CARAMBOLA:THE FORBIDDEN FRUIT FORPATIENTS WITHRENAL DISORDERS

Abstract:

Five-Finger is very popular across the ten administrative regions, but especially on the Coastal Plains of Guyana. Never was taught that it is forbidden to those with renal diseases. Thus, it has been discovered that this favorite and versatile fruit to many has its darker side, especially for people with renal disorders or poor kidney functions, which is the focal area of interest in this study. Carambola is also credited with similar characteristics to watermelon and papaya fruits, due to the enzymes that

aid in digestion and gut health. 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. Thefruit 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.

Keywords: gut health, Carambola, kidney disease, gastroenteropathies

INTRODUCTION

*Averrhoa Carambola L*is a tropical fruit known to many around the world for its versatility. Guyana is among the many countries that grow and use Averrhoa carambola L commonly known asfive-fingersto the natives of the land. It is generally used in food preparation and for medicinal purposes. The woody genera produce tubers that are described as sweet fruit, when eaten fresh or raw, or asan acidic fruitpopularlyused in the country's cuisines.

When the fruit is processed, manydelicious cuisines are created including the Five-Finger Drink, Preserved Fruit used for the Guyanese Black Cake, Chutney, or Achar are just a few of the wonders of carambola in food preparation in Guyana.

Commonly known as Five-Finger in Guyana, it is so called because of the five points that are visible when it is sliced. Five-Finger is very popular across the ten administrative regions, but especially on the Coastal Plains of Guyana. Never was taught that it is forbidden to those with renal diseases. Thus, it has been discovered that this

favorite and versatile fruit to many has its darker side, especially for people with renal disorders or poor kidney functions, which is the focal area of interest in the book.

HISTORICAL BACKGROUND OF CARAMBOLA/STAR FRUIT/FIVE-FINGER

Carambola is recognized as 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 in Guyana 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 five-finger fruit, also called carambola or star Fruit, in South America Guyana is used in a variety of dishes, fresh or preserved.

During the 12th century, in Cordoba Spain, the fruit trees were discovered by, and named after the genus, Spanish philosopher and physician, Ibn-Ruschdut, 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 inSri Lanka or the Moluccas, the islands of Indonesia. This discovery allows the fruit to

travel through Asia and later tosouthern 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 as such received names such as "star fruit" due to itsstar 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 Floridafrom South America and the nearby Caribbean islands.

Around 1887 the carambola fruit was formally introduced and rediscovered for its medicinal properties and decorative atheistic. Star fruit, now called in 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 being used interchangeably to suit the geographic location.

These include Carambola,star fruit, or five-finger in some English-speaking countries. It is also called "*belimbling in (Malay, Indonesian), babingbing(Philippines), caramba, yang-tao(Chinese), carambolier (French), ma fueng (Thailand), Fuang (Laos) and khe (Vietnam)*, Pg. 132."

In this book, we continue the exploration of Carambola, five-finger, and star fruit, to educate you on the negative effects of the fruit if you are predisposed to Renal Disease.

Figure 1. Photo of*Averrhoa bilimbi L*

Figure 2. Photo of*Averrhoa carambola L.*

IMPORTANT FACTS ABOUT AVERRHOA CARAMBOLA/ STAR FRUIT/ FIVE FINGER

In Guyana, the tropical fruit (*Averrhoa carambola*), is commonly known as Five fingers due to its corrugated or pointed edges. It is described as an evergreen tree, grown along the coastal belt in Guyana, South America. It was first discovered in the late 18th century.

Like many in the global community who embraced the carambola for its versatilities, Guyanese also use the fruit in the cuisine of both savory and sweet dishes, and for the nutritional values, especially vitamin C.

