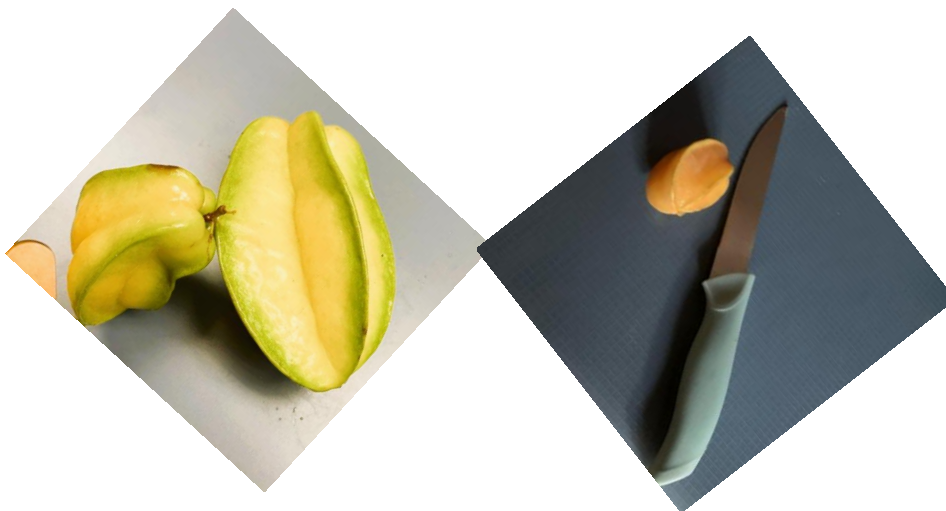




**CARAMBOLA/FIVE-FINGER:  
THE FORBIDDEN FRUIT FOR PATIENTS  
WITH  
RENAL DISORDERS**

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## ABOUT THIS BOOK

This book is about the tropical fruit *Averrhoa* Carambola, also known as Star Fruit or Five Finger, depending on the geographical location or cultural setting. The uses, benefits, and negative health effects are also outlined for your education. The negative health effects that are associated with the oxalic acids and the caramboxin substances present in the fruit have renal and neurological effects on individuals who have impaired kidney functions or renal disorders that can be fatal.

The negative effects of the carambola, star fruit, or five-finger outlined in this book are supported by the evidence-based data in copious qualitative and other methods of research projects over time.



## HISTORICAL BACKGROUND OF CARAMBOLA/STAR FRUIT/FIVE-FINGER

Carambola is part of the Oxalidaceae family of the herbaceous, with tubers and bulbs. These are often with shrubs and woody genera of which there are two woody species due to the fruit they produce, namely, *Averrhoa carambola* L. and *Averrhoa bilimbi* L. *Averrhoa bilimbi* L. is native to southeast Asia and popular in its chutneys, curries, and pickles due to the acidity of the fruit (Nakasone & Paul, 1998). Like the Carambola or five-finger, this species, commonly called “One-Finger Surry” is known for its tartness and is used in similar dishes, mostly by the East Indian ethnic group in Guyana, South America. Nonetheless, like many countries in the north and west, the carambola also called five-finger fruit is used in a variety of dishes, fresh or preserved.

During the 12<sup>th</sup> century in Cordoba Spain, the fruit trees were discovered by and named after the genus, Spanish philosopher and physician, Ibn-Ruschdud, commonly known as Averroes, the name given to the fruit trees. In the early 16 Century, the Portuguese discovered the fruit during the colonization of India. During this time, the name Carambola was discovered, with its origin in Sri Lanka

or the Moluccas, the islands of Indonesia. This discovery allows the fruit to travel through Asia and later to southern China, India, and the Philippines.

In Asia alone, the fruit has over 20 different names, but the most common is some variation of “belimbing.” When the Spanish and Portuguese explorers arrived in Asia, they adopted the Indian word “karambal” and renamed the fruit “carambola”, which is still used today. The fruit continues to travel from one geographic location to another, and with each move, it receives names such as “star fruit” due to its star shape after it is cut, and five-fingers, seen in the five points or corrugation.

The two later names were accredited to the Portuguese who took the carambola with them as they explored South America and Africa and later cultivated it in nearby regions.

In 1753, Carl Linnaeus adopted the genus name, known to the Portuguese, and in his Species Plantarum was named the first person to provide evidence-based data about the fruit including the star-shaped of the fruit. Later, in the mid-1800s, Carambola was introduced to Florida from South America and the nearby Caribbean islands.

