

THE POTATO AND HUMAN NUTRITION

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Introduction

The potato has been long valued as a staple starch, contributing carbohydrate calories to the diet. This paper will focus on the present and future of less well publicized aspects of the Potato's Nutrition Story. This presentation will include data from the United States and will include comments about both fresh and prepared potatoes as both starch and vegetable.

The Nutrition Label

Table 1 includes the nutrient values FDA has approved for the voluntary labeling of a medium raw potato. FDA has provided these interim nutrition labeling data for retailers to use in setting up the labeling program in their stores. They can provide the information in a wide variety of ways. A representative sample of 2,000 grocery stores will be used to assess compliance of retailers with the nutrition labeling guidelines. Substantial compliance with the guidelines is defined as compliance by 60% of the 2,000 stores. If voluntary labeling is not achieved, then mandatory labeling will occur. Table 1 also places the nutrition information in the new format for the nutrition label that will appear on food products. The format is to be used if individual foods carry nutrition information. The nutrient values are slightly different than those developed by the Potato Board during a two-year study of potatoes in the 1970's. The label (Table 2) or point of sale material was originally introduced in 1979. Of course not every potato has the same value but these values provide a basis of comparison.

In addition, while normally not found on the nutrition information label, potatoes also provide per serving, 2% US RDA for zinc, 8% of US RDA for copper, 4% of US RDA for pantothenic acid, and 15% of US RDA for iodine. Indeed then, the potato nutrition story is an important one beyond calories. It's important to note that these values are for a medium potato. A typical baking potato has 1.6 more nutrients.

As noted these values reflect the analysis of a composite of potatoes grown in the U.S. and a conservative interpretation of those data. Therefore, analysis of any group of potatoes from different locations, or if different varieties may find them to have higher (though not generally lower) levels of nutrients than shown in Table 2.

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TABLE 1.—*New nutritional label using values for potato provided by FDA, 1992.*

Amount Per Serving			
Calories 110		Calories from Fat 0	
		% Daily Value*	
Total Fat	0 g		0%
Saturated Fat	0 g		0%
Cholesterol	0 mg		0%
Sodium	10 mg		*
Total Carbohydrate	23 g		11%
Sugars	x g		
Dietary Fiber	3 g		10%
Protein	3 g		
Vitamin A* • Vitamin C 50% • Calcium* • Iron 8%			
*Percents (%) of a Daily Value are based on a 2,000 calorie diet. Your Daily Values may vary higher or lower depending on your calorie needs:			
Nutrient		2,000 Calories	2,500 Calories
Total Fat	Less than	65 g	80 g
Sat Fat	Less than	20 g	25 g
Cholesterol	Less than	300 mg	300 mg
Total	Less than	2,400 mg	2,400 mg
Carbo- hydrate		300 g	375 g
Fiber		25 g	30 g
1 g Fat = 9 calories			
1 g Carbohydrates = 4 calories			
1 g Protein = 4 calories			

The New Potato Nutrition Label

This description of the potato's nutritional value is also dependent on a standard (the US RDA has been replaced by the Daily Value in the U.S. as a result of the Nutrition Labeling and Education Act and regulations). The 1991 Nutrition Labeling and Education Act (NLEA) passed by the U.S. Congress sought to give the public nutrition information about virtually all the food eaten, in a simple format that would allow consumers to place nutritional values in the context of a healthy diet. FDA estimates that 80,930 life years will be gained by Americans using the information that will be available on the new label. The FDA has replaced the US RDA's with a new standard called DAILY VALUES. Table 1 demonstrates how

TABLE 2.—*Label nutrition information developed by the national potato board in the 1970's.*

Serving Size 1 Medium Potato (1/2 lb)

