

Genetic Modification in U.S. Foods Labeled “All-Natural”

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Abstract

The U.S. Food and Drug Administration does not define the term “all-natural” but says that it may refer to any food product that does not contain added color, artificial flavors, or synthetic substances. Additionally, labeling is not presently standardized for genetically modified (GM) food in the U.S. Yet, there is an increasing interest from the public to know exactly what they are eating; for instance, Prop 37 in California, which would have required retailers to label products made with GM foods, barely lost this fall with 47% of voters favoring it. Many people assume that the definition for “all-natural” is quite strict, including the implication that it is similar to the term “organic”, and therefore genetic modification has not occurred. To determine whether or not foods labeled “all-natural” match this assumption, a variety of corn products with this label (n=18) have been assayed through standard methods that extract DNA and look for the presence of specific markers indicative of genetic modification (using PCR and electrophoresis). Prior work in this lab indicated that at least 60% (n=61) of all U.S. corn products not labeled as “organic” have been genetically modified (only 3% of products labeled “organic” have tested positive). Preliminary data on those labeled “all-natural” indicate a similar percent of modification, with 54% of the samples testing positive. Additional samples are being assayed in an effort to gain a clearer picture of the percentage of GM products in the U.S. market place. Clearly there is a difference between the words “all-natural” and “organic”, at least when it comes to genetic modification, and consumers deserve to know the difference.

Keywords: Genetic Modification, "All-Natural" Food, Organic Food

1. Introduction

As with technology in any other industry, technology in Agri-biotechnology has made great advancements over the past few decades. One of those advancements is in the area of genetic modification. Genetic modification is most widely used in crop plants, such as corn and soy. In the United States, approximately 80% of maize, cotton and soya are biotech varieties, meaning they have been genetically modified.² These modifications allow for such alterations as herbicide tolerance, increased crop yield and insect resistance. There are currently hopes for research being done on crops to allow for modification that can even alter biologically active components of food crops, such as allergens and antinutrients.⁵

Genetically Modified Organisms (GMO's) are created when a gene is inserted from an external source such as viruses, bacteria, animals or plants into usually unrelated species.² There are many different techniques for creating GM crops, including Biolistic transformation, Electroporation, and Microinjection.² Though the specifics of these techniques are outside the scope of this paper, they all involve the movement of a desired gene into a host genome as well as marker genes that allow for researchers to verify the success of the gene transfer.

Although the benefits to GM are great and could possibly provide solutions to worldwide issues, there is fear that the abundance of GMO's could cause detrimental effects that are not wholly understood. Many in the science community are worried about the safety of GMO's in relation to human health as well as environmental health.³

Production may be moving too quickly and with too little knowledge of the outcomes of GM. There have been studies done on rats to observe the effects of GMO's. One in particular was performed at The Rowen Institute of Aberdeen on male rats. Rats who were fed a diet of only GM potatoes experienced a multitude of biological effects, including colonic enlargement, diminishing of the liver and thickening of the stomach mucosa.³ Of course, it is difficult to conclude whether these results would show up in humans, doctors still show concern over GM foods.³ For example, there is anxiety over the introduction of an invasive carrier virus, used to move DNA from one species to another, to humans and the effects on the human genome. As Dr. Vyvyan Howard, professor at the University of Liverpool, UK, has stated "the potential risks of GM foods cannot be assessed on our current understanding of genetic engineering because the variables are too great for any assessment to be regarded as valid."³

With so much information yet to be obtained on the benefits and possible harmful effects of GM in food, consumers should at least be able to decide if they would care to consume GMO's. Currently, however, there are no laws stating that GM foods need to be labeled as such. This is even true in products that consumers may mistake for being GMO free, such as "all-natural" products. Today the FDA "has not developed a definition for use of the term natural or its derivatives."⁴ Food can be termed all natural even if it contains GMO's, which can be misleading to consumers who may mistake these products as equal to "organic." In order for a food to obtain the label of USDA "organic" it must have been "produced through approved methods...Synthetic fertilizers, sewage sludge, irradiation, and genetic engineering may not be used."¹ When one purchases "organic," they know the product meets certain standards, this is not the case for foods only labeled as "all-natural."