Averrhoa carambola L. and *Averrhoa bilimbi L.*are the two main groups of the Averrhoa L fruit in Guyana. Five-Fingers/carambola isdescribed as a sweet fruit that is eaten fresh, and the One-Finger Surry-Bilimbi is acidic, not as popularas five-finger, but is used in the country's cuisines. These includepreserved fruits used in the Guyana Black Cake, Fruit Rum Cake, Five Finger Drink, chutneys, and pickles (Ministry of Agriculture, 1982). In the United States, the fruit is used mostly for its culinary cuisine such as wine-making, beverages, cakes, and pastries.

In addition to the gastronomies of Carambola,it is extensively cultivated globally and is used around the world for its medicinal properties.In Asian countries, carambola is used for its medicinal properties for hemorrhages, reduction of fevers, lowering blood pressure, therapy for coughs and sore throat, relieving hangovers, and soothing headaches.

Carambola is also credited with similar characteristics to watermelon and papaya fruits, due to the enzymes that aid in digestion and gut

health (Tan Yu Wei, 2022). However,this favorite tropical fruit which is known for its potent tart flavor, medicinal properties, and culinary cuisines, is now scientifically provento have negative effects on people with *RENAL DISORDERS and DISEASES.*Thus, people who are predisposed to chemical substances such as Caramboxin (CBX) and oxalate, which are present in the fruitcan have serious medical challenges and even 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.** A glutamatergic ionotropic receptors with 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.

In high amounts, oxalates usually bind with calcium and increase the risk of kidney stones when excreted. Thus, it is recommended that a low oxalate diet of 50 mg may be implemented, and if you are predisposed to renal diseases, you must avoid and be guided on the use of oxalates, or oxalic acid foods.

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).

As such, caution should be taken when consuming any of the foods listed above. The high percentage of caramboxin and oxalic exposurecan lead to both neurotoxic and nephrotoxic effects. Additionally, consuming large amounts of five-finger or its juice on an empty stomach can have adverse effects on individuals with normal kidney functions, and will be worse on those with poor kidney functions.

Nonetheless, scientists have suggested that persons who don't have any kidney problems may eat star fruit in any form since there are no negative effects on healthy kidneys. However, if kidney function is impaired in any form, eating star fruit can be very dangerous, and must be avoided. The signs and symptoms after consuming star fruit include persistent hiccups, nausea, vomiting, agitation, insomnia, mental confusion, and convulsions that may occur within one to five hours of eating the fruit.Weil 2009 supports this notion and statesthat persons with RENAL DISEASES can experience intoxicationafter eating the carambola fruit or drinking its juice in as little as half of

hour. Further, a patient with impaired kidney function can die after eating a single-star fruit (Weil, 2009)

NUTRITIONAL VALUE OF CARAMBOLA/STAR FRUIT/FIVE FINGER

Nutritional Facts on the Carambola/Star Fruit/Five-Finger Fruit for approximately1 cup (132g) of cubed star fruit. These are as follows:

Table 1. Nutritional value of carambola/star fruit/five finger

Name of Nutrients	Amount of nutrient	Unit of Measurement
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	IU
Carotene, Alpha	31.7	ug
Lutein+ Zeaxanthin	87.1	ug
Vitamin E	0,198	mg

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

MEDICINAL PROPERTIES AND HEALTH BENEFITS OF *AVERRHOA CARAMBOLA*/FIVE FINGER/STAR FRUIT

Carambola hasmany beneficial nutritional and medicinal properties. The benefitsand propertiesare 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 haverich antioxidant properties.The antioxidants in this fruitprovide anti-inflammatory properties and aid in the reduction of the symptoms of psoriasis, joint pains, sore throat, respiratory infection, anddermatitis.

Hypoglycemic properties due to its high fiber levels of 2- dodecyl- 6- methoxycyclohexa- 2,5- diene- 1,4- dione, whichhelps to maintain insulin levels. This fruit also aids in the reduction of blood sugar levels in diabetic patients.

Hypotensiveproperties, 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.

Carambola/ five fingersalso provide cardiovascular benefits, as it helps to regulatethe heartbeat and blood pressure because of the high amounts of sodium and potassium composition that provide electrolytes for the body.