- 100 calories
 - 3 grams of protein - 6% US RDA
 - 23 grams of CHO
 - 0 grams of fat
 - Almost 3 grams of dietary fiber
 - 10 mg sodium
 - 750 mg potassium
 - Negligible Vitamin A
 - 50% US RDA Vitamin C
 - 8% US RDA thiamin
 - 2% US RDA niacin
 - 10% US RDA calcium
 - Negligible calcium
 - 8% US RDA iron
 - 15% US RDA vitamin B₆
 - 8% US RDA folic acid
 - 8% US RDA phosphorus
 - 8% US RDA magnesium
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the potato's label would look using the new format and regulations. Because of the practice of setting serving sizes to enhance the nutritional image of a product confused consumer NLEA required FDA establish standard serving sizes including those for the 20 most consumed fruits and vegetables. The Federal Register (3) has several tables describing vegetable consumption. Based on the 1987-88, National Food Consumption Survey white potatoes ranked first among the 20 vegetables consumed in largest quantities (Table 3). Data from PMA, UFFVA and ERS, USDA (Table 4) all showed potato first in the list of vegetables by sales, promotion, or consumption. The final nutrition label regulations were issued in December, 1992. There are no published values for sugar. The values shown in Table 1 were approved by FDA to use in the voluntary nutrition labeling program for the 20 most frequently consumed raw fruits, vegetables and fish in the United States. These data are to be revised and updated at least every 2 years. Note the serving size is smaller, 6 oz than previously used by the National Potato Board.

But at the same time, the proposed Daily Values for most of the nutrients are lower than the current US RDA's and therefore the apparent nutrient contribution of the potato to the daily requirement of most vitamins and minerals appears to be similar. Regardless of system used to describe the potato, it is a very low fat food that is an important source of Vitamin C, iron and B vitamins.

TABLE 3.—*The 20 vegetables consumed in largest quantities. NFCS, 1987-88 (3).*

White Potato
Lettuce
Green Bean
Tomato
Broccoli
Carrot
Cabbage
Green pea
Summer squash
Onion
Cucumber
Green pepper
Corn
Celery
Cauliflower
Spinach
Collard
Sweet potato
Lima bean
Asparagus

TABLE 4.—*Vegetables in decreasing order by sales, production, or consumption (3).*

PMA	UFFVA	ERS, USDA
Potato	Potato	Potato
Iceberg lettuce	All lettuce	Lettuce
Tomato	Tomato	Tomato
Onion	Onion	Onion
Carrot	Carrot	Carrot
Celery	Sweet Corn	Celery
Broccoli	Cabbage	Cabbage
Green cabbage	Sweet Potato	Bell pepper
Cucumber	Cucumber	Broccoli

The potato's contribution of nutrients to the diet or its role in human nutrition is actually greater than it appears on the nutrition label because of the amount of potatoes consumed in the U.S. For example while the dietary fiber in a potato is limited because potato is eaten in significant amounts, the potato becomes an important source of dietary fiber for some groups.

I will present a few examples of how the potato plays a more important role in nutrition than might be expected based on its absolute nutri-

ent values. This is true, even though in select groups, like women age 34-59 years potatoes only contributed 3% of the energy consumed (8). This is not meant to be a comprehensive review of the vitamin and mineral potato research literature.

Vitamin B₆ is a nutrient that many Americans do not consume in sufficient amounts. Vitamin B₆ is involved in amino acid, nucleic acid, glycogen, porphyrin and lipid metabolism. It affects hormone modulation, erythrocyte immune and nervous system functions. Vitamin B₆ has proposed roles in the etiology and/or treatment of various chronic disease conditions including sickle cell anemia, asthma, cardiovascular heart disease and cancer. Table 5 shows potatoes based on NHANES II, excluding french fries, is the third largest source of Vitamin B₆ for adults 19-74 years old, and fried potato products ranked 10th. Together they provided 9.2% of the Vitamin B₆ (4). That's a significant contribution for a food thought to be a "low" to "fair" source of B₆. One medium potato contributes 15% of the US RDA. And for elderly, who are especially at risk for chronic disease, potatoes were the second most important contributor of Vitamin B₆. In this study bananas provided 0.21 mg/day followed by potatoes giving 0.15 mg/day (4).

