

# Carambola

**Carambola**, also known as **star fruit**, is the fruit of *Averrhoa carambola*, a species of tree native to the Philippines, Indonesia, Malaysia, India, Bangladesh and Sri Lanka. The fruit is popular throughout Southeast Asia, the South Pacific and parts of East Asia. The tree is also cultivated throughout non-indigenous tropical areas, such as in Latin America, the Caribbean, and the southern United States.

The fruit has distinctive ridges running down its sides (usually five, but can sometimes vary); in cross-section, it resembles a star, hence its name. The entire fruit is edible and is usually eaten out of hand. They may also be used in cooking, and can be made into relishes, preserves, and juice drinks.



Unripe carambolas on the tree

## Origins and distribution

The original range of *Averrhoa carambola* is unknown. It is believed that it may have originated from Sri Lanka or Moluccas, Indonesia; but it has been cultivated in the Indian Subcontinent and Southeast Asia for hundreds of years. They remain a local favorite in those areas but have also recently gained popularity in parts of East Asia and Queensland, Australia; as well as in the Pacific Islands, particularly Tahiti, New Caledonia, Papua New Guinea, Hawaii, and Guam. They are cultivated commercially in India, Southeast Asia, southern China, Taiwan, and Florida. They are also grown in Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Peru, Brazil, Jamaica, Haiti, the Dominican Republic, Puerto Rico, Trinidad, Guyana and parts of Africa.<sup>[1][2]</sup> In other areas they are usually grown as ornamentals, rather than for consumption.<sup>[1]</sup>



Sliced carambolas having 7, 6, and the usual 5 points

## Description

The fruit is about 2 to 6 inches (**unknown operator: u'strong'** to **unknown operator: u'strong'** cm) in length and is ovate to ellipsoid in shape. It usually has five prominent longitudinal ridges, but in rare instances it can be as low as four or as high as eight. In cross section, it resembles a star. The skin is thin, smooth, and waxy and turns a light to dark yellow when ripe. The flesh is translucent and light yellow to yellow in color. Each fruit can have 10 to 12 flat light brown seeds about 0.25 to 0.5 in (**unknown operator: u'strong'** to **unknown operator: u'strong'** cm) in width and enclosed in gelatinous aril. Once removed from the fruit, they lose viability within a few days.<sup>[3][4][5]</sup>

Like the closely related bilimbi, there are two main types of carambola, the small sour (or tart) type and the larger sweet type. The sour varieties have a higher oxalic acid content than the sweet type. A number of cultivars have been developed in recent years. The most common cultivars grown commercially include the sweet types 'Arkin' (Florida), 'Dah Pon' (Taiwan), 'Fwang Tung' (Thailand), 'Maha' (Malaysia), and 'Demak' (Indonesia); and the sour types 'Golden Star', 'Newcomb', 'Star King', and 'Thayer' (all from Florida). Some of the sour varieties like 'Golden Star' can become sweet if allowed to ripen.<sup>[1][3][4]</sup>

## Gastronomy



### Carambola, raw

Nutritional value per 100 g (unknown operator: u'strong' oz)	
<b>Energy</b>	128 kJ (unknown operator: u'strong' kcal)
<b>Carbohydrates</b>	6.73 g
- <b>Sugars</b>	3.98 g
- <b>Dietary fiber</b>	2.8 g
<b>Fat</b>	.33 g
<b>Protein</b>	1.04 g
Pantothenic acid (B <sub>5</sub> )	.39 mg (8%)
Folate (vit. B <sub>9</sub> )	12 µg (3%)
Vitamin C	34.4 mg (41%)
Phosphorus	12 mg (2%)
Potassium	133 mg (3%)
Zinc	.12 mg (1%)
Percentages are relative to US recommendations for adults. Source: USDA Nutrient Database <sup>[6]</sup>	

The entire fruit is edible, including the slightly waxy skin. The flesh is crunchy, firm, and extremely juicy. It does not contain fibers and has a texture similar in consistency to that of grapes. Carambolas are best consumed shortly after they ripen, when they are yellow with a light shade of green or just after all the traces of green has disappeared. They will also have brown ridges at the edges and feel firm. Fruits picked while still slightly green will turn yellow in storage at room temperature, but will not increase in sugar content. Overripe carambola will be yellow with brown spots and can become blander in taste and soggy in consistency.<sup>[4][7]</sup>

Ripe sweet type carambolas are sweet without being overwhelming as they rarely have more than 4% sugar content. They have a tart, sour undertone, and an oxalic acid odor. The taste is difficult to compare, but it has been likened to

a mix of apple, pear, and citrus family fruits all at once. Unripe starfruits are firmer and sour, and taste like green apples.<sup>[3][8]</sup>

Ripe carambolas may also be used in cooking. In Southeast Asia, they are usually stewed in cloves and sugar, sometimes with apples. In China, they are cooked with fish. In Australia, they may be cooked as a vegetable, pickled, or made into jams. In Jamaica they are sometimes dried.<sup>[1]</sup>

Unripe and sour type carambolas can be mixed with other chopped spices to make relishes in Australia.<sup>[1]</sup> In the Philippines, unripe carambolas are eaten dipped in rock salt.<sup>[9]</sup> In Thailand, they are cooked together with shrimp.<sup>[1]</sup>

The juice from carambolas are also used in iced drinks, particularly the juice of the sour varieties. In Hawaii they are used to make sherbet, while in the Philippines they can be used as seasoning. In India, the juice is bottled for drinking.<sup>[1]</sup>