Carambola/Five-finger has a high level of calcium that relieves tension in blood vessels and arteries, which helps reduce the risk of a heart attack or stroke.

Immunity Properties: Itprovides 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.

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 provideantioxidants that have proven to aid in cancer treatment. 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.

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 tothe presence ofVitamin C and A (Leelarungrayub et al. 2016).

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

There is a plethora of evidence to support the negative and detrimental effects of the consumption of carambola by persons with Renal disorders and or kidney diseases.Those with KIDNEY DISEASES or RENAL DISORDERSare admonished to avoid the use of this fruit.The American Kidney Foundation noted 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. Further, it is explained that people with healthy, normal kidneys are better able to process and pass out 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 statedthat persons with renal challenges who consume the fruit, may experiencea 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. Abeysekera, et al. (2015) concur and hypothesizein their recommendation that there is insufficient evidence of the effects of star fruit on individuals with renal impairment. Further, they proposed further investigation must be implemented as described in their findings in the oxalate nephrotoxicity study.Muthu, et

al.(2016)proposed a statement that resembles the one above and suggested that this controversial fruit has more benefits than negatives.

They submitted that the Ayurvedic and Traditional Chinese Medicines (TCM) in India, China, and Brazil used carambola to relieve many ailments in health concerns 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 alsoadmonish individuals suffering from kidney failure, kidney stones, or those undergoing dialysisto 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, Wijetunge, Nanayakkara et al. (2015)Also posited thatstar 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 tocaramboxin, 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 et al. (2019)postulated in their study thata 51-year-old male developed acute kidney failure and wassubjected 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 that28 (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,da Costa, Garcia- Cairasco et al.2003). Though there are numerous 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/ star fruit/five-finger has several stages of ripening tothe 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 gives a clear indication of the potency of the substance and its effect on health.

Here is an arrangement based on the ripening of the fruit on a tree in the family yard.

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/PreservedFruit

Ingredients
10 medium-sizeStarfruits
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

Ingredients

2lb Ground Preserved caram 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 poundof sugar until brown. Leave to cool after desirable consistency.

Cream butter and remaining sugar well. Then 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 intoa 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. Bake for 30-40 minutes until lightly brown on the top. Serve with anice 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 amountyield 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/ Instructions

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. Removefrom 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).
Arnarson, 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 andis widely cultivated on a commercial scale. Averrhoa carambola is considered the most important species and is cultivated extensively in Southeast Asia and Malaysia, (Muthu, Lee, Phua, &Bhore, 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 star fruit (*Averrhoa carambola*). Individuals with some types of kidney disease are susceptible to adverse neurological effects including intoxication, seizures, and even death after eating star fruit. Caramboxin has been identified as the neurotoxin responsible for these effects. Caramboxin is a non-proteinogenic amino acid that stimulates the glutamate receptors in neurons. Its chemical structure is similar to the amino acid phenylalanine. Caramboxin is an agonist of both N-methyl-D-aspartate (NMDA) and glutamate-gated ion channels, (AMPA) glutamatergic ionotropic receptors with potent excitatory, convulsant, and neurodegenerative properties (Gracia-Cairasco, Mayses-Neto, Del Vecchio, Oliveira, et al. 2013).

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, n.d.)

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 (Mayoclinic, 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, Ting. Liu, Al-Azzam, Pandya, & Afshar, 2020).

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

Oxalicacids: 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, Pharmacognosy, 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, Nirmal, Kumar, Jose, Tomer, Oz., et al., 2023).

CONCLUSION AND RECOMMENDATION

Averrhoa Carambola, a versatile fruit has many names, uses, and benefits, dependent on the country of origin. In China, the fruit is identified as star fruitand carambola. It is believed that the average consumption of carambola in China is 2.6 million tons per year, though the average production is 2 million tons. It is used in Indian cuisine, also the trees are used on the sidewalk as decorative plants.

