

## A Review on the Nutritional Quality and Medicinal Value of Custard Apple-An Under Utilised Crop of Madhya Pradesh, India

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### ABSTRACT

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Custard apple is one of the most delicious arid fruits known mostly for its dessert and confectionery values. *Annona squamosa*, which is one of the most widely grown species of *Annona*. Though rich in its nutritional aspects, it is an under-utilized arid zone crop. It has also been proved that the plant contains several medicinal properties which include antioxidant, anti-diabetic, anti-infective and anti dyslipidemic properties. The leaves are used as a vermicide, for treating cancerous tumors and are applied to abscesses, insect bites and other skin complaints. Scrapings of root-bark are used for toothache. This paper attempts to congregate the nutritional value, phytochemical composition, and medicinal uses of custard apple.

### Introduction

Agriculture sector in Madhya Pradesh forms the backbone of its economy. Madhya Pradesh, with its large area, enjoys diverse climatic and soil conditions suitable for a broad range of agricultural products. It contributes almost one-fourth of the Gross State Domestic Product (GSDP) and is the main source of employment for over 70 percent of the population and constitutes about 60- 75 percent of the rural income. There are many herbs, shrubs and trees, which have significant economic uses and are nutritious but are under severe neglect. Cultivation of some of these species is restricted to a small region in spite of their potential to grow in other regions. The major custard apple growing districts in Madhya

Pradesh is depicted in figure 1. According to [1], even though India has made significant progress in food production, disease control, and economic and social development since independence, it still accounts for 40 per cent of the world's malnourished children and about 60 per cent of Indian women are anemic. Likewise, as per the report on malnutrition in the Times of India Jan 25, 2016, Madhya Pradesh has been registered the highest infant mortality rates in the country for almost a decade and currently 51 infants out of 1000 doesn't even celebrate their first birthday. This is followed by Bihar (48), Uttarakhand (40), and Haryana (33). The latest report of NFHS-4 [2] revealed that 40 out of 100 children are malnourished in M.P.

A voluntary organisation Child Rights and You (CRY) stated that more than 40% children under the age of 5 are stunted (low height for weight) while 42.8% children below 5 are underweight. The percentage of children who are wasted (low weight for age) has come down from 35 to 25.8% but the number is still considered very high by WHO standards. There is wide diversity of several underutilized fruit trees in the state which are highly nutritious and can help to fight against malnutrition. One of them is custard apple, which is one of the most drought tolerant fruit trees in India and can be grown in rocky soils. This luscious and nutritious fruit is eaten throughout the world.

Custard apple (*Annona squamosa* L.) is one of the most important delicious arid fruits known mostly for its dessert and confectionery values. It belongs to the family Annonaceae of the order Magnoliales [3]. The genus name, '*Annona*' is from the Latin word 'anon', which means 'yearly produce'. *Annona cherimola* and *Annona reticulate* are the other related species. It is also known as *sharifa*, *sitaphal* and sugar apple. The fruit has pleasant texture and flavour and is sweet with slight acidity. It is a subtropical small deciduous spreading tree of height 5-9 feet, with large green dropping leaves and light yellow trumpet shaped flowers, emitting pungent sweet smell during late afternoon. It starts bearing at the age of 4 to 6 years and the bearing declines after 12 to 15 years. Being rich in carbohydrate (23.0g/100g) and possessing pleasant flavour, custard apple fruits are utilized for ice cream. Sitaphal is comparatively high calorie fruit and thus is included in diet for weight gain and athletes.

It gives 104 kcal per 100g of edible portion [4]. Custard apple prefers dry climate. It can withstand mild frost. The root system is confined to relatively shallow layers and therefore, these do not require deep soils.

However, it needs well-drained soil. The trees withstand high amounts of lime found in calcareous soils. The present review paper is an attempt to congregate the nutritional value, phytochemical composition, traditional uses, and other literature on Custard apple as a potential crop for the management of chronic disease and especially to combat malnutrition in the state of Madhya Pradesh. The fruit has pleasant texture and flavour and is sweet with slight acidity. Food value lies mainly due to sugar content which is about 12.4-18.15 per cent and protein 1.6 per cent [5].

### **Nutritive value of custard apple**

Custard apples are usually consumed as dessert fruit. The nutritive value of custard apple per 100 g of pulp is presented in table 1. The fruit is rich in starch when firm but increases markedly in sugar as it softens. The main sugars are glucose and fructose (80-90%). The calorific value is high (300-450 kJ per 100 g) and is almost double that of peach, orange and apple [6]. Custard apple is full of vitamin C anti-oxidants, which helps to combat many diseases and also enhances the immune system. It is abundant source of dietary fibre, Vitamin A, Vitamin C, Antioxidant, Potassium, magnesium and also contains calcium, Vitamin B6, Copper and Low fat levels, excellent source of Iron [7]. It has high calorific value, able to provide sustained energy and delicious in nature. It has about 3.1% of fibre in the edible portion.