Around 1887 the carambola fruit was formally introduced and rediscovered for its medicinal properties and decorative aesthetic. Star fruit, the name known in the Caribbean was also formally introduced to the Caribbean Islands, Central America, South America, and later Hawaii around 1935. Today, the fruit is widely grown around the world with the mentioned names among others used interchangeably to suit the geographic location.

Some examples include carambola, star fruit, and five-finger in some English-speaking countries. In other parts of the world it is called “belimbing in (Malay, Indonesian), babingbing (Philippines), caramba, yang-tao (Chinese), carambolier (French), ma fueng (Thailand), Fuang (Laos) and khe (Vietnam), Pg. 132.”

In this book, carambola/five-finger is explored to educate the readers on the versatilities, including the negative effects of the fruit if it is consumed by people who are predisposed to Renal Disease.

## IMPORTANT FACTS ABOUT AVERRHOA CARAMBOLA/ FIVE FINGER

In Guyana, the tropical fruit (*Averrhoa carambola*), is called Five-finger due to its corrugated or pointed edges. It was first introduced to the natives of Guyana in the late 18<sup>th</sup> century.

It is described as an evergreen tree, grown along the coastal belt in Guyana, South America. It is characterized as sweet, eaten fresh, and used in both savory and sweet cuisine for its nutritional values, especially vitamin C.

In addition, carambola/five-finger is said to have similar physiognomies to watermelon and papaya fruits, due to their nutritional values and water content (Tan Yu Wei, 2022).

## CLASSIFICATION OF CARAMBOLA/FIVE-FINGER

There are two main groups of carambola fruit, for example, *Averrhoa carambola* L. and *Averrhoa bilimbi* L.

Carambola/Five-Fingers is described as a sweet fruit that is eaten fresh, conversely, Bilimbi/One-Finger Surry is acidic and is not as popular as five-finger, but is used in the country's cuisines. **See Figures 1 and 2 for photos of the fruits**

Carambola can be further classified into species depending on the country of origin and is given a native name. **See the list in the Table - 1 below.**



Figure 1. Photo of *Averrhoa bilimbi L*



Figure 2. Photo of *Averrhoa carambola L.*

## USES OF CARAMBOLA/FIVE-FINGER

Carambola/Five-finger is used in various ways in cookery and medicinal purposes including for preserved fruits used in the famous Guyana Black Cake, Fruit Rum Cake, Five Finger Drink, Chutneys, and Pickles (Ministry of Agriculture, 1982).

**In the United States of America**, the fruit is used mostly for culinary cuisines such as wine-making, beverages, cakes, and pastries.

**In Asian countries**, carambola is used mainly for its medicinal value and in some amount cuisine.

## MEDICINAL PROPERTIES AND HEALTH BENEFITS OF AVERRHOA

### CARAMBOLA/FIVE FINGER/STAR FRUIT

*Carambola/Five-finger* has many beneficial nutritional and medicinal properties.

The benefits and properties are based on scientific evidence and include the following:

**Antioxidant properties**, this is due to the presence of L-ascorbic acid, epicatechin, and gallic acid, which have rich antioxidant properties. The antioxidants in the fruit provide anti-inflammatory properties and aid in the reduction of the symptoms of

psoriasis, joint pains, sore throat, respiratory infection, and dermatitis (Arnarson, 2023).

**Hypoglycemic properties** due to its high fiber levels of 2-dodecyl-6-methoxycyclohexa-2,5-diene-1,4-dione, which helps to maintain insulin levels. This fruit also aids in the reduction of blood sugar levels in diabetic patients (Gao et al., 2015; Lakmal et al., 2021).

**Hypotensive properties** due to the presence of apigenin, hypocholesterolemic, and micronized fiber properties, this fruit has been proven to be effective in anti-inflammatory, anti-infective, antitumor, and immune-boosting effects (Lakmal et al., 2021)

**Cardiovascular properties** due to essential minerals and electrolytes, provide cardiovascular benefits, as they help to regulate the heartbeat and blood pressure because of the high amounts of sodium and potassium composition that provide electrolytes for the body (Lakmal et al., 2021).

Circulation Properties due to the presence of electrolytes, have a high level of calcium that relieves tension in blood vessels and arteries, which helps reduce the risk of a heart attack or stroke (Muthu et al., 2016).

**Immunity Properties:** It provides boosting properties to the body's immune system by enhancing the white blood cell levels due to the high percentage of essential vitamins present in the starfruit/five finger. (Kumar et al., 2023; Lakmal et al., 2021).

