

Comparing Raw and Processed Fruits and Vegetables

By Nancy Freese, Morning Star

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Consuming fruits and vegetables promotes health, energy and quality of life. People get the vitamin, fiber and antioxidant benefits of fruits and vegetables whether they eat them from a can, the freezer or raw. Deciding which form to eat fruits and vegetables is a matter of cost and convenience.

Fruits and vegetables, in their processed form, are simply a “prepared” or “cooked” version of their raw counterparts, but preserved at peak quality for consumption at a convenient time. The same techniques people use in their kitchens are simply performed on a larger scale during the canning and freezing processes. The food is washed, peeled, seeded, cut and stored until it’s ready to be used.

- Canning and freezing locations are close to the fields where the food is grown. The fruits and vegetables are picked at their peak ripeness and quickly prepared and packaged, locking in freshness and nutrition to be enjoyed all year round.
- The process of freezing and canning fruits and vegetables does not change their nutritional value or flavor anymore than preparing the raw food at home.
- No preservatives are used during canning or freezing processes. Flavor and nutrition is sealed in naturally. Canning sterilizes food using heat to destroy micro-organisms that cause foodborne illnesses. Freezing’s low temperatures hold the food’s quality.
- To meet consumer preferences for attractiveness and flavoring, additional ingredients may be added. Vitamin C (citric acid) and calcium help the food retain its color and firmness. These ingredients also supplement the nutrient content of the fruits and vegetables. To enhance flavor, sugar and salt are sometimes added during the processing.

The USDA’s Dietary Guidelines for Americans says, “Try many colors and kinds (of fruits and vegetables.) Choose any form: fresh, frozen, canned, dried, juices. All forms provide vitamins and minerals, and all (but most juices) provide fiber.” The report points out, “Buy wisely. Frozen or canned fruits and vegetables are sometimes best buys, and they are rich in nutrients. If fresh fruit is very ripe, buy only enough to use right away.”

Nutritional Value

The key to maximizing the nutrition from fruits and vegetables is picking them at peak ripeness and eating them immediately afterward. Canned and frozen fruits and vegetables are preserved in this high quality state, while raw fruits and vegetables are harvested before their peak to withstand a week or more spent traveling to the store, sitting on the shelves and waiting in the crisper drawer before they’re consumed. The aging raw fruits and vegetables are degrading and losing nutrition all along this timeline. American’s refer to them as “fresh” but you have to wonder why. For example, fresh bananas are not even grown on American soil. They are picked green in Colombia, Guatemala, and other Central American countries to become yellow in route.

Two recent studies have verified that fruits and vegetables have similar nutrition whether they are consumed raw, frozen or canned. The University of Illinois study “Nutrient Conservation in Canned, Frozen and Fresh Foods” provides nutritional analyses on about 35 fruits and vegetables and confirms that Vitamin A, carotenes, dietary fiber, potassium, folate, Vitamin C, and thiamin survive processing well. The University of Massachusetts found that 40 recipes substituting canned, frozen or raw ingredients captured similar sensory appeal and nutritional value.

Nutrient Summary for <i>Tomato Vegetable Soup</i>			
Nutrient	Fresh	Canned	Frozen
Total Carbohydrate (g)	10.9	9.2	10.0
Fiber (g)	2.3	1.9	2.3
Sodium (mg)	437.0	593.5	439.2
Vitamin A (% RDA)	68.0	26.0	33.0
Vitamin C (% RDA)	35.0	21.0	32.0
Calcium (% RDA)	3.0	5.0	3.0
Iron (% RDA)	7.0	7.0	7.0
Folate (% RDA)	14.0	10.0	13.0
Thiamin (% RDA)	8.0	5.0	7.0

svg=serving; g=grams; mg=milligrams;

RDA: Recommended Dietary Allowances for a 25 to 50 year-old woman.

Source: University of Illinois Department of Food Science and Human Nutrition.

Cost per Pound Served

Canned is always the least expensive alternative per pound of usable food served. With processed fruits and vegetables, the inedible parts, like cores, seeds, peels, and pits, are removed before they ever hit the grocery store. Not bringing home this waste saves the customers money and time. Canned peaches save consumers 30 cents per pound of usable food (no pit) over fresh peaches. At 59 cents per pound less than fresh, canned tomatoes are an event better value. The graphs in attached Exhibit A summarize the economic value for several common fruits and vegetables.

