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Genetically Engineered Food: Not Ready for Prime Time

Evaluating an entirely new kind of food is both a daunting and an exciting prospect. From listening to the claims of the extravagantly funded public relations effort being mounted by the biotech seed industry, one could be inclined to conclude that all problems of nutrition, agriculture, and food security will shortly be addressed. Yet a careful examination of the small amount of peer-reviewed, non–industry-funded research on genetically engineered food reveals a starkly different picture.

There is little agreement between the small number of proponents of genetically engineered food (almost none outside of the industry and its immediate allies) and the rapidly growing number of critics. So perhaps we should begin a review of the issues with the basic question of whether or not biotech food is a new kind of food. The industry and its friends in the Food and Drug Administration claim that this is just traditional plant breeding in a new form that is "substantially equivalent" to other plant breeding, like hybrids.

Others disagree. Research scientist Michael Hansen, writing in *Chemical & Engineering News* (2000;78:21), points out that traditional plant breeding consists of moving around differing versions (alleles) of the same genes. In genetic engineering, gene material that probably comes from an entirely different organism is inserted in an essentially random fashion into the host. Hansen points out that the crucial unknowns in this process include the number of inserts of transgenic DNA, the exact location on the chromosome, and the functional and structural stability of those inserted chromosomes.

The very randomness of the genetic engineering process itself can bring about risk. For example, Hansen points out that, if inserted material lands in the middle of an important gene, that gene can cease to function. If a function of that gene were to code for the expression of a regulatory protein that prevents the production of a toxin, the level of that toxin could rise.

These genetic-engineering changes can result in a number of other unpredictable alterations in the food, such as allergy and changes in the nutritional value of the food itself. Allergies are of concern because there is a triple threat of potential allergy in genetically engineered food. This threat includes the danger of food-allergy reaction to a protein expressed by an inserted gene, allergic reaction to novel protein combinations arising from the genetic engineering, and the complete impossibility of guarding against such problems because of the labeling issue. Unlike almost all countries selling genetically engineered food in large quantities, the United States does not require labeling of genetically engineered food or its components.

There has been little peer-reviewed, non–industry-funded research on nutritional changes in genetically engineered food. In one independent study by the Center for Ethics and Toxics, a major type of genetically engineered soy was shown to undergo a 12% to 16% decrease in phytoestrogens because of the engineering. Other objective nutritional data are just starting to emerge. In general, the best we can say until more science is done is that genetically engineered food gives scant evidence of increasing nutritional factors and some reasons to be cautious about possible declines in significant areas. Much more unbiased research is needed in this area.

While we are looking for more research, there are other critical items to add to the list. Genetic engineering usually consists of the transfer of a "package" that consists of the foreign gene or genes to be inserted, plus a promoter (often a virus) to aid in the transfer process, plus a marker to permit the genetic engineers to ascertain whether the package has been delivered. The markers are frequently antibiotic-resistant genes, so that antibiotics can be used to ascertain whether the genetic engineering arrived in the host organism.

Emerging science is now casting doubt on the assumed benign nature of these package components. The antibiotic markers have been shown to be capable of migrating to human intestinal flora, raising the possibility of increasing antibiotic resistance, a serious problem in human health in the United States and around the world. Moreover, preliminary impartial science examining one of the most common promoters, cauliflower mosaic virus, raises good reasons to be concerned about migration of these viruses out of the package into the genes of the host, including the person eating the food. Concerns about these viral promoters include serious issues such as the reactivation of archaic viral material resident in human genes. Little is known, and more research, once again, is needed.

The industry's public-relations drum beats on. The biotech seed industry claims environmental, crop yield, and other economic benefits that do not stand up well under independent scrutiny. Those in public relations solemnly describe the possible future delivery of drugs or enhanced nutrition, with little or no experimental evidence to back up this science fiction. Perhaps worst of all, the industry repeatedly predicts that it represents the best or only route to addressing world hunger.

This last distortion is especially distressing, unsupported as it is by evidence or facts. Those of us who have worked directly on the issue of starvation (my own hands-on work in this field goes back more than 30 years) know that people in our world starve because they are poor, because food is unevenly distributed, and because farm land is converted to other purposes. We know that most of the bioengineered crops being grown in southern countries are for

Correspondence to: Martin Teitel, PhD, Executive Director, Council for Responsible Genetics, 5 Upland Road, Suite 3, Cambridge, MA 02140, USA. E-mail: mteitel@gene-watch.org

export, not for feeding people, and that there are few, if any, indigenous varieties of genetically engineered crops that would be appropriate for poor countries. Further, we know that few of the planet's 1.4 billion subsistence farmers can afford the expensive petrochemical additives and increased water that bioengineered crops demand.

We also know that, even if hunger were a function of low crop yield, which it usually is not, genetically engineered crops are not doing a good job of increasing true net yield. Finally, we know that, even if hunger did result in a single form of malnutrition instead of the multiple deficiencies that are typically seen in very poor areas, the hope for engineered crops like vitamin A–enhanced rice is both unproven science and dubious public-health practice.

