

INDIGENOUS POLYPHENOLS OF CASHEW: THE ALMA MATER IN NATURAL NUTRITION

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ABSTRACT

The cashew tree (*Anacardium occidentale*) is a tropical evergreen tree that produces the cashew seed and the cashew apple. The tree can grow as high as 14 m (46 ft), but the dwarf cashew, growing up to 6 m (20 ft), has proven more profitable, with earlier maturity and greater yields. The cashew seed is often considered a nut in the culinary sense; this cashew nut is eaten on its own, used in recipes, or processed into cashew cheese or cashew butter. Like the tree, the nut is often simply called cashew. The species is native to Central America, the Caribbean, and northern South America, including north-eastern Brazil. Portuguese colonists in Brazil began exporting cashew nuts as early as the 1550s. In 2017, Vietnam, India, and the Ivory Coast were the major producers. The shell of the cashew seed yields derivatives that can be used in many applications including lubricants, waterproofing, paints, and, starting in World War II, arms production. The cashew apple is a light reddish to yellow fruit, whose pulp can be processed into a sweet, astringent fruit drink or distilled into liquor.

KEYWORDS: Cashew nut, Cashew oil, Cardanol, Cardol and Anacardic acid.

Natural supplement: Medicinal plants play a dynamic role in survival of mankind and progression of human cultures all over the world (Mandal et al., 2020; Roy et al., 2020; Bose et al., 2019). Furthermore, some plant produces critical nutrients possessing very high therapeutic values (Mandal et al., 2018; Sen et al., 2020; Mandal, 2018; Mandal et al., 2019). Moreover, a number of plant species, has also been identified in last ten years with promising therapeutic potential (Mandal et al., 2020; Dastidar et al., 2020; Baidya et al., 2020; Banerjee et al., 2019). Culinary uses for cashew seeds in snacking and cooking are similar to those for all tree seeds called nuts. Cashews are commonly used in Indian cuisine and Pakistani cuisine, whole for garnishing sweets or curries, or ground into a paste that forms a base of sauces for curries (e.g., korma), or some sweets (e.g., kaju barfi). It is also used in powdered form in the preparation of several Indian sweets and desserts. In Goan cuisine, both roasted and raw kernels are used whole for making curries and sweets. Cashews are also used in Thai and Chinese cuisines, generally in whole form. In the

Philippines, cashew is a known product of Antipolo, and is eaten with suman. The province of Pampanga also has a sweet dessert called turrone de casuy, which is cashew marzipan wrapped in white wafers. In Indonesia, roasted and salted cashews are called kacang mete or kacang mede, while the cashew apple is called jambu monyet (lit. 'monkey rose apple'). In the 21st century, cashew cultivation increased in several African countries to meet the demands for manufacturing cashew milk, a plant milk alternative to dairy milk. In Mozambique, bolo polana is a cake prepared using powdered cashews and mashed potatoes as the main ingredients. This dessert is popular in South Africa. In Brazil, cashew fruit juice and the fruit pulp are used in the production of sweets, juice, alcoholic beverages, such as cachaça, and as a flour, milk or cheese. In Panama, the cashew fruit is cooked with water and sugar for a prolonged time to make a sweet, brown, paste-like dessert called dulce de marañón (marañón being a Spanish name for cashew). (Alexander, 2008).

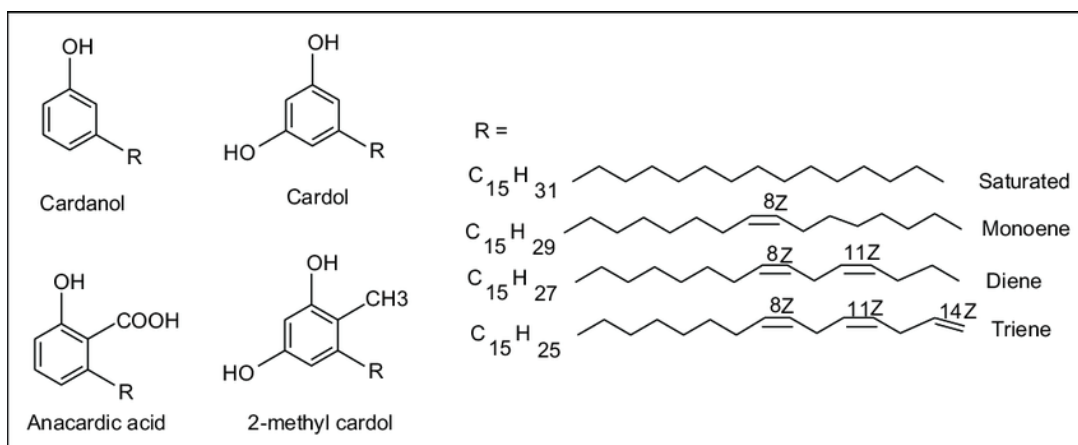


Figure-1: Cardanol, Cardol and Anacardic acid.