Convenience and Safety

Processed fruits and vegetables are convenient and safe to use.

1. **Safety** - An analysis by The Center for Science in the Public Interest (CSPI) of 3,500 food-poisoning outbreaks shows that contaminated produce is responsible for the greatest number of individual food-borne illnesses. Contamination happens because the food is grown in unsanitary conditions, not washed properly, eaten past its viability, or cut using contaminated tools.
2. **Preparation**– Processed fruits and vegetables require little effort in the kitchen because they are already cooked, clean and cut.
3. **Shelf-life** – Canned and frozen fruits and vegetables do not have to be eaten right away like their fresh counterparts. Processed can wait in the freezer or pantry until needed.
4. **Year round Availability** - Because processing stabilizes the food quality, the processed fruits and vegetables are available year round, instead of just during their growing season.

Conclusion

Canned and frozen fruits and vegetables offer the nutrition, convenience and value needed by Americans to create balanced, healthful diets. Just because fruits and vegetables are preserved for convenient consumption at a later date, they should not be confused with highly-processed, manufactured foods containing high calorie and low nutritional value.

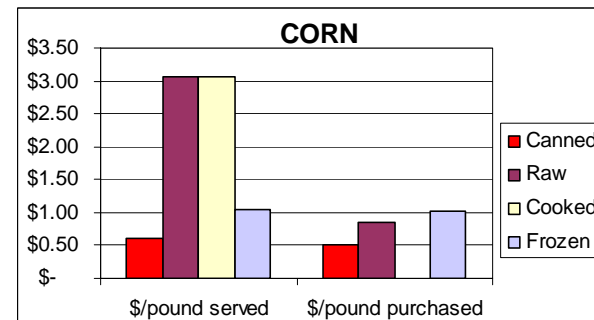
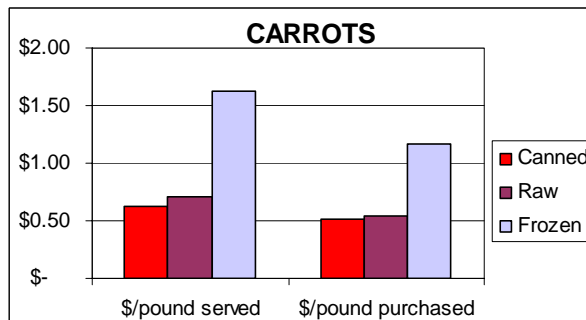
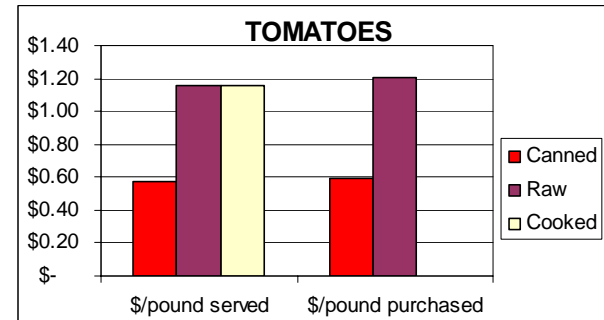
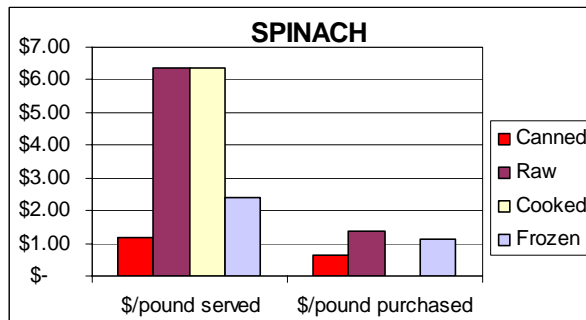
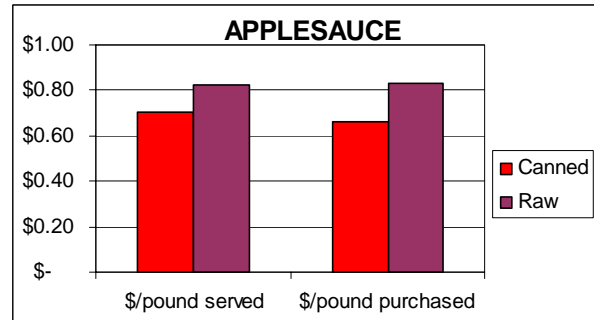
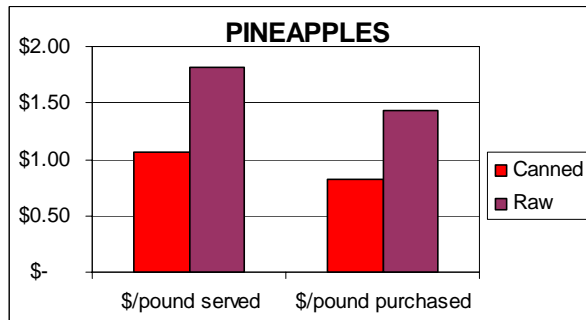
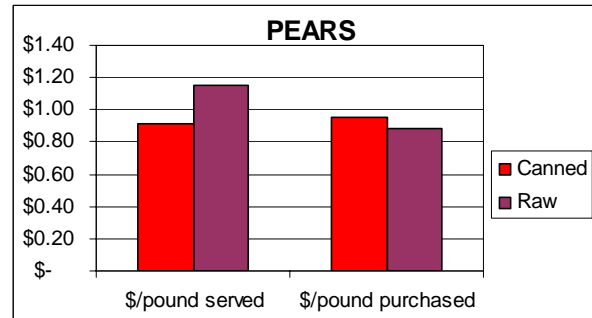
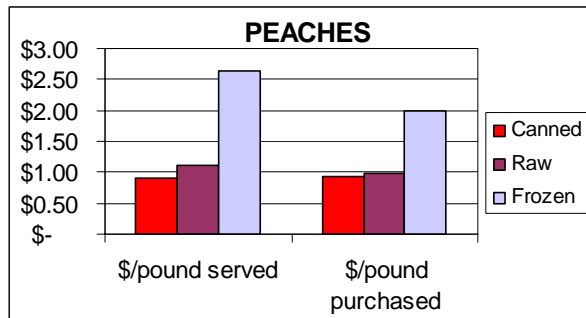
Resources