## Health

### Benefits

Carambola is rich in antioxidants, potassium, and vitamin C; and low in sugar, sodium, and acid. It is also a potent source of both primary and secondary polyphenolic antioxidants.<sup>[10]</sup> *Averrhoa carambola* has both antioxidant and antimicrobial activities. Scavenging of nitric oxide (NO) by the fruit extract is dependent on concentration and stage of ripening. Extracts showed antimicrobial activity against *E. coli*, *Klebsiella* spp., *Staphylococcus aureus*, and *Pseudomonas aeruginosa*.<sup>[11][12]</sup>

### Risks

Carambola contains oxalic acid, which can be harmful to individuals suffering from kidney failure, kidney stones, or those under kidney dialysis treatment. Consumption by those with kidney failure can produce hiccups, vomiting, nausea, and mental confusion. Fatal outcomes have been documented in some patients.<sup>[13][14][15][16][17][18]</sup>

### Drug interactions

Like the grapefruit, carambola is considered to be a potent inhibitor of seven cytochrome P450 isoforms.<sup>[19][20]</sup> These enzymes are significant in the first-pass elimination of many medicines, and, thus, the consumption of carambola or its juice in combination with certain medications can significantly increase their effective dosage within the body. Research into grapefruit juice has identified a number of common medications affected, including statins, which are commonly used to treat cardiovascular illness, and benzodiazepines (a tranquilizer family including diazepam).<sup>[21]</sup>



Carambolas in varying stages of ripeness

## Cultivation

The carambola is a tropical and subtropical fruit. It can be grown at up to **unknown operator: u','** feet (**unknown operator: u'strong'unknown operator: u','**m) in elevation. It prefers full sun exposure, but requires enough humidity and a total of 70 inches or more of rainfall a year. It does not have a soil type preference, but it requires good drainage.

Carambola trees are planted at least 20 feet (**unknown operator: u'strong' m**) from each other and typically are fertilized three times a year. The tree grows rapidly and typically produces fruit at four or five years of age. The large amount of rain during spring actually reduces the amount of fruit, but, in ideal conditions, carambola can produce from 200 to 400 pounds (**unknown operator: u'strong' to unknown operator: u'strong' kg**) of fruit a year. The carambola tree flowers throughout the year, with main fruiting seasons from April to June and October to December in Malaysia,<sup>[22]</sup> for example, but fruiting also occurs at other times in some other locales, such as South Florida.<sup>[4]</sup>

Major pests are fruit flies, fruit moths, ants, and birds.<sup>[3][22]</sup> Crops are also susceptible to frost,<sup>[3]</sup> especially in the United States and in the Philippines.

Top producers of carambola in the world market include Australia, Guyana, India, Israel, Malaysia, the Philippines, Taiwan, and the United States.<sup>[4]</sup> Malaysia is a global leader in starfruit production by volume and ships the product widely to Asia and Europe.<sup>[22]</sup> Due to concerns over pests and pathogens, however, whole starfruits cannot yet be imported to the US from Malaysia under current Food and Drug Administration regulations. In the United States, carambolas are grown in tropical and semitropical areas, including Texas, Florida, Puerto Rico, and Hawaii.<sup>[1][23]</sup>

In the United States, commercial cultivation and broad consumer acceptance of the fruit only dates to the 1970s. That acceptance is attributable to Morris Arkin, a backyard horticulturalist, from Coral Gables, Florida. During the late 1960s, Arkin began cultivating plants and trees in his backyard, eventually developing a kind of carambola, or star fruit, that became commercially viable and was named after him. Until the early 1970s, carambola had been grown only as specimen trees in botanical gardens and experiment stations and as a curiosity in home landscapes. However, because of its attractive star shape when cut in cross-section and yellow to golden color, it began to grow in popularity. Fruit from early introductions were however, sour and sometimes considered unpalatable. This limited market and public acceptance, inhibiting development and expansion of carambola as a commercial fresh fruit. Arkin cultivated the 'Arkin' variety – a sweet carambola with good handling characteristics – in the mid to late 1970s. Soon afterward, the limited commercial area of carambola under cultivation in south Florida (4 to 12 ha) was top-worked to 'Arkin' and this new cultivar led to a rapid increase in consumer demand for the fruit which further stimulated interest in establishing new commercial plantings. Today, the 'Arkin' variety represents 98% of the current acreage in South Florida.<sup>[24]</sup>



Ripening carambolas still on the tree

## Other uses

The trees are also grown as ornamentals for their abundant brightly colored and unusually-shaped fruits, as well as for their attractive dark green leaves and their lavender to pink flowers.<sup>[4]</sup>

Like the bilimbi, the juice of the more acidic sour types can be used to clean rusty or tarnished metal (especially brass) as well as bleach rust stains from cloth. They may also be used as a mordant in dyeing.<sup>[1]</sup>

## Common names

The carambola is known under different names in different countries. It should not be confused with the closely related bilimbi, with which it shares some common names.

- Assamese - *kordoi* (কৰ্দৌ) / *rohdoi* (ৰহদৌ)
- Telugu - *ambanamkaya* (అంబాణంకాయ)
- Bengali - *kamranga* (কামরাঙা)
- Sinhala - *kamranga*
- Malayalam - *Caturappuli*
- Marathi & Konkani- *karambal*
- English - *carambola*, *starfruit*
- Filipino - *balimbíng*, *saranate*
- Hindi & Gujarati - *kamrakh*
- Tamil - *thambaratham* (தம்பரத்தம்)
- Indonesian & Malay - *belimbing*
- Seychellois Creole - *karanbol*
- Sylheti - *khafrenga*
- Jamaican - *star fruit*, *jimbilin*
- Vietnamese - *khế*
- Kannada - *karambal-drakshi*
- Tulu - *bimbli*
- Trinidad and Tobago - *five finger*
- Thai - *ma fueang* (มะไฟฝรั่ง)

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