In Guyana, the fruit is known as carambola and five-finger; it is seasonal but very prevalent and widely used by most of the populace. The natives used the fruit frequently for juices, drinks,

cakes and pasties in the fresh or preserved state. Despite its versatility and popularity, the fruit has been discovered to be harmful to persons with renal illnesses.

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 offive-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 fingers,also contain 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 the beverages and dessert, 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.

References

Abeysekera, R.A., Wijetunge, S., Nanayakkara, N., Wazil, A.W.M., Ratnatunga, N. V. I., Jayalath, T., and Medagama, A. (2015). Star fruit toxicity: a cause of both acute kidney injury and chronic kidney disease: *a report of two cases. Pubmed Journal.* Retrieved from https://pubmed.ncbi.nlm.nih.gov/26680759/

Aranguren C, Vergara C, Rosselli D. (2023). Toxicity of star fruit (*Averrhoa carambola*) in renal patients: A systematic review of the literature. *Saudi J Kidney Dis Transplant. 9*(28),709-15. Retrievedfrom: https://www.sjkdt.org/text.asp?2017/28/4/709/211347

Arnarson, A. (2023). Antioxidants Explained in Simple Terms. Retrieved from https://www.healthline.com/nutrition/antioxidants-explained

Badal, S., Smith, K. N. (2017). Areas of Science Embraced by Pharmacognosy. Retrieved from https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/pharmacognosy#:~:text=Pharmacognosy%20is%20the%20study%20of,of%20natural%20origin%20%5B1%5D.

Ding, Y., Ting. J.P., Liu, J., Al-Azzam, S.,

Pandya, P., and Afshar, S. (2020). Impact of non-proteinogenic amino acids in the discovery and development of peptide therapeutics. *Amino Acids*. *52*(9), 1207–1226. doi: 10.1007/s00726-020-02890-9

Gao, Y., Huang, R., Gong, Y., Park, H. S., Wen, Q., Almosnid, N. M., et al. (2015). The Antidiabetic Compound 2-Dodecyl-6-Methoxycyclohexa-2,5-Diene-1,4-Dione, Isolated from *Averrhoa carambola* L., Demonstrates Significant Antitumor Potential against Human Breast Cancer Cells. *Oncotarget 6*(27), 24304–24319. doi:10.18632/oncotarget.4475 or https://pubmed.ncbi.nlm.nih.gov/26203774/

Gracia-Cairasco, N., Mayses-Neto, M., Del Vecchio, Oliveira, J. A., Dos, Santos, F. L., Castro, O. W., Arisi, G. M., Dantas, M.R., Carolino, R. O., G., Coutinho,-Netto, J., Dagostin, A. L.A., Rodrigues, M.C.A., Leao, RM., Quintiliano, S.A.P., Silva, L.F., Gobbo-Neto, L., Lopes, N.P. (2013). "Elucidating the Neurotoxicity of Star Fruit". AngewandteChemie International Edition. *52* (49), 13067-70. Doi:10.1002/anie.201305382

Hariadi, H. (2020). The influence of carambola starfruit (*Averrhoa bilimbi*) and Papaya (*Carica papaya*) on the quality of the organoleptic properties, vitamin C content, and fiber in jelly candies. IOP Conference Series. Vol. 443.Earth and Environmental Science. Retrieved from https://iopscience.iop.org/article/10.1088/1755-1315/443/1/012017

Henry Y. Nakasone and Rober E. Paul, (1998). Tropical Fruits. Publisher: CAR

INTERNATIONAL Walling Ford, Oxon OX 10 8 DE, UK Contact information xxx@cabi.org or xxx@cabi.org
Jaeger R., Cuny E. (2016). Terpenoids with special pharmacological significance: A review. *Nat. Prod. Commun.* Retrieved fromdoi: 10.1177/1934578X1601100946.
Khatri, M. (2022). Foods High in Oxalates. Retrieved from https://www.webmd.com/diet/foods-high-in-oxalates
Kumar, A., Nirmal, P., Kumar, M., Jose, A., Tomer, V., Oz., Et. Al (2023). Major Phytochemicals: Recent Advances in Health Benefits and Extraction Method. *Molecules.*28(2): 887. Retrieved from doi: 10.3390/molecules28020887