1. Dietary Guidelines for Americans, USDA/US Dept of Health and Human Services, 2000
2. University of Colorado fact sheet - Which is Best? Canned, Frozen or Fresh?
3. University of Illinois nutritional study summary and website link
4. University of Massachusetts recipe study
5. USDA abstract for “How Much Do Americans Pay for Fruits and Vegetables?” and website link
6. Hartman Group-- Consumers Perception of Fresh (packaged vs. fresh...and center store migration)

EXHIBIT A – Value of different forms of fruits and vegetables

When all the inedible waste has been removed, forms of fruits and vegetables can be compared on a price per pound served basis. The following graphs also show the cost per pound purchased and cost per ½ cup serving in 1999 dollars.

Note: Cooked is prepared on the stove top starting with raw ingredients.



*Sources: "How much do Americans pay for fruits and vegetables?" USDA July 2004.
University of Illinois, "Nutrient Conservation in Canned, Frozen and Fresh Foods"*

EXHIBIT B – Nutritional Summary

NUTRIENT CONSERVATION IN CANNED, FROZEN AND FRESH FOODS

The University of Illinois, Department of Food Science and Human Nutrition

October 1997

SUMMARY

Americans' food choices have changed in the last 20 years, reflecting health issues that have been reported in the media. While health professionals recommend an increase in the amount of fruits and vegetables eaten by all segments of the population, it appears these recommendations have not been acted upon by the American public. **Our study confirms canned foods are comparable to, and sometimes better than, fresh and frozen varieties in their nutritional contribution to the American diet.**

Key findings contained in this study include:

