the dipeptide, but the constituent amino acids are as safe as those present in all the proteins that we eat [an exception is excessive phenylalanine ingestion in patients with the rare

congenital illness, phenylketonuria (PKU), as phenylalanine is one of the 2 amino acids in aspartame].

Scientific Evaluation and Controlled Studies

If one wants to do a trial to see if an intervention is therapeutically useful for a disease, the best type of investigation is a randomized, doubly blind trial. That is one in which members of a population receive the questioned therapy or a placebo on a randomized basis, and neither the patient nor the treating and evaluating health workers know which treatment is given. If the chosen endpoint shows improvement in the condition in the group receiving the therapy versus the placebo, then the therapy is considered of value. In the scurvy example, if a trial of vitamin C is shown to cure scurvy when compared with placebo, the vitamin C is considered therapeutic. Things are more complicated with studies involving limes, as it would be difficult to get a lime placebo.

Some studies of specific nutrients have been performed to see if the nutrient has a salutary role. Experimental studies have suggested that vitamins with antioxidant properties, such as vitamin A or vitamin E, might have a binding effect on free radicals, or reactive oxygen species, and might prevent or reverse cancer. Unfortunately, well-controlled randomized, double-blind studies have not shown efficacy. For example, a Scandinavian study of cigarette smokers did not show a reduction in the incidence of lung cancer in those given vitamins A and E.⁵

In looking at more complex problems, such as obesity, one can see other confounding influences. If a trial of a high-fat versus a low-fat-containing diet is entertained, various things need to be “controlled” to exclude their influence: the other components of the diets, for example protein content, should be equivalent; there has to be assurance that the diets are rigorously followed; a decision has to be made whether to keep the caloric content the same or to allow the subject to eat as much as he wants of the diet; the amount of physical exercise must be the same for each group; the 2 groups must be as close to identical as possible, usually achieved statistically by randomization; and the duration of the study should be long enough to achieve meaningful results. Many of these characteristics cannot be achieved in the outpatient setting, and, yet, it is outpatients who will be taking the advice derived from the studies. Most weight-loss studies comparing various diets have not controlled for calories and have shown efficacy in the short term, but not the long term. This should not surprise us, as weight loss or gain is related to total calories ingested, not to the type of food (fat, carbohydrate, or protein), due to the caloric interchangeability of these nutrients; and to the amount of physical exercise performed.

An example may clarify this issue. Perhaps the most popular diet along these lines is the DASH (Dietary Approaches to Stop Hypertension) eating plan.⁶ This diet contains foods with less sodium chloride, calories, and cholesterol than that of the usual American diet. In addition, an exercise program is included and encouraged. The balance among fats, carbohydrates, and proteins is similar to that of the American diet. One can see the difficulties in doing a study to substantiate that the diet is an improvement over other diets for prolonged weight loss. One would have to control for salt intake, exercise, and caloric input, and the study would have to be sufficiently long to show prolonged efficacy. We already know that exercise and caloric restriction promote weight loss; what has not been demonstrated is efficacy of one diet over another in the long term. The difficulty in achieving

prolonged weight loss in the long term is due to the challenge of prolonged restriction of calories.

As mentioned above, some have advocated avoidance of sweet foods in children as they might condition children to eat less “nutritionally rich” foods. Note that exclusion of fruits is not included in the proscription, even though many are quite sweet. One can see the difficulties in doing a well-controlled study of this thesis, randomizing one group of children to have no artificial sweeteners and no sweetened beverages (except “natural” fruit juices), the other with no restrictions, for a prolonged duration, perhaps a year, and measuring the effect on body mass index (a measurement of body fat content). The most important chore would be the exclusion of sweetened beverages in our society and the onerous task of supervising the restrictions. Those of us with children and grandchildren understand the difficulties.