The shell of the cashew nut contains oil compounds that can cause contact dermatitis similar to poison ivy, primarily resulting from the phenolic lipids, anacardic acid, and cardanol. Due to the possible dermatitis, cashews are typically not sold in the shell to

consumers. Readily and inexpensively extracted from the waste shells, cardanol is under research for its potential applications in nanomaterials and biotechnology. (Hamad et al., 2015).



Structure-1: Green Cashew & Marketed Cashew.

Table-1: Micronutrients.

Nutrition: Cashews, raw. Nutritional value per 100 g (3.5 oz) [Energy: 553 kcal (2310kJ)]								
Carbohydrates [30.19 g]		Fat [43.85 g]		Protein [18.22 g]	VitaminsQuantity %DV		MineralsQuantity %DV	
Starch	23.49 g	Saturated	7.783 g		Vitamin A	0 IU	Ca ⁺⁺	4%; 37 mg
Sugars	5.91 g	Monounsaturated	23.797 g		Thiamine (B1)	37%; 0.423 mg	Cu ⁺⁺	110%; 2.2 mg
Dietary fibre	3.3 g	Polyunsaturated	7.845 g		Riboflavin (B2)	5%; 0.058 mg	Fe ⁺⁺	51%; 6.68 mg
					Niacin (B3)	7%; 1.062 mg	Mg ⁺⁺	82%; 292 mg
					Pantothenic acid (B5)	17%; 0.86 mg	Mn ⁺⁺	79%; 1.66 mg
					Vitamin B6	32%; 0.417 mg	P	85%; 593 mg
					Folate (B9)	6%; 25 µg	K ⁺	14%; 660 mg
					Vitamin B12	0%; 0 µg	Na ⁺	1%; 12 mg
					Vitamin C	1%; 0.5 mg	Se ⁺⁺	28%; 19.9 µg
					Vitamin D	0%; 0 µg	Zn ⁺⁺	61%; 5.78 mg
					Vitamin E	6%; 0.90 mg		
					Vitamin K	32%; 34.1 µg		
Water: 5.20 g								

Raw cashews are 5% water, 30% carbohydrates, 44% fat, and 18% protein (table). In a 100-gram reference amount, raw cashews provide 553 Calories, 67% of the Daily Value (DV) in total fats, 36% DV of protein, 13% DV of dietary fiber and 11% DV of carbohydrates.

Cashews are rich sources (20% or more of the DV) of dietary minerals, including particularly copper, manganese, phosphorus, and magnesium (79-110% DV), and of thiamin, vitamin B₆ and vitamin K (32-37% DV) (table). Iron, potassium, zinc, and selenium are present in

significant content (14-61% DV) (table). Cashews (100 grams, raw) contain 113 milligrams (1.74 gr) of beta-sitosterol. (McWilliam *et al.*, 2015)



Structure-2: Ripe Cashew Fruit.

Allergy: For some 6% of people, cashews can lead to complications or allergic reactions which may be life-threatening. These allergies are triggered by the proteins found in tree nuts, and cooking often does not remove or change these proteins. Reactions to cashew and tree nuts can also occur as a consequence of hidden nut ingredients or traces of nuts that may inadvertently be introduced during food processing, handling, or manufacturing, particularly in people of European descent.

Cashew oil: Cashew oil is a dark yellow oil for cooking or salad dressing pressed from cashew nuts (typically broken chunks created during processing). This may be produced from a single cold pressing. (Morton JF, 2020).

Cashew shell oil: Cashew nutshell liquid (CNSL) or cashew shell oil (CAS registry number 8007-24-7) is a natural resin with a yellowish sheen found in the honeycomb structure of the cashew nutshell, and is a byproduct of processing cashew nuts. It is a raw material of multiple uses in developing drugs, antioxidants, fungicides, and biomaterials. It is used in tropical folk medicine and for antitermite treatment of timber. Its composition varies depending on how it is processed. Cold, solvent-extracted CNSL is mostly composed of anacardic acids (70%), cardol (18%) and cardanol (5%). Heating CNSL decarboxylates the anacardic acids, producing a technical grade of CNSL that is rich in cardanol. Distillation of this material gives distilled, technical CNSL containing 78% cardanol and 8% cardol (cardol has one more hydroxyl group than cardanol). This process also reduces the degree of thermal polymerization of the unsaturated alkyl-phenols present in CNSL. Anacardic acid is also used in the chemical industry for the production of cardanol, which is used for resins, coatings, and frictional materials. These substances are skin allergens, like the oils of poison ivy, and present danger during manual cashew processing. This natural oil phenol has interesting chemical structural features that can be modified to create a wide spectrum of biobased monomers. These capitalize on the chemically versatile construct, which contains three