**High Fiber Properties:** the fiber and antioxidant properties in carambola/five fingers reduce the toxicity level in the body and thus, lower the risk of getting cancer. The rich source of some essential vitamins such as Vitamin C, E, and A properties provide antioxidants that have proven to aid in cancer treatment (Lakmal et al., 2021). The fiber content also aids in the digestive tract and relieves symptoms of constipation, bloating, and cramping.

**Pharmacological and Phytochemical properties:** Pharmacological studies reveal that crude extracts have many phytochemical compounds including flavonoids, terpenes, and other phenolics. Among them is 2-dodecyl-6-methoxycyclohexa-2,5-diene-1,4-dione (**122, DMDD**) with the highest chemical compound and multiple biological activities. These have health and organic benefits for medicinal uses (Badal & Smith, 2017).

These discoveries are supported by a preliminary study which suggests that the consumption of star fruit juice twice daily for 1 month improves the participant's

antioxidant, and vitamin status, as well as improves their lipoproteins levels which are attributed to the presence of Vitamin C and A (Leelarungrayub et al., 2016). Uses of Carambola in Asian countries for its medicinal properties for hemorrhages, reduction of fevers, lowering blood pressure, therapy for coughs and sore throat, relieving hangovers, and soothing headaches.

### **NUTRITIONAL VALUE OF CARAMBOLA/ STAR FRUIT/ FIVE FINGER**

The Nutritional Facts on the Carambola/Star Fruit/Five-Finger Fruit for approximately 1 cup (132g) of cubed star fruit. These are as follows:

| <b>Name of Nutrients</b> | <b>Amount of nutrient</b> | <b>Unit of Measurement</b> |
|--------------------------|---------------------------|----------------------------|
| Water                    | 121                       | g                          |
| Energy                   | 40.9/ 169                 | Kcal/ KJ respectively      |
| Protein                  | 1.37                      | g                          |
| Total (Lipid (fat)       | 0.436                     | g                          |
| Carbohydrates            | 8.88                      | g                          |
| Total Dietary Fiber      | 3.7                       | g                          |
| Sugar                    | 5.3                       | g                          |
| Calcium, Ca              | 3.96                      | mg                         |
| Iron                     | 0.106                     | mg                         |
| Magnesium                | 13.2                      | mg                         |
| Selenium                 | 0.792                     | mg                         |
| Phosphorus               | 15.8                      | mg                         |

|                    |       |     |
|--------------------|-------|-----|
| Potassium          | 176   | mg  |
| Sodium             | 2.64  | mg  |
| Zinc               | 0.158 | mg  |
| Vitamin C          | 45.4  | mg  |
| Thiamin            | 0.018 | mg  |
| Riboflavin         | 0.021 | mg  |
| Pantothenic Acid   | 0.516 | mg  |
| Niacin             | 0.484 | mg  |
| Vitamin B-6        | 0.022 | mg  |
| Folate             | 15.8  | ug  |
| Vitamin A          | 80.5  | I U |
| Carotene, Alpha    | 31.7  | ug  |
| Lutein+ Zeaxanthin | 87.1  | ug  |
| Vitamin E          | 0,198 | mg  |
|                    |       |     |

(The United States Department of Agriculture USDA, (2018) database)



## RECOMMENDATION FOR THE USE OF CARAMBOLA/FIVE-FINGER

Carambola has high amounts of oxalates and caramboxin, which usually bind with calcium and increase the risk of kidney stones when excreted and lead to both neurotoxic and nephrotoxic effects respectively.

Therefore, it is recommended that a low oxalate diet of 50 mg may be implemented for those who can tolerate the fruit. If persons are predisposed to renal diseases, care must be taken to avoid the use of oxalates, or oxalic acid foods, and or use under the guidance of your Healthcare Provider.

Here is a list of some foods and the percentages of (oxalic acid) present. The Following include:

- **Spinach:** 755 mg per ½ cup
- **Firm tofu:** 235 mg per 3-ounce serving
- **Soy milk:** 336 mg per 1 cup.
- **Potatoes:** 97 mg per serving
- **Beets:** 152 mg per 1 cup
- **Raspberries:** 48 mg per 1 cup

- **Navy/haricot beans:** 76 mg per ½ cup
- **Almonds:** 122 mg per 1 ounce
- **Dates:** 24 mg per 1 date

**Other oxalate-rich foods include:**

- Bran flakes
- Rhubarb
- French fries
- Nuts and nut butter
- Soy seeds (Shaikh & Uttekar, 2024; Khatri, 2022).