2. Materials and Methods

An array of corn products labeled "all-natural" (n=31) were collected from stores in the United States. Using standard micro-pipetting, assaying, PCR, and gel electrophoresis, the products were tested for the presence of genetic modification (GM). 1g of each corn product was ground into a powder using a mortar and pestle. This powder was then added to 5mL of water to create a slurry. 50µL of each slurry was mixed with 500µL of Bio-Rad Laboratories' InstaGene. The solution was then placed into a hot water bath (95°C) for five minutes and then placed into a centrifuge for five minutes. 20µL of the new solution was placed into two new microtubes each. To one of these tubes 20µL of the Plant Master Mix primer enzyme was added. To the other tube 20µL of the GMO Master Mix primer enzyme was added.

Each set of samples was tested with the addition of DNA ladders to act as a testing control group. The microtubes were placed into the PCR machine for 40 cycles in order to amplify the presence of the desired DNA. After this had finished, each product was placed into a 3% agarose electrophoresis gel at 100V for 40 minutes. The gels were then stained with ethidium bromide and left in the fridge for 45 minutes. Each gel was read under UV light and marked for the presence or absence of the Plant Master Mix primer enzyme (455bp) and the GMO Master Mix primer enzyme (200bp).

Data from corn products labeled "organic" (n=16) that had been tested previously in the lab was collected. This data was used for a comparison to "all-natural" products. To create a census of society's knowledge of GM in "all-natural" corn based products, a survey was created and distributed to 75 freshmen students at Capital University. The data was compiled and reviewed in comparison to the experimental data compiled during this research. The FDA and USDA were also investigated to find their rules and regulations for labeling products with the terms "all-natural" and "organic".

3. Results

After assaying 31 various corn-based "all-natural" products, 19 were positive for genetic modification and 12 were negative for genetic modification. The majority of the products tested were corn tortilla chips (n=19) and the rest were various types of corn products. Comparatively, of the total 16 corn-based "organic" products tested, 5 were positive for genetic modification and 11 tested negative for genetic modification. The survey taken by 75 freshmen at Capital University showed that 36% of students believed that foods labeled "all-natural" contained genetically modified substances. 56% of students considered "organic" and "all-natural" to be held to the same standards by the FDA and USDA. Only 32% of students knew that the FDA has not developed a definition for use of the term "natural" or its derivatives.

Table 1. Results of “all-natural” products tested

Product	Description	Label Claim	GM Result
Bob's Red Mill Corn Flour	Other Corn Products	All Natural	Negative
Casa Sanchez Tortilla Chips	Corn/Tortilla Chips	All Natural	Positive
Clancy's Big Dippers	Corn Chips	All Natural	Positive
Clancy's Big Dippers	Tortilla Chips	All Natural	Positive
Clancy's Restaurante Style	Corn/Tortilla Chips	All Natural	Positive
De Bole's Corn Spaghetti	Other Corn Products	All Natural	Positive
El Restaurante	Corn/Tortilla Chips	All Natural	Positive
El Sabrosa Tostada Chips	Corn/Tortilla Chips	All Natural	Positive
Frontera	Corn/Tortilla Chips	All Natural	Negative
Garden Fresh Gourmet Tortilla Strips	Corn/Tortilla Chips	100% Natural	Positive
Giant Eagle White Round	Corn/Tortilla Chips	All Natural	Positive
Grande Restaurante Style	Corn/Tortilla Chips	All Natural	Positive
Green Mountain Gringo	Corn/Tortilla Chips	All Natural/GMO Free	Negative
Guitless Gourmet	Corn/Tortilla Chips	All Natural	Positive
Herr's Hulless Puff'n Corn	Corn Puffs	All Natural	Positive
Hodgson Mill	Corn Starch	All Natural	Negative
Marilyn's Blue Corn	Corn/Tortilla Chips	All Natural	Negative
Mikesell's Potato Chips	Chips	All Natural	Negative
Miss Vickie's	Potato Chips	All Natural	Positive
Mission Tortilla Chips	Corn/Tortilla Chips	All Natural	Positive
Pirate's Booty (Spongebob)	Corn/Rice Puffs	All Natural	Negative
Popchips	Corn/Tortilla Chips	All Natural	Negative
Riceworks Sweet Chili	Rice Chips	All Natural	Positive
Simple Truth White Corn	Corn/Tortilla Chips	All Natural	Negative
Simple Truth Yellow Corn	Corn/Tortilla Chips	100% Natural	Negative
Snyder's of Hanover Restaurante Style	Corn/Tortilla Chips	All Natural	Negative
Snyder's of Hanover White Corn	Corn/Tortilla Chips	All Natural	Positive
Solea Polenta	Tortilla Chips	All Natural	Positive
Whole Food's Corn Flakes	Corn Cereal	All Natural	Negative
World Market Thin Tortillas	Corn/Tortilla Chips	All Natural	Positive
XOCHITL Mexican Style	Corn/Tortilla Chips	All Natural	Positive