- **Dietary Fiber** – Many fruits and vegetables are important sources of dietary fiber. The canning process does not affect fiber content, making them comparable to fresh and frozen varieties. In fact, the heating process appears to make the fiber more soluble and, therefore, more useful to the body.
- **Vitamin A** – Many canned fruits and vegetables are high in vitamin A. Since little of the vitamin is lost during the canning process, canned products have vitamin A levels similar to their fresh and frozen counterparts. In some cases, such as canned pumpkin, the vitamin A levels actually are higher.
- **Carotenes** – Vitamin A is present in many fruits and vegetables as carotenes – antioxidants that provide protection for the body's cells. Tomatoes, in particular, contain an important carotenoid called lycopene, which appears to be effective in cancer prevention. Some analyses show lycopene is effective when consumed after it is heated or canned.
- **Folate** – Beans are an excellent source of folic acid, which recent studies indicate plays a critical role during pregnancy. Since folate holds up well during the canning process, making them similar to dried varieties that are cooked from scratch.
- **Vitamin C** – Apricots, asparagus, oranges, grapefruits, pineapple, strawberries, spinach and tomatoes are all significant sources of vitamin C. Although small amounts of the vitamin are lost during heat treatment, most of what is lost ends up in the liquid in which the product is packed. The vitamin C retained after canning remains stable during the one to two-year shelf life of the canned product.
- **Protein** – Canned poultry and fish – considered protein foods – are comparable to their fresh-cooked counterparts in nutritional value, since protein is not affected by heat treatment. This makes the canned varieties convenient alternatives to fresh-cooked, since they require much less preparation time.

Other advantages of canned foods are their convenience, as well as their safety. Knowing their nutritional value is as high as their fresh or frozen counterparts, we can use them with confidence either straight from the can or in recipes.

EXHIBIT C1 - Nutritional Content Comparison

Corn						
Nutrients	Raw (DB)	Cooked (DB)	Canned (DB)	Green Giant Canned	Frozen (DB)	IGA Frozen
Serving Size (cup)	1/2	1/2	1/2	1/2	1/2	1/2
Wt/svg (g)	77	82	128	112.5	82	67.5
Kcal/svg	66.2	88.6	81.9	75	72.2	60
Fat (g)	0.91	1.1	0.64	7.5	0.63	0.75
Cholesterol (mg)	0	0	0	0	0	0
Total Carbohydrate (g)	14.6	20.6	19.7	15	17.1	14.3
Fiber (g)	2.1	2.3	2.2	3	2	0.75
Sodium (mg)	11.6	13.9	272.6	300	2.5	7.5
Potassium (mg)	207.9	204.2	209.9	n/a	172.2	n/a
Protein (g)	2.5	2.7	2.5	3	2.5	2.3
Vitamin A (IU/svg)	216.4	117.9	194.6	0	106.6	0
Vitamin A (% RDI)	4.3	2.4	3.9	0	2.1	0
Vitamin C (mg/svg)	5.2	5.1	7	0	5.2	1.8
Vitamin C (% RDI)	8.7	8.5	11.7	0	8.7	3
Calcium (mg/svg)	1.5	1.6	5.1	0	3.3	0
Calcium (% RDI)	0.15	0.16	0.51	0	0.33	0
Iron (mg/svg)	0.4	0.5	0.53	0	0.34	0
Iron (% RDI)	2.2	2.8	2.9	0	1.9	0
Folate (mcg/svg)	35.3	38	48.8	n/a	29.3	n/a
Folate (% RDI)	8.8	9.5	12.2	n/a	7.3	n/a

DB: Data Bank Values (USDA Nutrient Composition Tables)

RDI: Recommended Daily Intake (Nutrition Label Standard)

Raw: Uncooked, in fresh form

Cooked: Raw form cooked at home

Canned: Commercially Sterile

If doesn't say DB, then information comes from the label.