Antioxidant Nutrition

Today, nutrition is focusing less on preventing deficiency diseases such as niacin and pellagra and more on enhancing immunity and preventing chronic disease and so the vitamins and minerals in commonly consumed foods take on increasing importance in health promotion and disease prevention. For example, Vitamin C was valued for its prevention of scurvy. Vitamin C is an antioxidant nutrient and as an antioxidant nutrient it may

TABLE 5.—*Vitamin B₆ sources for adults 19-74 Y, NHANES II(4).*

RANK	FOOD	%TOTAL
1	Beef steaks and roasts	9.1
2	Alcoholic beverages	6.0
3	POTATOES, excluding fried	6.0
4	Cold cereal, excluding superfortified	5.0
.		
.		
10	FRENCH FRIES, FRIED POTATO	3.2
.		
.		
49	RICE	0.4

trap free radicals and thereby reduce the oxidation that initiates or mediates the development of heart disease, cancer and other chronic disease. A potato is considered an excellent source of Vitamin C, with one medium potato providing 50% of the current US RDA.

Some other people functions of the antioxidant nutrients include inhibition of LDL oxidation, reversal of growth of oral leukoplakes, reduction of incidence of oral, esophageal, stomach and pancreatic cancers and protection of the eye from light and oxygen damage, perhaps reducing or delaying cataract development (2). Recent newspaper headlines suggesting that "megadoses of Vitamin C are linked to longer life" give us a view to the future. It may be important to analyze the nutrient values of potatoes not commonly grown today in the U.S. to determine if there are significant quantities of other antioxidants like Vitamin E and beta carotene or other cancer preventing phyto-chemicals such as butyric acid. The National Cancer Institute supports a "designer food" initiative for the future. There is interest in producing and manufacturing foods with disease preventive qualities.

Dietary Fiber

Health experts recommend consumption of 25-30 gm of dietary fiber per day. Most Americans consume about 11 gm. Although the FDA has not agreed there is sufficient data to make health claims for fiber, the scientific community agrees that insoluble fiber contributes to laxation and some cancer prevention and soluble fibers contribute to improved glucose and blood cholesterol control. Table 6 shows the dietary fiber values for potatoes (7). While the potato cannot be considered a high fiber food, a medium

TABLE 6.—*Dietary fiber (percentage of sample fresh wt) (7).*

	POTATO BOILED WITHOUT SKIN	POTATO FRENCH FRIES
MOISTURE	79.5	68.3
SOLUBLE FIBER		
hemicellulose	0.2	0.2
pectin	0.1	0.2
Total	0.3	0.4
INSOLUBLE FIBER		
hemicellulose	0.4	0.7
cellulose	0.5	0.9
klason lignin	tr	0.1
Total	1.0	1.8
TOTAL DIETARY FIBER	1.3	2.3

potato with skin provides almost 3 grams of dietary fiber. Table 7 shows that the potato is an important source of dietary fiber for women, especially low income U.S. women, who obtain 11.1% of their dietary fiber from white potatoes. Higher income women who tend to eat more fruits and vegetables get 8.6% of their dietary fiber from white potatoes (9).

TABLE 7.—*Fiber sources for women, 19-50 Y, CSFII (9).*

FOOD GROUP	< 185% POVERTY		> 185% POVERTY	
	DF g/da	% Total	DF g/da	% Total
VEGETABLES	2.3	23.5	2.8	24.4
Bread	1.2	12.5	1.5	13.3
WHITE POTATOES	1.1	11.1	1.0	8.6
Soups	0.9	9.3	0.6	5.1
Fruits	0.8	8.3	1.4	12.1

Mineral Nutrition

Nutrition of the current and future also includes examination of the role minerals play in preventing and managing chronic disease. The role of magnesium in glucose control is being researched. A serving of potatoes provides 8.5% of the US RDA. The role of copper in prevention of heart disease and diabetes is under study. The potato is an important source of copper in the U.S. diet according to the 1977-1978 NFCS. French fries ranked 6th and contributed 2.6% of the copper and white potatoes ranked 8th and contributed 2.4% of the copper (6).

