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Sitaphal: Reemergence.

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ABSTRACT

Sitaphal is a yellowish green fruit of the family of plant species Annona. The species with an Amazonian origin is recently being cultivated in other countries including India. The fruit has established its medicinal properties for decades. Still it is not a fruit which is commonly consumed as this is a seasonal fruit. In this review we wish to outline the source, recipes, chemistry and medicinal values of the fruit and seek for a reemergence with an initiative both from private and Government sectors.

Keywords: sitaphal, custard apple, antioxidant, resurgence

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INTRODUCTION

Sitaphal (custard apple) is a fruit from the small tree named annona squamosa which belongs to the Family Annonaceae of the order Magnoliales [1]. It is also called custard apple. The genus name, 'Annona' is from the Latin word 'anon', which means 'yearly produce'. Annona squamosa, Annona cherimola and Annona reticulate are the related species varieties. The seeds and the leaves also are being used for preparation of medicine. Annona squamosa is also been extensively used as traditional medicine for different ailments. The leaves of the plants have been used as insecticide, antihelmintic and in the healing of bleeding wounds. Unripe and dried Fruits are used as antidysenteric. Bark act as powerful astringent, antidysenteric and vermifuge. Rootbark, leaves and stems are sources of many isoquinoline alkaloids. Powdered seeds can also used to kill head-lice and fleas [2]. Despite the medicinal property of the fruits and reasonable taste, the species has not completely come into common use like many other fruits like jack, mangoes etc. Custard Apple requires hot dry climate during flowering and high humidity during fruit setting. Flowering comes during hot dry climate still fruit setting takes place on onset of monsoon. Low humidity is not good for pollination and fertilization. The Custard Apple withstands drought conditions and cloudy weather [3]. Even though there are a lot of medicinal values for this fruit, the consumption and movement in the market is less. We wish to focus on this and seek for a promotion on the usage of custard apple.

Source and nutrition

100. gms of edible portion of the fruit Amount Per Serving	
Energy	104 kcal
Protein	1.6 gm
Fat	0.4 gm
Carbohydrates	23.5 gm
Fibre	3.1 gm
Calcium	17mg
Phosphorus	47mg
Iron	4.37 mg
Vitamin C	37 mg

The health and medicinal benefits of the custard apple fruit are numerous even though the leaves or seeds have also been shown to possess significant bioactivity. Annona species have been widely grown throughout Central and South America. It is also grown in West Indies, Phillipines Taiwan ,USA other than India. The tree usually grows at a height of 1200 metres [4]. The fruit is round to conical, 5–10 cm in diameter and 6–10 cm long, with a thick rind composed of knobby segments (fig 1.).

The color is typically pale green to blue-green, with a typical bloom. It is unique among Annona fruits in being segmented, which tend to separate when ripe, exposing the interior. The flesh is fragrant and sweet, creamy white to light yellow, and resembles and tastes like a custard and hence the name. There is also flesh surround the seed which has to be consumed discarding the brownish black seed. The Indian version which also grows in plains has a slightly bigger fruit with less segmentation (fig 2). Sitaphal is comparatively high calorie fruit and thus is included in diet for weight gain and athletes. It gives 104kcal per 100gm of edible portion.

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. Sitaphal also has good amounts of iron, phosphorous, potassium, and vitamin C. It has about 3.1% of fibre in the edible portion [5].

The sitaphal also contains traces of sodium, magnesium, pantothenic acid, ascorbic acid and B vitamins [6].

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Figure 1: showing the Sitaphal fruit.

Figure 2: showing the native Sitaphal

Chemistry

Various chemicals including steroid, terpeniod , glycoside, alkaloid, flavonid saponin and phenolic compounds have been identified from the fruit. Specific chemicals extracted include palmitone, organic acids like hexanoic and octanoic acid and purines. Essential oils, pinenes have also been described and extracted from custard apple [7]. One class of chemicals which sets custard apple apart from other fruit species is the presence of *acetogenins* [8]. The acetogenins are unique to the Annonaceous family and in in vitro and in vivo studies appear to have considerable anti-cancer properties and anti-hypertensive properties. Many of the compounds appear to have multiple physiological activity e.g. some acetogenins have both anti-cancer and anti-hypertensive activity.

Medicinal values

Antioxidant Activity

In the Taiwanese study [9], the antioxidant activity in mature fruits of 36 species and varieties produced in Taiwan was analyzed by the ferric reducing antioxidant power (FRAP) assay. In this study, sugar apple was categorized as having very high antioxidant activity i.e >70mmol/100g edible part. . Many studies including conducted in India [10,11] showed that extracts of Annona squamosa, Annona cherimola and Annona muricata have high anti-oxidant activity.