**Note:** attentiveness should be taken when consuming any of the foods listed above.

## **TOXICITY OF CARAMBOLA/FIVE-FINGER**

Carambola contains Caramboxin (CBX) and oxalate, which can have serious medical challenges that lead to death. Caramboxin is a non-proteinogenic amino acid that has a similar chemical makeup to **phenylalanine** and is responsible for the **glutamate receptors** in neurons. This chemical is an agonist of both **NMDA and AMPA** (Stumpf et al., 2019).

Glutamatergic ionotropic receptors have potent excitatory, convulsing, and neurodegenerative properties. Conversely, Oxalic acid is a colorless, crystalline powder that is a strong organic acid. Oxalic acid was first discovered in the extract from the wood sorrel plant. It also occurs naturally in leafy vegetables such as rhubarb, spinach, beet leaves, Swiss chard, cabbage, and sweet potatoes, and fruits such as peanuts, cranberries, strawberries, cocoa/chocolate, and bell peppers. Oxalate/Oxalic acid is also known as an organic compound produced naturally by the body during metabolism or can be obtained from certain foods as indicated. These are sometimes bound to certain minerals to form compounds such as iron or calcium oxalate (Shaikh & Uttekar, 2024).

### **SIGNS, SYMPTOMS, AND EFFECTS OF CARAMBOLA/FIVE-FINGER**

The consumption of the fruit caused individuals to experience signs and symptoms such as persistent hiccups, nausea, vomiting, agitation, insomnia, mental confusion, seizure, intoxication, and convulsions (this may occur within one to five hours of eating the fruit; while intoxication may occur half an hr. after eating or drinking the juices. Finally, death may result in serious cases, (Weil, 2009).

## **EVIDENCE-BASED DATA TO SUPPORT THE HEALTH RISKS AND SIDE-EFFECTS OF CARAMBOLA/FIVE-FINGER**

There is a plethora of evidence to support the notion that carambola or five-finger has negative and detrimental effects upon consumption by persons with renal disorders and or kidney diseases. Thus, those with kidney diseases, or renal disorders are admonished to avoid the use of this fruit. The National Kidney Foundation (2023) indicated that star fruit has toxins that are harmful to the body. **Levine and Caroline (2018)** claimed that a toxic substance (neurotoxin) found in carambola can affect the brain and cause neurological disorders in persons with kidney disease, who are unable to process and pass out the toxins.

It is also explained that people with healthy, normal kidneys are better able to process and excrete these toxins from their bodies. They conclude that the consumption of carambola while experiencing kidney disease may lead to poisoning and display of signs and symptoms such as hiccups, mental confusion, seizures, and death in severe cases. **Muthu, Lee, Phua, and Bhore (2016)** support this notion and state that persons with renal challenges who consume the fruit may experience a dry cough, hiccups, mental confusion, become comatose, and sometimes die. They also recommend that

persons with renal diseases avoid the consumption of carambola to prevent the fatal consequences of eating this fruit. Despite these discoveries and recommendations, some scientists and researchers agree that there is a need for more investigation and research to make a sound conclusive statement on the fruit. Abeysekera et al. (2015) concur and hypothesize in their recommendation that there is insufficient evidence of the effects of star fruit on individuals with renal impairment. Additionally, they proposed supplementary investigation must be implemented as described in their findings in the oxalate nephrotoxicity study. Muthu, Lee, Phua, and Bhore (2016) in their study also argued in a statement that resembles the one above and suggested that this controversial fruit has more benefits than negative effects. They submitted that the Ayurvedic and Traditional Chinese Medicines (TCM) in India, China, and Brazil used carambola to relieve many ailments for a great deal of the world population who are diagnosed or predisposed to renal diseases (Muthu, et al., 2016).

Stumpf, Schuinski, Baroni, and Ramthun (2019) also suggest that the fruit contains a high amount of oxalate and caramboxin (CBX) which is neurotoxic and hazardous for uremic patients or persons with kidney or renal disease. This is especially precarious since it is damaging to the nervous system. They also admonish individuals suffering from

kidney failure, kidney stones, or those undergoing dialysis to avoid the consumption of carambola. Miller (2022) supports the body of information that Carambola/five-finger contains high amounts of oxalic acid when taken in concentrated forms, and has proven to have serious health risks. Thus, care should be taken to prevent the challenges it brings. Hariadi (2020) provided current evidence-based data and buttressed the notion that carambola has been proven to have negative effects on health if taken while experiencing the presence of chronic kidney disease, gastroenteropathies, chronic pancreatitis, and dehydration. Findings also revealed that the consumption of the fruit on an empty stomach, due to the high concentrations of oxalate in the fruit and or its juice makes people predisposed to toxicity (Hariadi, 2020)

Abeysekera et al. (2015) Also posited that star fruit commonly consumed as part of the diet has proven to be dangerous and caused nephrotoxicity in patients who consumed the fruit as a treatment for diabetes.

