PROCEEDINGS

Agriculture Outlook '92

New Opportunities for Agriculture

68th Annual Outlook Conference

United States Department of Agriculture

Washington, DC December 3-5, 1991

ANNUAL AGRICULTURAL OUTLOOK CONFERENCE
United States Department of Agriculture
Washington, D.C. 20250-3900

NUTRIENT CONTENT OF FOODS IMPORTANT TO HEALTH

Jacqueline Dupont* and Gary R. Beecher†

*National Program Leader for Human Nutrition
ARS/USDA, Beltsville, Maryland
†Research Leader, Nutrient Composition Laboratory
BHNRC/ARS/USDA, Beltsville, Maryland

Dietary Guidelines for Americans are recommended by the USDA and the Department of Health and Human Services to help people make food choices that will provide all the essential nutrients and an appropriate level of energy. Because we don't know everything that is in food and how all of the components contribute to health, and because of the pleasures of eating foods that have good taste and social meaning it is of first importance to EAT A VARIETY OF FOODS. But, at the same time we must MAINTAIN A HEALTHY WEIGHT. Those two needs may sometimes conflict with each other and that is one reason we are advised to CHOOSE A DIET LOW IN FAT.

Consumers find it difficult to make those choices, partly because it is hard to know where the fat is found in foods. Food producers and marketers are modifying foods to help consumers find appropriate choices. It is important to understand how the food modifications affect the amount of fat and the amount of calories in foods.

There are two parts to the understanding of energy value of food (Figure 1). The first is DENSITY. Gravity determines density. Things with solidly packed molecules weigh more than those that are airy because of the force of gravity--so, one way to dilute calories per serving is to mix in a lot of air.

The second part of energy value is ENERGY DENSITY, the amount of calories obtained from the energy-yielding nutrients, fat, carbohydrate, and protein. Fat has 9 calories per gram and carbohydrate and protein each have 4 calories per gram. Obviously, one can consume 2.25 times as much volume of carbohydrate or protein as fat to get the same number of calories. Some parts of food have zero calories--those are water and fillers.

So, to have a food with fewer calories per serving, one can dilute fat with air or water (diet margarine); substitute a carbohydrate or protein for fat; add air to protein (meringue) or water to

protein (jello); or water to carbohydrate (potato, rice, pasta); or add a no-calorie filler (some fibers). To keep water from separating from the food, gums, starches and proteins may be added. Combinations of all of these processes are being used to provide a great variety of reduced calorie meat products, desserts and main dishes of many kinds.

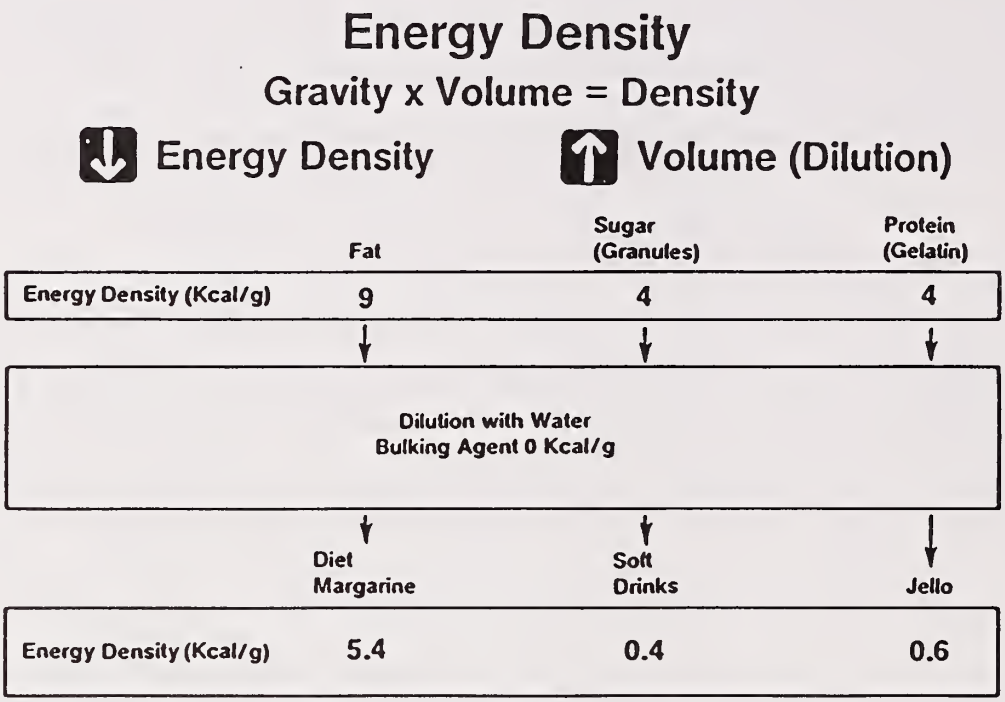

Figure 1. Definition of energy value of foods.