EXHIBIT C2 - Nutritional Content Comparison

Stewed Tomatoes				
Nutrients	Raw (DB)	Cooked (DB)	Canned (DB)	Del Monte Canned
Serving Size (cup)	1/2	1/2	1/2	1/2
Wt/svg (g)	90	120	127.5	126
Kcal/svg	18.9	32.4	35.7	35
Fat (g)	0.2	0.49	0.17	0
Cholesterol (mg)	0	0	0	0
Total Carbohydrate (g)	4.2	7	8.7	9
Fiber (g)	1	1.2	1.3	2
Sodium (mg)	8.1	13.2	281.8	360
Potassium (mg)	199.8	334.8	303.5	n/a
Protein (g)	0.75	1.3	1.2	1
Vitamin A (IU/svg)	560.7	891.6	689.8	500
Vitamin A (% RDI)	11.2	17.8	13.8	10
Vitamin C (mg/svg)	17.2	27.4	14.6	9
Vitamin C (% RDI)	28.7	45.7	24.3	15
Calcium (mg/svg)	4.5	7.2	12.2	20
Calcium (% RDI)	0.45	0.72	1.2	2
Iron (mg/svg)	0.41	0.65	0.95	0.36
Iron (% RDI)	2.3	3.6	5.3	2
Folate (mcg/svg)	13.5	15.6	6.9	n/a
Folate (% RDI)	3.4	3.9	1.7	n/a

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EXHIBIT C3 - Nutritional Content Comparison

Carrots						
Nutrients	Raw (DB)	Cooked (DB)	Canned (DB)	Del Monte Canned	Frozen (DB)	Freshlike Frozen
Serving Size (cup)	1/2	1/2	1/2	1/2	1/2	1/2
Wt/svg (g)	64	78	123	123	64	63.8
Kcal/svg	27.5	35.1	28.3	35	25	26.3
Fat (g)	0.66	0.14	0.17	0	0.13	0
Cholesterol (mg)	0	0	0	0	0	0
Total Carbohydrate (g)	6.5	8.2	6.6	8	5.8	4.5
Fiber (g)	1.9	2.6	2.2	3	2	1.5
Sodium (mg)	22.4	51.5	295.2	300	37.8	33.8
Potassium (mg)	206.7	177.1	212.8	n/a	115.8	n/a
Protein (g)	0.66	0.85	0.71	0	0.7	0.75
Vitamin A (IU/svg)	18002.6	19152.1	11894.1	15000	13620.5	3750
Vitamin A (% RDI)	360.1	383	237.9	300	272.4	75
Vitamin C (mg/svg)	6	1.8	2.5	60	2.8	0.9
Vitamin C (% RDI)	10	3	4.2	6	4.7	1.5
Calcium (mg/svg)	17.3	24.2	38.1	20	20.5	15
Calcium (% RDI)	1.7	2.4	3.8	2	2.1	1.5
Iron (mg/svg)	0.32	0.48	0.64	0.36	0.39	0
Iron (% RDI)	1.8	2.7	3.6	2	2.2	0
Folate (mcg/svg)	9	10.8	10	n/a	6.1	n/a
Folate (% RDI)	2.3	2.7	2.5	n/a	1.5	n/a

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Cooked: Raw form cooked at home

Canned: Commercially Sterile

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EXHIBIT C4 - Nutritional Content Comparison

Spinach						
Nutrients	Raw (DB)	Cooked (DB)	Canned (DB)	Del Monte Canned	Frozen (DB)	IGA Frozen
Serving Size (cup)	1/2	1/2	1/2	1/2	1/2	1/2
Wt/svg (g)	15	90	117	115	78	124.5
Kcal/svg	3.3	20.7	22.3	30	18.7	30
Fat (g)	0.05	0.23	0.43	0	0.24	0
Cholesterol (mg)	0	0	0	0	0	0
Total Carbohydrate (g)	0.53	3.4	3.4	4	3.1	3
Fiber (g)	0.41	2.2	1.9	2	2.4	3
Sodium (mg)	11.9	63	3733	360	57.7	172.5
Potassium (mg)	83.7	419.4	269.1	n/a	252	n/a
Protein (g)	0.43	2.7	2.5	2	2.3	3
Vitamin A (IU/svg)	1007.3	7371	7525.4	2500	6051.3	9000
Vitamin A (% RDI)	20.1	147.4	150.5	50	121	180
Vitamin C (mg/svg)	4.2	8.8	15.8	15	19	9
Vitamin C (% RDI)	7	14.7	26.3	25	31.7	15
Calcium (mg/svg)	14.9	122.4	97.1	100	86.6	90
Calcium (% RDI)	1.5	12.2	9.7	10	8.7	9
Iron (mg/svg)	0.41	3.2	1.9	1.1	1.6	0.54
Iron (% RDI)	2.3	17.8	10.6	6	8.9	3
Folate (mcg/svg)	29.2	131.2	67.9	n/a	93.3	n/a
Folate (% RDI)	7.3	32.8	17	n/a	23.3	n/a