Oliveira and Aguiar (2015) concur that previous findings suggest that the presence of neurotoxicity in patients tested, was due to the presence of oxalate in star fruit. They further explained that the neurotoxic effect is due to caramboxin, which appears to inhibit the GABAergic system, which is the major inhibitory system in the central nervous system

(CNS). This is also proven to be responsible for sudden cries, confusion, seizures, and death. Therefore, it is recommended that Physicians should be alert when screening their patients, and ask about carambola ingestion history, especially when presented with unexplained acute kidney injury with or without neurological features. This is imperative since taking carambola in a large amount, on an empty stomach, and or in a dehydrated state, increases the risk for neurotoxicity in the patient. Stumpf, Schuinski, Baroni, and Ramthun (2019) postulated in their study that a 51-year-old male developed acute kidney failure and was subjected to four dialysis sessions after he ingested over 50-star fruits before the acute neurologic deficits. In his history, he presented with paresis and altered mental status. He was tested negative for all other neurological diseases. He later recovered renal function (Stumpf et al., 2019)

Aranguren, Vergara, and Rosselli (2017) in a systematic review examined 123 patients from eight countries who were presented with chronic kidney disease (CKD) and undiagnosed kidney diseases and had consumed low dosages of carambola over time. Of these, 47 were from Brazil, Taiwan (36), Bangladesh (20), China (8), France (8) Sri Lanka (2), Thailand (1), and Colombia (1). The findings revealed that 28 (22%) of the patients died.

In another clinical study, 32 uraemic patients who ingested carambola were examined at various stages before the intoxication episodes, twenty patients were on regular haemodialysis eight were on peritoneal dialysis and four were not on dialysis. The patients were analyzed as follows: two were chosen from their charts, 17 were directly monitored by the clinic and 13 were referred by physicians throughout the country. Findings reveal persistent and intractable hiccups in 30 patients (93.75%), vomiting in 22 (68.7%), variable degrees of mental confusion, and psychomotor agitation in 21 (65.6%). There were decreased muscle power, limb numbness, paresis, insomnia, and paresthesias in 13 (40.6%) and seizures in seven (21.8%). Further, it was noted that patients who were severely intoxicated and promptly treated with haemodialysis, recovered without sequelae, and those who were severely intoxicated and were not treated or treated with peritoneal dialysis did not survive. It is recommended that a daily haemodialysis approach is ideal for carambola intoxication, (Neto et al., 2003). Though there is a lot of documentation on the dangerous effects of carambola on individuals with impaired renal functions, there are equal benefits to patients with healthy kidney functions. These include vitamins, flavonoids, antioxidants, fibrous properties, and other nutritional benefits. Nonetheless,

care **MUST** be taken to avoid or to prevent detrimental effects on the person with renal disorders.

### **RIPENING AND MATURITY STAGES OF THE CARAMBOLA**

The carambola/five-finger has several phases of ripening to the maturity stage.

These vary from place of production to harvesting, ripening, and mature stages. In most instances, they are generally characterized as green, light green, green-yellow, yellow-green, yellow, and orange. The correct ripeness of the fruit determines its taste, nutritional content, and other variability of chemical substance.

The Ministry of Fisheries, Crops, and Livestock; The National Agricultural and Research Institute, and the New Guyana Marketing Cooperation in their Postharvest Handling Technical Bulletin for Carambola (2014), have outlined the Maturity Indices. The main stages range from green to yellow to orange.

The process generally takes approximately 2 months while the appearance is indicated by the change in color of its ripeness. Thus, the level of ripeness and maturity can give a clear indication of the potency of the substance and its effect on health.

Here is an example of the ripening of Five-finger on a tree in Mr. James' 2024 backyard.

**Figure 3.** Stages of Ripening and Maturity of the Carambola. Green, green-yellow, yellow-green, yellow, and orange.



## **Samples of Recipe of the Carambola /Star Fruit/Five Finger**

### **Carambola/ Five-Finger Dried Preserved Fruit**

#### **Ingredients**

10 medium-size Starfruits

1 lb. Sugar

¼ cup Orange Peel

1 tbsp. mixed Spices

¼ tsp Salt

#### **Method:**

Pick when fully ripe. Slice, and remove seeds and gut.

Boiled until brown and caramelized. Add sugar, spices, peel, and salt to further caramelize and preserve.