These formulations combine the aspects of DENSITY as defined by gravity and ENERGY DENSITY as determined by the combination of 9, 4, and 4 calories per gram of food components. They present problems to the people responsible for providing information about food composition to consumers. There is a need constantly to analyze every new food that is formulated for its energy value, availability of the energy to the consumer, and the effects of the formulation on availability of all the other nutrients in the particular food and other foods consumed with it.

How do we CHOOSE A DIET LOW IN SATURATED FAT? There are some general guidelines about relative amounts of saturated fatty acids in foods, and they must be interpreted along with the information about total fat. To make sound estimates of saturated fatty acids will require the consumer to read labels, and for the food supplier to be able to put accurate information on the label! That means that food scientists must provide accurate and reliable data and the responsibility for that requires continuous development of

better and more efficient methods, training of technicians, and monitoring quality of performance.

We should CHOOSE A DIET LOW IN CHOLESTEROL (Figure 2). Why is that difficult? Only animal food products contain cholesterol, but the numbers keep changing. Old methods to measure cholesterol measured a group of sterols including cholesterol and other compounds, so the total value for an egg was 274 mg. New instruments and their efficient use have enabled us to separate all those different compounds and give accurate values to each one, so now we know that the same egg actually has 213 mg cholesterol, and small amounts of sitosterol and other plant sterols. It is important to know the true value of cholesterol, but all those other compounds are important too, and must be included in our data bases.

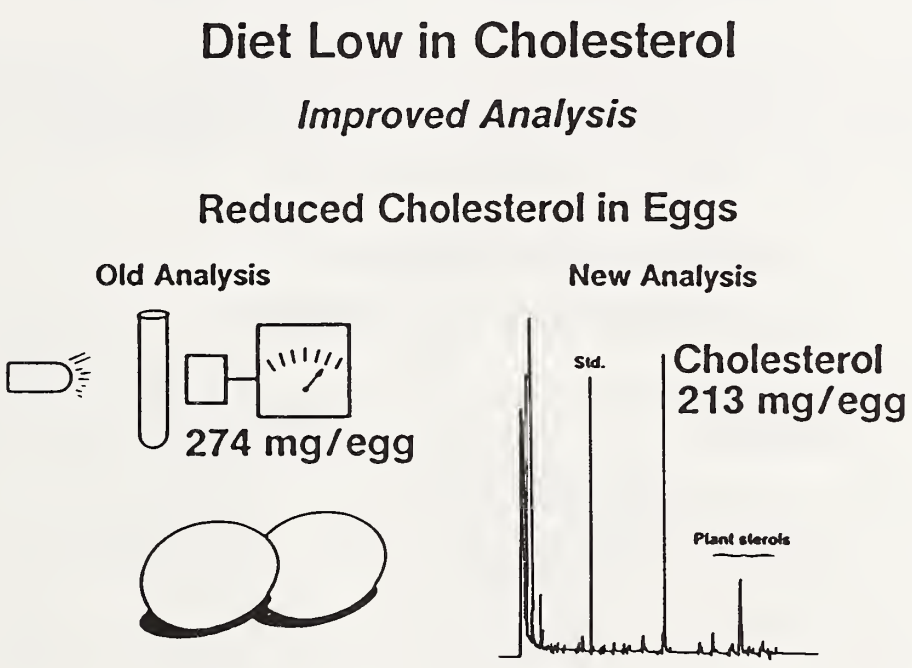

Figure 2. Explanation of changing quantitative values of sterols in foods related to advancement of technology.

