

Natural Acids of Fruits and Vegetables

Fruits

Type	Predominant Acids* Present
Apples	<i>Malic</i> , <i>quinic</i> , <i>a-ketoglutaric</i> , <i>oxalacetic</i> , <i>citric</i> , <i>pyruvic</i> , <i>fumaric</i> , <i>lactic</i> and <i>succinic</i> acids
Apricots	<i>Malic</i> and <i>Citric</i> acids
Avocados	<i>Tartaric</i> Acid
Bananas	<i>Malic</i> , <i>citric</i> , <i>tartaric</i> and traces of <i>acetic</i> and <i>formic</i> acids
Bilberry	<i>Citric</i>
Blackberries	<i>Isocitric</i> , <i>Malic</i> , <i>lactoisocitric</i> , <i>shikimic</i> , <i>quinic</i> , and traces of <i>citric</i> and <i>oxalic</i> acids
Blueberries	<i>Citric</i> , <i>malic</i> , <i>glyceric</i> , <i>citramalic</i> , <i>glycolic</i> , <i>succinic</i> , <i>glucuronic</i> , <i>galacturonic</i> , <i>shikimic</i> , <i>quinic</i> , <i>glutamic</i> and <i>aspartic</i> acids.
Boysenberries	<i>Citric</i> , <i>malic</i> , and <i>Isocitric</i> acids.
Cherries	<i>Malic</i> , <i>citric</i> , <i>tartaric</i> , <i>succinic</i> , <i>quinic</i> , <i>shikimic</i> , <i>glyceric</i> and <i>glycolic</i> acids.
Crabapple	<i>Malic</i>
Cranberries	<i>Citric</i> , <i>malic</i> and <i>benzoic</i> acids.
Currants	<i>Citric</i> , <i>tartaric</i> , <i>malic</i> and <i>succinic</i> acids.
Elderberries	<i>Citric</i> , <i>malic</i> , <i>shikimic</i> and <i>quinic</i> acids.
Figs	<i>Citric</i> , <i>malic</i> and <i>acetic</i> acids.
Gooseberries	<i>Citric</i> , <i>malic</i> , <i>shikimic</i> and <i>quinic</i> acids.
Grapefruit	<i>Citric</i> , <i>tartaric</i> , <i>malic</i> and <i>oxalic</i> acids.
Grapes	<i>Malic</i> and <i>tartaric</i> (3:2), <i>citric</i> and <i>oxalic</i> acids.
Kiwifruit	<i>Citric</i>
Kumquat	<i>Citric</i>
Lemons	<i>Citric</i> , <i>malic</i> , <i>tartaric</i> and <i>oxalic</i> acids (no <i>Isocitric</i> acid)
Limes	<i>Citric</i> , <i>malic</i> , <i>tartaric</i> and <i>oxalic</i> acids.
Loganberry	<i>Malic</i> , <i>citric</i> acids
Nectarine	<i>Malic</i>
Orange Peel	<i>Malic</i> , <i>citric</i> and <i>oxalic</i> acids.
Orange	<i>Citric</i> , <i>malic</i> and <i>oxalic</i> acids.
Passionfruit	<i>malic</i>
Peaches	<i>Malic</i> and <i>citric</i> acids
Pears	<i>Malic</i> , <i>citric</i> , <i>tartaric</i> and <i>oxalic</i> acids
Pineapples	<i>Citric</i> and <i>malic</i> acids.
Plums	<i>Malic</i> , <i>tartaric</i> and <i>oxalic</i> acids.
Raspberry	<i>Citric</i>
Rosehip	<i>Malic</i>
Quinces	<i>Malic</i> acid (no <i>citric</i> acid)
Salad	<i>Citric</i> and <i>malic</i>
Strawberries	<i>Citric</i> , <i>malic</i> , <i>shikimic</i> , <i>succinic</i> , <i>glyceric</i> , <i>glycolic</i> and <i>aspartic</i> acids.
Tangerine	<i>Citric</i>
Youngberries	<i>Citric</i> , <i>malic</i> and <i>Isocitric</i> acids.

Vegetables

Beans	<i>Citric</i> , <i>malic</i> and small amounts of <i>succinic</i> and <i>fumaric</i> acids
Broccoli	<i>Malic</i> and <i>citric</i> (3:2) and <i>oxalic</i> and <i>succinic</i> acids.
Carrots	<i>Malic</i> , <i>citric</i> , <i>Isocitric</i> , <i>succinic</i> and <i>fumaric</i> acids.
Mushrooms	<i>Lactarimic</i> , <i>cetostearic</i> , <i>fumaric</i> and <i>allantoic</i> acids.
Peas	<i>Malic</i> acid.
Potatoes	<i>Malic</i> , <i>citric</i> , <i>oxalic</i> , <i>phosphoric</i> and <i>pyroglutamic</i> acids.
Rhubarb	<i>Malic</i> , <i>citric</i> and <i>oxalic</i> acids.
Tomatoes	<i>Citric</i> , <i>malic</i> , <i>oxalic</i> , <i>succinic</i> , <i>glycolic</i> , <i>tartaric</i> , <i>phosphoric</i> , <i>hydrochloric</i> , <i>sulphuric</i> , <i>fumaric</i> , <i>pyrrolidinonecarboxylic</i> and <i>galacturonic</i> acids.

* Acids which occur in appreciable quantities are shown in italics. The relative amount of each varies widely with the variety, degree of ripeness and seasonal influences. Complete identifications of all the acids present in many of the products is obviously lacking in many instances.

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Food Product/ Applications	Citric Acid Form	Purpose	Typical Use Level
Soft Drinks	Citric Acid	Impacts find tangy flavour. Sequesters harmful heavy metal ions	0.25-0.4%
Soft Drinks	Sodium Citrate	Offers agreeable, cooling, saline taste. Assists in retaining carbonation.	0.1%
Wine	Citric Acid	Prevents or dissolves ferric turbidity caused by tannin-iron or phosphate-iron complexes.	0-0.3%
Candies	Citric Acid	Enhances flavour of fruits and berries. Promotes sucrose inversion.	0.5%
Canned Fruits and Vegetables	Citric Acid	Allows reduction of retorting temperature. Preserves flavour, appearance and consistency.	0.1%
Jams and Jellies	Citric Acid/Sodium Citrate	pH adjustment for optimal pectin gelling	0-0.3%
Gelatin Desserts	Citric Acid/Sodium Citrate	pH adjustment for optimal gelatin setting. Contributes to tartness and refreshing properties.	2.5%
Processed Cheese	Sodium Citrate	Stabilises emulsified fat. Complexes calcium ions. Improves microbiological stability.	3 – 4%
Antioxidants	Citric Acid	Acts as synergist to antioxidants due to complexation of heavy metal ions	0.02%

Natural Occurrence of Citric Acid in Fruits and Vegetables

Plant	Citric Acid, wt %
Lemons	4.0-8.0
Grapefruit	1.2-2.1
Tangerines	0.9-1.2
Oranges	0.6-1.0
Blackcurrant	1.5-3.0
Red Currant	0.7-1.3
Raspberries	1.0-1.3
Strawberries	0.6-0.8
Apples	0.008
Potatoes	0.3-0.5
Tomatoes	0.25
Asparagus	0.08-0.2
Turnips	0.05-1.1
Peas	0.05
Corn Kernels	0.02
Lettuce	0.016
Eggplant	0.01

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