All in all, genetically engineered food is not more nutritious, not cheaper, not better tasting, and of questionable safety. It seems to benefit only the market share and profit margins of the handful of corporations who manufacture it, leaving the rest of us to function as experimental subjects in the largest food test in history. We would be better off if we left biotech experiments in the laboratory and devoted ourselves to solving the manifest difficulties of our food supply with safe and proven methods.

Martin Teitel, PhD
Cambridge, Massachusetts, USA

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Nutritional Assessment in the Elderly: Facing up to the Challenges of Developing New Tools for Clinical Assessment

Malnutrition is an important predictor of morbidity and mortality in the elderly but is often overlooked. Therefore, it is imperative that assessment tools for measuring nutritional status in the elderly be easy to administer and well validated.

Malnutrition can occur from undernutrition due to lack of calories, vitamins, or minerals, overnutrition due to excessive calories,[1] or excessive amounts of potentially toxic substances such as alcohol. The prevalence of undernutrition in the free-living elderly population is estimated to be between 5% and 10%. Undernutrition is present in 30% to 60% of institutionalized patients and in 35% to 65% of hospitalized patients.[2,3]

Malnutrition can worsen existing medical problems and cause a decline in functional status. Among the free-living elderly, a relation between quality of diet and dependency in activities of daily living has been shown.[4] In the hospitalized elderly, a correlation exists between nutritional parameters (cholesterol, albumin, and body mass index) and rate of complications, readmissions, and mortality.[5] In addition, lack of adequate nutritional intake during hospitalization is associated with significant deterioration in nutritional status on discharge and an increased risk of mortality.[6]

Nutritional assessment in the elderly has commanded more attention since the realization that poor nutritional status is common in the elderly and that it is a powerful predictor of poor outcomes in this population. Most importantly, a large proportion of chronic disease affecting the elderly population can be either prevented or significantly improved by improving nutrition. Screening for malnutrition at an early stage allows the intervention to be most successful.

Nutrition assessment generally relies on estimates of the adequacy of three domains: intake, macronutrient status, and micronutrient status.[7] A comprehensive nutritional evaluation includes a complete history and physical examination in addition to a more specific nutrition-oriented assessment. Specific nutritional assessment includes estimating food intake, anthropometric measurements, and evaluation of several biochemical parameters commonly affected by changes in nutritional status. Omran and Morley provided an extensive review of the commonly used tools for nutritional assessment in older persons in previous issues of *Nutrition*.[8,9]

However, screening for malnutrition in older persons can be challenging because of the normal age-related changes in many of the commonly used parameters. Self-reported intake is generally difficult to obtain from elderly patients with dementia or other neurologic illnesses that prevent adequate communication. Similarly, in the institutionalized elderly, facility personnel are often unable to document observed intake because of time limitations. Assessment of macronutrient status usually includes an estimate of body composition, visceral protein status, and energy requirements. Unfortunately, several standard techniques do not work well in the elderly because the assumptions they rely on are not accurate in this population. For example, aging leads to an accrual of intramuscular fat missed by anthropometry, resulting in an underestimation of fat mass and an overestimation of lean mass if standard references are used.[10] Serum albumin is often difficult to interpret in the setting of illness because albumin is far more rapidly and profoundly affected by illness than by inadequate intake.[11] In addition, estimation of energy needs based on standard formulas such as the Harris–Benedict equation often does not hold in the elderly. The Harris–Benedict and other related formulas are estimates of body cell mass, the main determinant of resting energy expenditure. Elderly persons have body compositions that are often very different from those of the healthy young adults from whom the Harris–Benedict equation was derived; therefore, discrepant results often occur.[7]

Because of the inadequacy of individual measures of nutrition, screening tools have been developed and validated, which combine several parameters to provide a more accurate assessment of nutritional status. Among the practitioner-administered screening tools, the Subjective Global Assessment (SGA) is easy to use, practical, and thus widely used in many institutions.[8]

The SGA, developed by Detsky et al.,[12] is a tool that formalizes and quantifies a clinical impression formed from measurements of functional capacity as an indicator of malnutrition and from observation of physical signs of malnutrition or malnutrition-inducing conditions. It combines aspects of the patient's history (weight loss, change in dietary intake, gastrointestinal symptoms, and functionality), physical examination (muscle mass, subcutaneous fat, sacral and ankle edema, and ascites), and the practitioner's overall impression of the patient's status (normal or mildly or significantly malnourished). The SGA does not incorporate laboratory data because adding this information does not alter its performance in predicting malnutrition.[13]

The SGA was validated by comparing its ability to predict infection from nutritional status against six other methods including albumin, transferrin, creatinine-to-height index, anthropometry, delayed cutaneous hypersensitivity, and the prognostic nutritional index.[14] The SGA was a better predictor of nutritional status than these other methods. Arguably, a limitation of the SGA is its reliance on the clinician's impression, regardless of individual experience.

The importance of having a tool such as the SGA for use in the elderly population is that, if validated, it would obviate the depen-

Correspondence to: Caroline M. Apovian, MD, FACN, Boston Medical Center, Boston University School of Medicine, Building D, Suite 614, 88 East Newton Street, Boston, MA 02118-2393, USA. E-mail: caroline.apovian@bmc-org