functional groups: the aromatic ring, the hydroxyl group, and the double bonds in the flanking alkyl chain. These include polyols, which have recently seen increased demand for their biobased origin and key chemical attributes such as high reactivity, range of functionalities, reduction in blowing agents, and naturally occurring fire retardant properties in the field of rigid polyurethanes, aided by their inherent phenolic structure and larger number of reactive units per unit mass. CNSL may be used as a resin for carbon composite products. CNSL-based Novolac is another versatile industrial monomer deriving from cardanol typically used as a reticulating agent for epoxy matrices in composite applications providing good thermal and mechanical properties to the final composite material. (Quattrocchi U, 2016).

Cashew apple: The cashew apple, also called cashew fruit, is the fleshy part of the cashew fruit attached to the cashew nut. The top end of the cashew apple is attached to the stem that comes off the tree. The bottom end of the cashew apple attaches to the cashew nut, which is encased in a shell. In botanical terms, the cashew apple is an accessory fruit that grows on the cashew seed (which is the nut). The cashew apple can be eaten fresh, cooked in curries, or fermented into vinegar, as well as an alcoholic drink. It is also used to make preserves, chutneys, and jams in some countries such as India and Brazil. In many countries, particularly in South America, the cashew apple is used to flavor drinks, both alcoholic and nonalcoholic. Cashew nuts are more widely traded than cashew fruits, because the fruit, unlike the nut, is easily bruised and has a very limited shelf life. Cashew apple juice, however, may be used for manufacturing blended juices. When consumed, the apple's astringency is sometimes removed by steaming the fruit for five minutes before washing it in cold water. Steeping the fruit in boiling salt water for five minutes also reduces the astringency. In Cambodia, where the plant is usually grown as an ornamental rather than an economic tree, the fruit is a delicacy and is eaten with salt. (Rosen T. *et al.*, 1994).

Alcohol: In the Indian state of Goa, the cashew apple is mashed and the juice extracted and kept for fermentation for a few days. Fermented juice then undergoes a double distillation process. The resulting beverage is called feni or fenny. Feni is about 40–42% alcohol. The single-distilled version is called urrac, which is about 15% alcohol. In the southern region of Mtwara, Tanzania, the cashew apple (bibo in Swahili) is dried and saved. Later, it is reconstituted with water and fermented, then distilled to make a strong liquor named gongo. In Mozambique, cashew farmers commonly make a strong liquor from the cashew apple. It is known under various names in the local languages of Mozambique (muchekele in Emakua, spoken in the North; xicadju in Changana, spoken in the South). In contrast to the above-mentioned feni of Goa, the cashew liquor made in Mozambique does not involve the extraction of the juice from the cashew apples. Following harvest and the

removal of the nuts, the apples are spread on the ground under trees and courtyards and allowed to lose water and ferment. The shrivelled fruits are then used for distillation. (Varghese T., et al., 1964).

Animal feed: Discarded cashew nuts unfit for human consumption, alongside the residues of oil extraction from cashew kernels, can be used to feed livestock. Animals can also eat the leaves of cashew trees.

Other uses: As well as the nut and fruit, the plant has several other uses. In Cambodia the bark gives a yellow dye, the timber is used in boat-making, and for house-boards, and the wood makes excellent charcoal.

CONCLUSION

Cashews are low in sugar and rich in fiber, heart-healthy fats, and plant protein. They're also a good source of copper, magnesium, and manganese — nutrients important for energy production, brain health, immunity, and bone health. Cashews are rich in carotenoids and polyphenols, two categories of antioxidants that may help reduce inflammation and offer protection from disease. However, more cashew-specific research is needed. Cashews appear to provide fewer calories than once thought. Their rich fiber and protein content can help reduce hunger and increase feeling full. Put together, all of these factors may help you lose excess weight. Nut-rich diets are consistently shown to be beneficial to heart health. Cashews appear to offer some benefits to lower blood pressure, triglycerides, and cholesterol. However, more studies are needed before strong conclusions can be made. Cashews are low in sugar and rich in fiber — two factors which, when combined, may help reduce blood sugar levels and protect against the development of type 2 diabetes. However, more research is needed to confirm these benefits. Cashews are a versatile addition to any diet. Eat them on their own, add them to your favorite dishes, or use them to make cashew-based sauces and desserts. Choose dry roasted or raw unsalted varieties whenever possible. Cashews are generally considered safe. For most benefits, consider purchasing raw, unsalted cashews and soaking them before eating, whenever possible. Dry roasting cashews improves the antioxidant activity.

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