Natural Acids of Fruits and Vegetables

Fruits

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

Vegetables

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

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