DB: Data Bank Values (USDA Nutrient Composition Tables)

RDI: Recommended Daily Intake (Nutrition Label Standard)

Raw: Uncooked, in fresh form

Cooked: Raw form cooked at home

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EXHIBIT C5 - Nutritional Content Comparison

Peaches									
Nutrients	Raw (DB)	Juice (DB)	Del Monte Juice	Canned (DB) Light Syrup	Del Monte Light Syrup	Canned (DB) Heavy Syrup	Del Monte Heavy Syrup	Frozen (DB)	Flavorite Frozen
Serving Size (cup)	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Wt/svg (g)	85	125	124	125.5	124	131	127	125	105
Kcal/svg	36.6	55	60	67.8	60	96.9	100	117.5	37.5
Fat (g)	0.08	0.04	0	0.04	0	0.13	0	0.16	0
Cholesterol (mg)	0	0	0	0	0	0	0	0	0
Total Carbohydrate (g)	9.4	14.5	15	18.3	15	26.1	24	30	9.8
Fiber (g)	1.7	1.6	1	1.6	1	1.7	1	2.3	1.5
Sodium (mg)	0	5	10	6.3	10	7.9	10	7.5	0
Potassium (mg)	167.5	160	n/a	121.8	n/a	120.5	n/a	162.5	n/a
Protein (g)	0.6	0.79	0	0.55	0	0.6	0	0.79	0.75
Vitamin A (IU/svg)	454.8	476.3	300	444.3	300	434.9	300	355	940
Vitamin A (% RDI)	9.1	9.5	6	8.9	6	8.7	6	7.1	18.8
Vitamin C (mg/svg)	5.6	4.5	4.8	3	4.8	3.7	4.8	117.8	126
Vitamin C (% RDI)	9.3	7.5	8	5	8	6.2	8	196.3	210
Calcium (mg/svg)	4.3	7.5	0	3.8	0	4	0	3.8	0
Calcium (% RDI)	0.43	0.75	0	0.38	0	0.4	0	0.38	0
Iron (mg/svg)	0.09	0.34	0.36	0.45	0.36	0.35	0.36	0.46	0.27
Iron (% RDI)	0.5	1.9	2	2.5	2	1.9	2	2.6	1.5
Folate (mcg/svg)	2.9	4.3	n/a	4.1	n/a	4.2	n/a	4	n/a
Folate (% RDI)	0.73	1.1	n/a	1	n/a	1.1	n/a	1	n/a

DB: Data Bank Values (USDA Nutrient Composition Tables)

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Raw: Uncooked, in fresh form

Cooked: Raw form cooked at home

Canned: Commercially Sterile

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EXHIBIT C6 - Nutritional Content Comparison

Pears							
Nutrients	Raw (DB)	Canned (DB) Juice	Del Monte Juice	Canned (DB) Light Syrup	Del Monte Light Syrup	Canned (DB) Heavy Syrup	Del Monte Heavy Syrup
Serving Size (cup)	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Wt/svg (g)	82.5	124	124	125.5	124	133	127
Kcal/svg	48.7	62	60	71.6	60	98.4	100
Fat (g)	0.33	0.09	0	0.04	0	0.18	0
Cholesterol (mg)	0	0	0	0	0	0	0
Total Carbohydrate (g)	12.5	16.1	15	19.1	15	25.5	24
Fiber (g)	1.9	2	1	2.1	1	2.2	1
Sodium (mg)	0	5	10	6.3	10	6.7	10
Potassium (mg)	103.1	119.1	n/a	82.9	n/a	86.5	n/a
Protein (g)	0.32	0.42	0	0.24	0	0.27	0
Vitamin A (IU/svg)	16.5	7.5	0	0	0	0	0
Vitamin A (% RDI)	0.33	0.15	0	0	0	0	0
Vitamin C (mg/svg)	3.3	2	2.4	0.9	2.4	1.5	2.4
Vitamin C (% RDI)	5.5	3.3	4	1.5	4	2.5	4
Calcium (mg/svg)	9.1	11.2	0	6.3	0	6.7	0
Calcium (% RDI)	0.91	1.1	0	0.63	0	0.67	0
Iron (mg/svg)	0.21	0.36	0	0.35	0	0.3	0
Iron (% RDI)	1.2	2	0	1.9	0	1.7	0
Folate (mcg/svg)	6	1.5	n/a	1.5	n/a	1.6	n/a
Folate (% RDI)	1.5	0.38	n/a	0.38	n/a	0.4	n/a