Lakmal, K., Yasawardene, P., Javarajah, U., and Seneviratne, S. L. (2021). Nutritional and medicinal properties of Star fruit (*Averrhoa carambola*): A review. Retrieved from https://doi.org/10.1002/fsn3.2135
Leelarungrayub J, Yankai A, Pinkaew D, Puntumetakul R, Laskin JJ, Bloomer RJ. A preliminary study on the effects of star fruit consumption on antioxidant and lipid status in elderly Thai individuals. *Clin Interv Aging*. Retrieved from doi:10.2147/CIA.S110718 or https://www.verywellfit.com/star-fruit-calories-carbs-nutrition-facts-4174575#citation-1
Levine, Caroline. "neurotoxin". *Encyclopedia Britannica*, 21 Nov. 2018. Retrieved From https://www.britannica.com/science/neurotoxin. Accessed 31 January 2024.
Mayoclinic, (2023). Dermatitis. Retrieved from https://www.mayoclinic.org/diseases-

conditions/dermatitis-eczema/symptoms-causes/syc-20352380#:~:text=Dermatitis%20is%20a%20common%20condition,%2C%20ooze%2C%20crust%20or%20flake.
Medline Plus, (2024). Antioxidants. Retrieved Fromhttps://medlineplus.gov/antioxidants.html#:~:text=Antioxidants%20are%20man%2Dmade%20or,Beta%2Dcarotene
Medline Plus, (n.d.) Seizure. Medical Encyclopedia. Retrieved from https://medlineplus.gov/ency/article/003200.htm#:~:text=The%20term%20%22seizure%22%20is%20often,have%20mild%20symptoms%20without%20shaking.
Ministry of Agriculture (1982). How to cultivate Avocado pears, mangoes, papaw, sapodilla, pineapples, carambola, bilimbi, citrus, grapes. Central Agricultural Station.
Ministry of Fisheries, Crops, and Livestock New Guyana Marketing Corporation National Agricultural Research Institute, (2004). POSTHARVEST HANDLING TECHNICAL SERIES CARAMBOLA (FIVE FINGERS) Postharvest Care and Market Preparation. (Technical Bulletin. No. 30). Retrieved from https://pdf.usaid.gov/pdf_docs/Pnacy846.pdf
Miller, L. (2022). Interesting Starfruit Uses – Learn How to Use Starfruit. Gardening Know HowRetrievedfrom https://www.gardeningknowhow.com/edible/fruits/starfruit/how-to-use-starfruit.htm

Moore, S. (2024). What are Glutamate Receptors? News, Medical Lifestyle Sciences.Review. Retrieved from https://www.news-medical.net/life-sciences/What-are-Glutamate- Receptors. aspx
Muthu,N., Lee, S. Y., Phua, K. K., Bhore, S. J. (2016). Nutritional, Medicinal and Toxicological Attributes of Star-Fruits (Averrhoa carambola L.).*12*(12), 420–424.A Review.

Retrieved from https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC5357571/doi: 10.6026/97320630012420

National Kidney Foundation (n.d). Why should you avoid eating star fruit? Retrieved from https://www.kidney.org/atoz/content/why-you-should-avoid-eating-starfruit#:~:text=The%20substances%20found%20in%20starfruit,disease%2C%20this%20is%20not%20possible.