Dietary Guidance

These data and more contribute to the development of dietary guidance by government and voluntary health agencies throughout North America. The recently released book, *Eat For Life* (11), based in the National Academy of Sciences *Diet and Health Study* seeks to describe an eating pattern that will protect health. The authors suggest "You will learn to trim fat from the meat you eat—but you do not have to give up meat by any means, and you will eat more bread, pasta, potatoes, vegetables and fruits." The USDA vegetable servings per day.

The NCI announced in Summer 1992 its campaign called Five-A-Day to promote the consumption of 5 servings of fruits and vegetables daily. It's not a simple task. Block (1) reported only 10% of Americans are currently eating five servings. On a given day, 17% of the populations eat no vegetables including potatoes.

Public Perceptions

There are some barriers to increasing the consumption of fruits and vegetables including potatoes. Several years ago, Ketchum Communications designed an advertisement for the National Potato Board showing a potato being painted green. The caption read "How far do we have to go to convince you the potato is a vegetable." Marketing data showed not all people viewed the potato as a vegetable, nor as nutritious. There have been some change in the way people perceive potatoes. In 1988 Ketchum Communications reported that 93% of consumers knew that potatoes are low in calories and 71% knew they were nutritious. These figures sharply contrast with the 1973 figures which had only 68% knowing potatoes were low in calories and 56% saying they were nutritious. These changes were due, in part, to the education and promotion activities of the National Potato Board. Nonetheless, reports from numerous studies shows a persistence to the belief that potatoes and starch are fattening. Dieters continue to avoid potatoes when on a self prescribed weight loss diet. Celebrities like Oprah Winfrey gain attention when saying, "If I could be bad for one day, I would take great pleasure from the grease on the potatoes." In 1992 the National Potato Board has a marketing campaign that includes the caption "Potato, a starch that is a vegetable too."

While the potato is very low fat, many of its favorite preparations are not. Table 8 lists some of the common ones. Many potato recipes promoted in the past had 50% calories from fat. And that fat becomes significant in the diet. Data from the 1985 CSF II french fries provided 3.1% of the energy but 4.1% of the fat for women 19-50 years old (5). If the current trend to promote low fat diets for the prevention of cancer, cardiovascular disease, obesity and other diseases continues there is a need for promoting low fat preparation of potatoes.

Finally, other myths persist about the potato. Some people avoid potatoes because it comes from the nightshade plant thought to aggravate arthritis. Fears about pesticide residues on the skin also limit consumption.

Summary

The potato plays its role in human nutrition only to the extent that it is consumed. The basic product has excellent nutritional value for today and the future. However, there may be ways to enhance its contribution to human nutrition through education, marketing, breeding, field management, and finally preparation for consumption.

"What I say is if a man really likes potatoes, he must be a pretty decent sort of fellow and well nourished." . . . Tom Curry

TABLE 8.— *Comparing potatoes, average values.*

	CALORIES	FAT (g)	% CALORIES FROM FAT
Baked potato, 3.8 oz., plain	100	0	0
Baked potato, 3.8 oz. with bacon and cheese	244	11	41
Baked potato, 3.8 oz. with butter and sour cream	385	29	63
Oven-crisped potatoes, ½ cup	72	1	12
Potato Chips, 1 oz.	150	10	60
French fries, 10 oz.	160	8	45
Mashed potato, ½ cup, with skim milk	50	0	0
Mashed potato, ½ cup, with butter and whole milk	120	6	45
Potato salad, ½ cup, with nofat yogurt dressing and vegetables	60	0	0
Potato salad, ½ cup, with mayonnaise	180	10	50
Scalloped potato, ½ cup, with skim milk	100	0	0
Scalloped potato, ½ cup, with butter and whole milk	150	5	30

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