Cook until soft and tender. Removed from heat and leave to cool.

Grind or chop in a mill or food processor.

Pour grape juice over the mixture for hurdle preservation

Store in a glass jar preferably.

**Uses:** include fruit cake, pound cake, wedding cake, pancake, pudding, and bars.

## **Carambola /Five Finger & Ginger Drink**

### **Ingredients**

1 lb. Carambola Fruit

2 tbsp. Chopped Ginger

¼ cup Honey

2 pt. Water

### **Method**

Blend all ingredients, strain, and serve over ice. Or chill and serve. (servings for 4 persons).

## **Carambola/Five-Finger Fruit Cake**

### **Ingredients**

2lb Ground Preserved carambola fruit

1 ½ lb. brown sugar

½ lb. (2cups) flour

8 oz. soft unsalted butter

6 eggs

1 cup red grape juice

1 tsp mixed spices nutmeg, cinnamon, cloves, and allspice

½ tsp baking powder

¼ lb. mixed citrus preserved and cooked peels

¼ mixed nuts of choice (optional)

## **Method**

Soak preserved fruit in grape juice overnight. Blend fruits, and spices in a food processor.

Make caramel using one pound of sugar until brown. Leave to cool for desirable consistency.

Cream butter and remaining sugar well. Whisk eggs until light and fluffy.

Add fruit mixture, stir, and add caramel to add color and desirable consistency.

Sift flour and baking powder, and add to the fruit mixture. Fold in and cut until the mixture is to a smooth consistency. Add nuts and all other ingredients for taste and consistency.

Greased and lined baking pans with waxed paper. Pour the mixture into a full half of the pan. Bake in a slow oven at 325°F for 2 hours. Remove after baking and pour the remaining juice over the mixture. Leave to cool and serve with a beverage of choice.

## **Carambola/Five-Finger Crumble**

### **Ingredients**

¾ cup All-purpose Whole Wheat Flour

¼ cup plain All-purpose Flour

¼ cup Demerara Brown Sugar

½ tsp. ground Cinnamon

2 tbsp. margarine or Olive Oil

5-6 small ripe Five-Fingers

Pinch Salt

### **Method**

Preheat the oven to 375 Fahrenheit.

In a mixing bowl, mix flour, 1 tbsp. sugar and margarine. Combine using a pastry blender until the mixture looks like bread crumbs.

Wash and slice five fingers into very thin even slices.

In a pan, place sliced five fingers with part of the sugar and cook for a few minutes until tender. Add a pinch of salt to flavor. Remove from heat and set aside.

In a dry Pyrex dish, sprinkle the crumbly dough evenly to cover the bottom. Place the cooked slices over the dough uniformly.

Add the remaining crumbled dough to cover the fruit with the remaining sugar.

Preheat oven. Bake for 30-40 minutes until lightly brown on the top. Serve with an ice cream topping of choice.

### **Carambola/ Five-Finger Tart**

#### **Five-Finger Filling:**

##### **Ingredients**

5 small ripe five-finger

1/2 cup granulated sugar

1 tsp. cinnamon

1 small egg or Almond milk

1tsp oil for the milk (as a wash for the dough)

1 tsp. salt

##### **Ingredients for the Pastry Dough**

4 cups flour

1 cup vegetable shortening

½ cup margarine or ghee

1 cup ice-cold water

## Method

Mix vegetable shortening and margarine into flour using the fingertips or pastry blender.

Add salt and ice-cold water to dry ingredients and mix well. Knead dough lightly and cover with a cold cloth for 1½ hours.

Wash five fingers, and slice into even pieces. On medium heat place a skillet and add 1 tsp. margarine and sliced five fingers.

Cook until water is removed; then add sugar and flavors and continue cooking.

Cook until tender and flavor well distributed. After 25 -45 minutes remove from heat. The cooking time is dependent on the thickness of the slices. Mix milk, oil, and salt to taste.

Preheat the oven to 350 degrees. Grease pans with shortening.

Remove the cold cloth from the dough, roll it, and cut it into desired shapes. Place cool filling into pieces, fold, and place into the pan. Seal corners and baste with egg or milk mixture.

Bake for 20-25 minutes

The amount yield for 12-14 persons

## **Carambola/Five-Finger Pancake**

### **Ingredients**

½ cup Blended Five Finger

2 cup Flour

2 tbsp. Sugar

3 tbsp. Olive Oil

1 Egg

¼ cup Milk of choice

2 tsp. Baking powder

Pinch of salt

### **Method**

Combine your dry ingredients (flour, sugar, salt, baking powder) in one bowl and your wet ingredients (egg, milk, olive oil, mashed bananas) in another bowl.