Recommendations for Governmental Involvement in Diet and Nutrition

- (1) *Diets for obesity prevention.* The body has many mechanisms in place that allow for varying absorption, synthesis, interconversion, elimination, and retention of nutrients to augment survival under varying circumstances. It should not be surprising that specific diets to control, modify, or prevent obesity have not shown efficacy over simple caloric restriction, fulfilling scientific scrutiny. As the amounts of micronutrients and macronutrients are present in variable amounts among foods, the homely recommendation that diets should strive to achieve some balance is reasonable. Mother's nagging her youngsters to “eat their vegetables” sounds like good teaching. Individual food tastes determine much of what we eat, and our tastes vary widely, both among different cultures and as each of us goes through life's stages. Gustatory satisfaction is one of the pleasures of life, and many of our social engagements take place around food and liquid consumption. Programs to modify this behavior will usually fail, especially in the long run. Therefore, governmental programs trying to force dietary changes, when there is no strong, scientific evidence supporting the measures, is an unwise restriction of liberty, by limiting the freedom to choose different foods and by the cost for its implementation (a type of tax, which is a diminution of the freedom to use the money elsewhere).
- (2) Obesity should be considered a characteristic, similar to other differences among members of our species (height, skin color, eye color, intelligence, sociability, etc.) and should not be an object of scornful criticism. Children chiding the obese child are similar to other bullying practices, which parents and other adults should abjure. The obese individual is prone to be obese. He is not responsible for the tendency to obesity. Weight control for the obese remains one of the major challenges during their lives. A thin person who does not have to be careful about what he eats should not be applauded for his thin-ness. Rather the obese person who is able to control his weight through caloric limitation and exercise should be recognized for his noble achievement.
- (3) The most effective strategy for weight control is to effect change on the other side of the metabolic equation, exercise. Weight gain is directly related to caloric input and inversely related to metabolic activity and exercise. It is unusual to see an obese tennis professional or lumbar-jack. Exercise should be encouraged in all of us

for weight control and general fitness. It would seem reasonable to have governmental influence on exercise in children, with mandatory gym and recess activities.

- (4) *Food labeling for specific purposes.* It is reasonable for governmental involvement in labeling contents of food that would specify harmful ingredients for specific diseases, such as gluten for CD and phenylalanine for PKU. In addition, it is reasonable to indicate the caloric content of foods, as the information might influence one's behavior in weight control programs. Further, listing Na and K content of foods might assist consumers with heart and kidney disorders. The cost involved in labeling all of the micronutrients for each food item, both for the manufacturer and the monitoring, and, eventually, to the consumer seems excessive. The guidepost should be whether the labeling of a nutrient content is of proven use in preventing or ameliorating disease.
- (5) Governmental labeling of "nutritious foods," versus "non-nutritious foods" is not well supported by well-performed, scientific studies. This should be eschewed, along with labeling sweet foods, those containing fats, or artificial sweeteners, except for aspartame in those with PKU. Further, governmental involvement in the amount of Na, fats, sugars, starch, etc. that is "healthy" should be abjured. No food is intrinsically "unhealthy" for the general population, but its healthiness is dependent upon a point of view. For example, someone subject to heart failure or with failing kidneys might require salt restriction (Na), whereas Na restriction for the general population might be harmful. Listing some carbohydrates as "healthy" (those in fruit juices), whereas others (fructose in cola products) as "unhealthy," does not make sense as each carbohydrate eventuates in the same metabolic cycles within the liver, and are metabolically interchangeable.
- (6) The Food and Drug Administration (FDA) does a responsible assessment of drugs, and should be the judge of the safety of artificial sweeteners. Aspartame has been studied quite exhaustively and is deemed safe by the FDA, which should be the final arbiter. Any new

sweeteners should be subjected to the same scrutiny, and any ongoing information on sweeteners should be within the province of the FDA. Claims for excessive use of vitamins, so-called megavitamin therapy, should be evaluated similarly to any drug product assessment, including evidence of risks. In general the RDA listed for vitamins, determined by FDA evaluation, and included in multivitamins, is a reasonable guideline for general use. Specialized considerations, such as additional folic acid during pregnancy, or increased vitamin D intake in those shown to be deficient, should also be encouraged.

- (7) Various dietary programs should undergo the same scientific evaluation that other treatment programs undergo. Clearly, it is unjustified for governmental advocacy of 1 dietary program over another, when there are no hard data. Simple measures to limit caloric intake, regardless of the source, should be the mainstay. For reasons specified above; including adaptability, interchangeability among nutrients, and cultural and genetic predispositions; it is unlikely that 1 specific dietary program will prove useful for weight control over another for the general population.

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