CHOOSE A DIET WITH PLENTY OF VEGETABLES, FRUITS, AND GRAIN PRODUCTS. Why is there so much emphasis on such an old saw? Epidemiological research has shown that people who choose such diets are less likely to have cancer and other diseases than those people who eat a less varied diet. Controlled dietary studies have helped to clarify what foods and which components of foods contribute to protection from different diseases. Because of that knowledge we must develop reliable and efficient methods to analyze

all of the protective foods so that better informed choices can be made within the preferred habits of our diverse population. We are now making many of these measurements. For instance are the minerals, Boron, Molybdenum, Nickel and Vanadium, dietary essentials and how much is in foods? We are working intensively to devise scientifically strong, but technically feasible and efficient methods for many factors that may be shown to be extremely important in protection from disease. In relation to cardiovascular heart disease we need to provide qualitative and quantitative values for dietary fibers, omega-3 fatty acids, saponins and tocotrienols. To reduce cancer risk we need to increase consumption of fruits and vegetables and learn their quantitative contributions of carotenoids, flavonoids, phytates, phyto-estrogens, phyto-sterols, saponins and trypsin inhibitors. We must learn by experimentation how these factors are protective or harmful.

All of our research is directed to determining the relationships between food and health (Figure 3). Food provides nutrients that interact with our genetic potential to achieve health. All of the modern biological sciences provide links that describe our nutritional status and its impact on health.

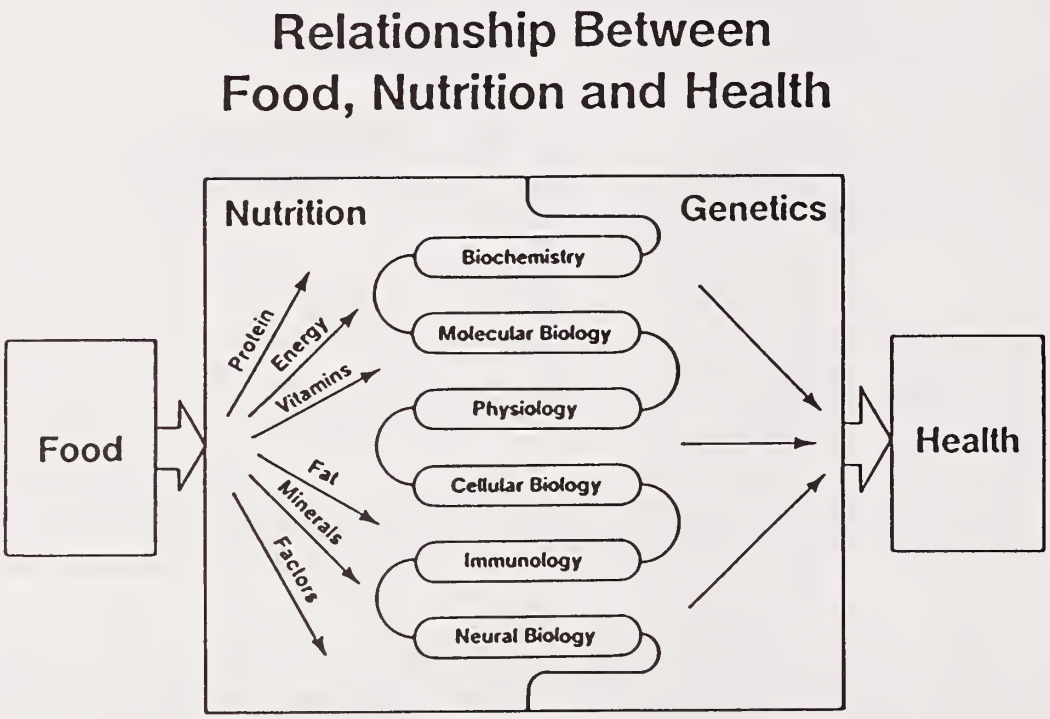

Figure 3. Current Understanding of relationship between nutrition, genetics and the basic sciences as they are influenced by food consumption to modulate health status.

We have the data bases for the nutrients that have been known for 40 years and longer. Now we are compiling the knowledge to build new data bases to answer the dietary guidelines questions of the coming decades. These newly recognized factors will take a position in the spectrum of nutrient classes. We propose that a new name be given to this class of nutrients. The words vita - Latin for life and Alimin - Latin for nourishment, together make the word vitalimin, factor of life nourishment (Figure 4).

VITA = Life

ALIMIN = Nourishment

VITALIMIN = Factor for Life Nourishment

Figure 4. Proposed nomenclature for a class of nutrients in foods that are up and down regulators of life processes.

Bibliography

Halliwell, B. (1990). How to characterize a biological antioxidant. Free Rad. Res. Comm. 9:1-32.

Nielsen, F. H. (1991). Nutritional requirements for boron, silicon, vanadium, nickel, and arsenic: current knowledge and speculation. FASEB J. 5:2661-2667.

Wattenberg, L.W. (1990). Inhibition of carcinogensis by minor anutrient constituents of the diet. Proc. Nutr. Soc. 49:173-183.