Add the dry ingredients to the bowl with the wet ingredients, then stir until they're incorporated.

Prepare pan and bake to a golden brown color.

## **Carambola/ Five-Finger Dip**

### **Ingredients**

2 small Five finger

2 tbsp. Sugar

¼ cup finely chopped ginger

2 cloves finely chopped garlic

1 tbsp. olive oil

Salt to taste

### **Method**

Slice five fingers thinly and set in a bowl. Heat skillet with oil

Add part ginger, garlic, and five fingers. Sauté for two minutes, add remaining ginger, salt, and sugar, simmer, and cook until the fruit is tender and the sauce has the body.

Serve over meat and finger foods. Pair this with fish and poultry dishes, or use it as a substitute for lemon or lime slices to garnish chilled beverages.

## **Carambola/Five-Finger Chutney**

### **Ingredients**

7 large Star Fruit

4 oz. Lemon juice

1 ½ cup brown sugar

1 cup chopped bitter melon

1 medium onion

2 tbsp. Olive oil

4 cloves garlic

2 tsp freshly crushed ginger

Salt to taste

### **Method**

Heat saucepan over medium heat, add oil and allow to heat to a mild temperature.

Add Five-Finger and cook for 5-6 minutes until tender and soft. Add ginger, onion, bitter melon, and garlic. Cook ingredients until the texture breaks down. Remove from heat and set aside.

Combine sugar, and lemon juice in a pot and bring to a boil. Cook until all ingredients are marinated into the fruit. Add salt to taste and stir occasionally until all the crystals are dissolved completely. Add the precooked mixture, reduce the heat, and stir frequently until a thick consistency is formed. Leave to simmer. Remove from heat, and leave to cool. Place in a glass jar and refrigerate.

## DEFINITION OF TERMS

**Antioxidant:** Antioxidants are man-made or natural substances that may prevent or delay some types of cell damage. These are especially found in fruits and vegetables. They may be obtained as dietary supplements. An example is Beta-carotene (Medline Plus, 2024).

**Armarson**, 2023, also states that “Antioxidants are molecules that can help your body fight off harmful free radicals, which have been linked to health conditions like diabetes and cancer. They’re found in many plant-based foods. Vitamin E and C are examples.”

**Averrhoa Carambola L:** The Star-fruit or five-finger plant is of the (family: Oxalidaceae; species: *Averrhoa carambola* L.) and is widely distributed around the world, especially in tropical countries such as India, Malaysia, Indonesia, the Caribbean, and South America, including Guyana, and the Philippines. This Carambola or five-finger plant belongs to the genus, *Averrhoa*, which contains 5 species, namely *A. bilimbi*, *A. dolichocarpa*, *A. leucopetala*, *A. microphylla*, and *A. carambola*. However, *A. carambola*, star fruit, or five-finger is the most popular and is widely cultivated on a commercial scale. *Averrhoa carambola* is considered the

most important species and is cultivated extensively in Southeast Asia and Malaysia, (Muthu et al., 2016).

**Bilimbi/Belimbling:** is an extremely sour, yellow-green fruit with a thin, soft skin and crunchy, juicy flesh. The oblong-shaped fruit has five discernible ribs. A cross-section of the fruit reveals a five-point star within, accentuating the pentagonal shape of the fruit. The fruit resembles smooth-skinned gherkins. They grow in clusters on bushy trees with green leaves and attractive red-purple flowers. They contain several pale, small, flat seeds embedded in each fruit. Bilimbi fruit is also referred to as Tree Cucumbers and Belimbing, known for its tart-tangy flesh (Produce Market, n.d).

**Caramboxin** (CBX) is a toxin found in (*Averrhoa carambola*) /Five-finger. “Carboxin is an anilide obtained by formal condensation of the amino group of aniline with the carboxy group of 2-methyl-5,6-dihydro-1,4-oxathiine-3-carboxylic acid. A fungicide for control of bunts and smuts that is normally used as a seed treatment. It has a role as an EC 1.3.5.1 [succinate dehydrogenase (quinone)] inhibitor and an antifungal agrochemical. It is an anilide, an enamide, an oxacycle,

an organosulfur heterocyclic compound, an anilide fungicide, and a secondary carboxamide” (National Center for Biotechnology Information, 2024).