Table 2. Results of “organic” products tested

Product	Description	Label Claim	GM Result
Archer Farms Blue Corn Chips	Corn/Tortilla Chips	Organic	Negative
Archer Farms White Corn Chips	Corn/Tortilla Chips	Organic	Negative
Arrowhead Mills	Corn Meal	Organic	Negative
Dr. Oetker Cornmeal Muffin Mix	Corn Muffin/Bread	Organic	Negative
Envirokids Gorilla Munch	Corn Cereal	Organic	Negative
Envirokidz Amazon Frosted Corn Flakes	Corn Cereal	Organic	Negative
Garden of Eatin Baked Crunchitos	Corn/Tortilla Chips	Organic	Positive
Garden of Eatin Rounds	Corn/Tortilla Chips	Organic/No GMO	Negative
Garden of Eatin Taco Shells	Corn/Tortilla Chips	Organic	Positive
Hodgson Mill	Corn Meal	Organic	Negative
Mrs. Leeper's Corn Spaghetti	Other Corn Product	Organic	Positive
Nature's Best Tortilla Rounds	Corn/Tortilla Chips	Organic	Positive
Organics Tortilla Chips	Corn/Tortilla Chips	Organic	Negative
Rapunzel	Corn Starch	Organic	Negative
Wegmanns Fruit Hoops Sweetened Multi-Grain	Corn Cereal	Organic	Positive
Wild Oats Tortilla Chips	Corn/Tortilla Chips	Organic	Negative

4. Discussion

Genetically modifying food products has been a popular use of technology for years now. In recent years both the use of genetic modifications and the consumer's curiosity in them has grown substantially. With nearly two thirds of the "all-natural" labeled products in this experiment containing GM material, it is suggested that the consumer is not fully aware of the extent of the use of genetic modification. Though two thirds of individuals surveyed believed that “all-natural” products would contain genetic modification, almost half of the individuals believed that “all-natural” and “organic” were held to the same standards of being a food product that contains absolutely no genetically modified materials. This experiment not only showed this to be inaccurate but also guides the way for what work still needs to be done.

As stated earlier, the term “all-natural” is not clearly defined for consumers. Companies that are producing these products are taking advantage of this flaw in the regulation in order to exploit consumers who are unaware of the lack of regulations. By using the term "natural," consumers are inclined to associate the product with the literature definition of meaning that it comes directly from nature. This would suggest that no alterations have been made to the product before or during its growth process, which this experiment shows is clearly inaccurate.

More legislation needs to be produced regulating the labeling of food products so that consumers can make a conscience decision as to whether or not they would like to ingest these products. Propositions like the failed Prop 37 in California would take a necessary step toward allowing individuals to know what alterations have been made to their food. Legislation regulating labeling laws would also not allow the term "natural" to be placed on any food product that contains genetic modification, which would remove the possibility of consumers being misguided by a play on words. Though many companies, scientists, individuals, etc. oppose the restriction of labeling for genetic modification there is very little substantial and non-biased research to show whether or not these modifications are capable of having adverse impacts on consumer health. This information alone should be enough to encourage the regulation of genetically modified food products so consumers may make their own decision about what to ingest on a daily basis.

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