Neto, M.M., da Costa,J.A.C.,Garcia-Cairasco,N., Netto, J.C.,Nakagawa, B., and Dantas, M. (2003). Intoxication by star fruit (*Averrhoa carambola*) in 32 uraemic patients: treatment and outcome: Vol.18. Issue 1. *Nephrology Dialysis Transplantation* (pp.120–125). Retrieved from https://academic.oup.com/ndt/article/18/1/120/1809123

Oliveira, E. S. M., Aguiar, A.S., (2015). Why eating star fruit is prohibited for patients withchronic kidney disease? *Brasileiro Nefrologia Journal*. *37*(2). 241-7. Retrieved from https://pubmed.ncbi.nlm.nih.gov/26154645/ or doi: 10.5935/0101-2800.20150037.

Sachdev, P. (2022). Star Fruit. A review editorial of WebMD. Retrieved from https://www.webmd.com/diet/star-fruit

Shaikh, J., and Uttekar, P. S. (2024). What Foods Are High in Oxalate (Oxalic Acid)? Kidney Stone Prevention. Retrieved from https://www.medicinenet.com/what_foods_are_high_in_oxalate_oxalic_acid/article.htm

Sharma B.R., Kumar V., Gat Y., Kumar N., Parashar A., Pinakin D.J. (2018).

Microbial maceration: A sustainable approach for phytochemical extraction. *Biotech. 3*(8). 401. Retrieved from doi: 10.1007/s13205-018-1423-8.
Specialty Market (2023). Carambola. Retrieved from https://specialtyproduce.com/produce/Carambola_11453.php#:~:text=Geography%2FHistory,turn%20of%20the%2016th%20century.

Speciality Produce, (n.d.) Blimibi Fruit. Retrieved from https://specialtyproduce.com/produce/Bilimbi_Fruit_14716.php
Stumpf, A. M. M., Schuinski, A.F.M., Baroni, G., and Ramthun, M. (2019). Acute Kidney Injury with Neurological Features: Beware of the Star Fruit and its Caramboxin. Indian J. Nephrol, *30*(1). 42–46. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6977387/
Tan Yu Wei, C. (2022). Carambola Fruit. Britannia. Retrieved from https://www.britannica.com/topic/carambola
The Ministry of Fisheries, Crops, and Livestock; The National Agricultural and Research Institute, and the New Guyana Marketing Cooperation (2004). CARAMBOLA (FIVE FINGERS) Postharvest Care and Market Preparation. Postharvest Handling Technical Bulletin. Retrieved from https://pdf.usaid.gov/pdf_docs/Pnacy846.pdf
USDA (n.d). Start Fruit. Wisconsin Department of Public Instruction. Retrieved from https://dpi.wi.gov/sites/default/files/imce/school-nutrition/pdf/fact-sheet-star-fruit.pdf

U.S. Department of Agriculture. Carambola (starfruit), raw. (2018). Food Data Central Search. Retrieved from https://fdc.nal.usda.gov/fdc-app.html#/food-details/171715/nutrients

Weil, A. July 21, 2009. Is Eating Star Fruit Dangerous? Retrieved from https://www.drweil.com/diet-nutrition/nutrition/is-eating-star-fruit-dangerous/#:~:text=But%20if%20your%20kidney%20function,hours%20of%20eating%20the%20fruit.

Wu, X. C., Lu, S. Y., Zhou, X., Qin, L. H., Jiang, L. H., Li, Y. C., et al. (2020a). Anti-hepatocarcinoma Effect of and its Mechanism of 2-Dodecyl-6-Methoxycyclohexa-2,5-Diene-1,4-Dione in *Averrhoa carambola* L. Roots. *Chin. J. Hosp. Pharm. 40*(1). 42–47. Retrieved from doi:10.13286/j.1001-5213.2020.01.05 or https://www.frontiersin.org/articles/10.3389/fphar.2021.699899/full

Xu, Z., and Deng, M. (2017). Oxalidaceae. In: Identification and Control of Common Weeds: Vol. 2. (pp 617–628). *Springer, Dordrecht.* Retrieved from https://link.springer.com/chapter/10.1007/978-94-024-1157-7_44