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EXHIBIT C7 - Nutritional Content Comparison

Pineapple					
Nutrients	Raw (DB)	Canned (DB) Juice	Dole Juice	Canned (DB) Syrup	Dole Syrup
Serving Size (cup)	2 slices	2 slices	2 slices	2 slices	2 slices
Wt/svg (g)	112	94	114	96	117
Kcal/svg	54.8	56.4	60	49.9	90
Fat (g)	0.48	0.08	0	0.12	0
Cholesterol (mg)	0	0	0	0	0
Total Carbohydrate (g)	13.8	14.8	15	13	23
Fiber (g)	1.3	0.28	1	0.76	1
Sodium (mg)	1.1	0.94	10	0.96	10
Potassium (mg)	126.6	114.6	n/a	100.8	n/a
Protein (g)	0.44	0.39	0	0.35	0
Vitamin A (IU/svg)	25.8	35.7	0	14.4	0
Vitamin A (% RDI)	0.52	0.71	0	0.29	0
Vitamin C (mg/svg)	17.2	9	15	7.2	12
Vitamin C (% RDI)	28.7	15	25	12	20
Calcium (mg/svg)	7.8	13.2	0	13.4	0
Calcium (% RDI)	0.78	1.3	0	1.3	0
Iron (mg/svg)	0.42	0.26	0.36	0.37	0.36
Iron (% RDI)	2.3	1.4	2	2.1	2
Folate (mcg/svg)	11.8	4.6	n/a	4.6	n/a
Folate (% RDI)	3	1.2	n/a	1.2	n/a

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EXHIBIT C8 - Nutritional Content Comparison

Applesauce					
Nutrients	"Apples cooked" unsweetened	Canned (DB) Unsweetened	Musselman's Natural	Canned (DB) Sweetened	Musselman's Regular
Serving Size (cup)	1/2	1/2	1/2	1/2	1/2
Wt/svg (g)	85	122	122	127.5	126
Kcal/svg	45	52.5	50	96.9	90
Fat (g)	0.3	0.06	0	0.23	0
Cholesterol (mg)	0	0	0	0	0
Total Carbohydrate (g)	11.7	13.8	13	25.4	22
Fiber (g)	2.0	1.5	2	1.5	2
Sodium (mg)	0.8	2.4	10	3.9	10
Potassium (mg)	75	91.5	n/a	77.8	n/a
Protein (g)	0	0.21	0	0.23	0
Vitamin A (IU/svg)	37	35.4	n/a	14	n/a
Vitamin A (% RDI)	0.74	0.71	n/a	0.28	n/a
Vitamin C (mg/svg)	0	1.5	n/a	2.2	n/a
Vitamin C (% RDI)	0	2.5	n/a	3.7	n/a
Calcium (mg/svg)	4.3	3.7	n/a	5.1	n/a
Calcium (% RDI)	0.43	0.37	n/a	0.51	n/a
Iron (mg/svg)	0.16	0.15	n/a	0.45	n/a
Iron (% RDI)	0.89	0.83	n/a	2.5	n/a
Folate (mcg/svg)	0.5	0.73	n/a	0.77	n/a
Folate (% RDI)	0.12	0.18	n/a	0.19	n/a

DB: Data Bank Values (USDA Nutrient Composition Tables)

RDI: Recommended Daily Intake (Nutrition Label Standard)

Raw: Uncooked, in fresh form

Cooked: Raw form cooked at home

Canned: Commercially Sterile

If doesn't say DB, then information comes from the label.