Anti-oxidants like Vitamin C, present in the fruit helps to fight free radicals in our body. These are also rich in potassium and magnesium that protect us from cardiac diseases and blood pressure. The advantage of this fruit is that it is easily digestible even at old ages. Potassium in the sweet fruits makes active and removes the lethargies. It also helps to fight muscle weakness. It also contain Vitamin A, which keeps your skin



**Table.1** Nutrient value of custard apple per 100 g of pulp

<b>Nutrient</b>	<b>Amount</b>
Water	70-80%
Protein	5.2g
Ash	1.9g
Calories total	235
Carbohydrate calcs.	213
Fat calories	6.1
Protein calories	17
Total carbohydrate	59 g
Dietary fibre	11 g
Total fat	725 mg
Saturated fat	120mg
Mono-saturated fat	285 mg
Poly unsaturated fat	100 mg
Omega-6fatty acids	100 mg
Vitamin A	15 I.V.
Vitamin C	91 mg
<b>Nutrient</b>	<b>Amount</b>
Thiamine	275 mcg
Riboflavin	283 mcg
Niacin	2.2 mg
Vitamin B6	500 mcg
Folate	35 mcg
Pantothenic acid	565 mcg
Calcium	60 mg
Iron	105 mg
Magnesium	53 mg
Phosphorus	80 mg
Potassium	618mg
Sodium	23 mg
Zinc	250 mcg
Copper	215 mcg
Selenium	1.5 mcg

Source: [Kokate, 2014]

### **Medicinal value of custard apple**

The health and medicinal benefits of the Custard apple fruit are numerous and it appears to possess potent bioactive principles in most of its plant parts (fruit, seed and leaves). The various chemical constituents isolated from leaves, stems, and roots of the

plant include anonaine, aporphine, coryline, isocorydine, norcorydine, and glaucine [10]. For centuries, Ayurvedic practitioners in India have extensively use various parts of the sugar apple (*Annona squamosa*) tree for the management of diabetes. Essential oils, pinenes have also been described and extracted from custard apple [11]. One class

of chemicals which sets custard apple apart from other fruit species is the presence of *acetogenins* [12]. The acetogenins are unique to the Annonaceous family, which are very long chain fatty acids, and only found in Annonaceous species. The *in vitro* and *in vivo* studies appear to have considerable anti-cancer properties and anti-hypertensive properties.

The anti-cancer properties of custard apple appear to be mainly due to a class of compounds called acetogenins which are specific to Annonaceous species. Acetogenins have been tested *in vitro* against 60 types of cancer cells, including breast, prostate and colon. Compared with paclitaxel a standard anti-cancer drug, bullatacin, an acetogenin, was 300 times as potent even at *in vivo* test system. Custard apple has been used for treatment of malaria. Three known aporphine alkaloids were isolated from the bark. Structures of compounds were identified as N-Nitrosoxylopin, Roemerolidine and Duguevalline (Fig. 2). All the three anti-malarial alkaloids exhibit moderate activity against chloroquine sensitive strain (D10) and a chloroquine resistant strain (Dd2) of *Plasmodium falciparum* [13].

Despite its high sugar content the glycemic index of custard apple is low (i.e. 54). The fruit has antioxidant activity making it suitable even for diabetic patients [4]. In anti-diabetic studies on animals, custard apple appears to mimic insulin stimulating its production and enhanced uptake of glucose by muscles which leads to stabilization of blood sugar concentrations. In fact, even leaf extracts are also effective in lowering blood glucose levels and several reports indicate that *Annona squamosa* leaf extract can substitute effectively with decreased doses of externally administered insulin. [14]

The fruit of *Annona* spp. have been shown to have anti-microbial activities due to several

compounds which include Ent-kauranes, Acetogenins, essential oils and Benzylisoquinolines alkaloids [15]. Two acetogenins, annoreticuin and isoannoreticuin isolated from the leaves, were found to be selectively cytotoxic to certain human tumours. It also possesses Anti HIV properties. Among the 14 isolated compounds in a study, 16, 17-dihydroxy-entkauran-19-oic acid showed significant activity against HIV replication [16] in H9 lymphocyte cells with an EC<sub>50</sub> value of 0.8 µg/ml.

Realizing the advantages of these species, serious attempts have to be made to popularize the cultivation of underutilized plants. Among them, a few species have performed exceedingly well by competing even with traditionally grown local crops and have provided sustainable income to farmers. Even though there are a lot of medicinal values for this fruit, the consumption and movement in the market is less. It is also established fact that seasonal, locally available, and cheap fruits and vegetables can also keep the population healthy and nutritionally secure rather than costly off-season ones. For longer-term use and sustainability, food production systems need to be linked with local initiatives.

To increase nutritional value and accelerate the value addition of custard apple several products have been prepared viz., ice cream, carbonated beverages smoothies, cheese cakes etc. The fruit pulp has shown numerous medicinal properties which include antioxidant, anti-diabetic, anti-infective and anti dyslipidemic properties. It is the fruit of 21<sup>st</sup> Century, still the pulp of the fruit is not very easy for intake. There are a variety of recipes to overcome this problem and increase intake. There should be resurgence of intake of this fruit especially in the wake of increased percentage of diseases due to improper dietary habits and to reduce malnutrition.

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