**Convulsions:** also refers to "seizure" is often used interchangeably to describe people who have uncontrollable shaking that is rapid and rhythmic, with the muscles contracting and relaxing repeatedly. There are many different types of convulsions or seizures, some have mild symptoms without shaking (Medline Plus, 2023)

**Dermatitis:** is a common condition that causes swelling and irritation of the skin. There are many causes and forms signaled by itchy, dry skin or a rash, which may result in a blister, ooze, crust, or flakes of the skin. Three common types of this condition are atopic dermatitis, contact dermatitis, and seborrheic dermatitis. Atopic dermatitis is also known as eczema (Mayo Clinic, 2023).

Glutamate Receptors are the primary mediators of excitatory transmission in the central nervous system and are mostly located on the dendrites of postsynaptic neuronal and **glial cells**, such as astrocytes and oligodendrocytes (Moore, 2024).

**Neurotoxin:** “the substance that alters the structure or function of the nervous system. More than 1,000 chemicals are known to have neurotoxic effects in animals. The substances include a wide range of natural and human-made chemical compounds, from snake venom and pesticides to ethyl alcohol, heroin, and cocaine” (Levine, 2018).

**Non-proteinogenic Amino Acids** (NPAAs) are not naturally encoded in the human genetic code or found in the polypeptide chains. On the other hand, in organisms such as bacteria, fungi, plants, and marines, NPAAs are essential building blocks of polypeptide chains (Ding et al., 2020).

**Oxalidaceae:** a wood sorrel family, is a small family of dicotyledonous flowering plants, consisting of about 5 genera with approximately, 570 species, mostly in tropic, subtropic, or temperate zones. Plants are usually herbaceous, sometimes shrubs or small trees. (Xu & Deng, 2017).

**Oxalic acids:** also known as Oxalates are naturally occurring compounds in plants. These may be obtained from foods or are made in the body. Examples of foods high in oxalic acid include dark green leafy greens, legumes, and some grains (Khatri, 2022).

**“Pharmacognosy** is the study of morphological, chemical, and biological properties as well as history, cultivation, collection, extraction, isolation, bioassay, quality control, and preparation of crude drugs of natural origin” (Badal & Smith, 2017).

**Phytochemicals:** are plant-based bioactive compounds produced by plants for their protection. There are more than a thousand phytochemicals discovered to date. They can be derived from various sources such as whole grains, fruits, vegetables, nuts, and herbs. Some of the significant phytochemicals are carotenoids, polyphenols, isoprenoids, phytosterols, saponins, dietary fibers, and certain polysaccharides. These phytochemicals possess strong antioxidant activities and exhibit antimicrobial, antidiarrheal, anthelmintic, antiallergic, antispasmodic, and antiviral activities (Kumar et al., 2023).

## CONCLUSION AND RECOMMENDATION

Averrhoa Carambola, a versatile fruit has many names, uses, and benefits, dependent on the geographic location. For example, in China, carambola/star fruit is believed to have an average consumption of carambola of 2.6 million tons per year, though the average production is 2 million tons. In India, the fruit is used in Indian cuisine, while the trees are used on the sidewalk as decorative plants.

In Guyana, five-finger is seasonal and appears about three times per year. It is very prevalent and widely used by most of the populace. The natives used the fruit frequently for juices, drinks, cakes, and pastries, in a fresh or preserved state.

Despite its versatility and popularity, the fruit has been discovered to be harmful to persons with renal illnesses. Further, the carambola, star fruit /five-finger has been scientifically proven to have negative effects on health if taken while experiencing the presence of chronic kidney disease, gastroenteropathies, chronic pancreatitis, and dehydration. It was also discovered that the consumption of five-finger on an empty stomach, in higher concentration makes persons predisposed to toxicity, due to the presence of caramboxin and oxalic acid in the fruit/juice.

In addition, other scientific evidence has validated that five-finger also contains toxic substances called neurotoxins, which affect the brain and can lead to neurological disorders. People with healthy kidneys are usually able to process these toxins, but those with kidney diseases are not so fortunate, and this leads to related illnesses. These may be signaled by hiccups, mental confusion, seizures, and death in severe cases. The level of ingestion at which the beneficial effects transition to nephrotoxicity and neurotoxicity is still to be accurately ascertained based on consumption. Consequently, people with kidney diseases should talk with their healthcare provider before consuming five fingers.

Individuals must receive annual check-ups to monitor their health status. When dining out, avoid beverages and desserts, especially if you are unsure of the level of ripeness and possible potency of the active ingredients that may lead to toxicity. Thus, the fruit may be taken in moderation by everyone. However, anyone who is diagnosed with renal issues or kidney disease is advised to avoid the consumption of carambola in any form.

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