Effects on Cardio-Vascular Disease

Hole et al. tested the protective effect of aqueous extract of the fruits on isoproterenol induced myocardial infarction in rats. Pretreatment with pulp of custard apple decreased the myocardial damage [12]. Consumption of one quarter of the normal sized custard apple daily for a 80 kg human exhibited cardioprotective effects similar to therapeutic doses of captopril [13]. In a different study, consumption of custard apple showed that fruit pulp (2.5-5.0 g/kg body weight) reduced total cholesterol level by 46% in normal and 32.4% in diabetic rabbits with increased HDL-cholesterol [14]. The triglyceride/HDL ratio in the rabbits, a significant predictor of heart disease in humans [15], was halved. Beppu et al. [16] showed that oral administration of ethanol extracts of fresh custard apple fruit potently lowered plasma triglyceride concentrations by 65% of mice fed a moderately high fat diet for four weeks and exhibited a potent inhibitory

effect on adipogenesis reducing fat tissue by about 20%.This anti dyslipidemic action is significant in prevention of cardiovascular morbidity.

Anti HIV properties

Among the 14 isolated compounds in a study, 16,17-dihydroxy-entkauran-19-oic acid showed significant activity against HIV replication [17] in H9 lymphocyte cells with an EC50 value of 0.8 µg/mL

Antidiabetic properties

Studies in rabbit showed that 5 g of semi-dried pulp of sugar apple per kg of body weight was effective as a supplement in anti-diabetic treatment. This amounts to eating one eighth of a normal custard apple in humans. The probable mechanism may be due to increased sensitivity to insulin. 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 indicates that Annona squamosa leaf extract can substitute effectively with decreased doses of externally administered insulin [18].

Anticancer properties

Tumor cells have three distinguishing properties.

- They have a transport mechanism to transport glucose faster into them.
- They develop new blood vessels called neoangiogenesis, thereby getting more nutrients diverting from normal cells.
- They also have a MDR (multi drug resistance) protein expression which throws out a drug from the cell saving them from the killing actions of the anticancer drugs [19].

The anti-cancer properties of custard apple appear to be mainly due to a class of compounds called acetogenins which are specific to Annonaceaous 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. Cuendet et al. [20] showed that acetogenins increased mammary tumour latency from 55 to 66 days in Sprague-dawley rats. The acetogenins inhibit mitochondrial and cytoplasmic production of adenosine triphosphate (ATP), which is the major source of energy for the cells and also a precursor of the nucleotides needed to produce DNA and RNA. Annonaceous acetogenins also inhibit the enzymes of complex I in the electron transport system in mitochondria [21-23]. They also inhibit the NADH oxidases found in the plasma membranes of tumor cells [22]. The acetogenins inhibit MDR (multi drug resistance) expression and induce apoptosis of cancer cells. Bullatacin , extracted from custard apple is 258 times more cytotoxic against breast cancer cell than Adriamycin [24].

Anti-infective

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. The anti-bacterial activity of the crude methanol extract of sugar apple, and an isolated diterpene, against Staphylococcus aureus and Streptococcus pneumonia is being established. There are also reports of chemicals which are also active against candida albicans, proteus [25]etc.

Miscellaneous

Other than the fruity portion of the plant, the other portions have been found to have medicinal value. Aqueous extracts of Anona squamosa seeds possessed significant antitumor activity in vivo against AK-5 tumor. Gupta et al [14]. also showed in their animal studies that feeding sugar apple pulp increased haemoglobin levels by up to 21%. This response could be translated to humans. It has been used traditionally in diarrhea, dysentery, cold, as an abortifacient, with insecticidal properties [26]. Roemerolidine and Duguevalline alkaloids have been extracted from the bark of annona species. They showed moderate

antiplasmodial activities (antimalarial) with no observable cytotoxicity. However N- Nitrosoxylopine was found to active against both of the plasmodium strains but with cytotoxicity [27]. Powdered seeds are used to kill head-lice and fleas but care should be taken to avoid contact with eyes. Two acetogenins, annoreticuin and isoannoreticuin, isolated from the leaves of annona were found to be selectively cytotoxic to certain tumours. The leaves and stems also give alkaloids, dopamine, salsolinol and coclaurine. 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. Potassium also helps to fight muscle weakness. Magnesium helps to maintain water balance in the body. It is good for arthritic patients by possibly removing acids from joints. Copper in custard apple is effective against constipation [28].

Recipes

Apart from taking the fruit as such, which is the most common form of intake of the fruit; there are certain preparations which make it more palatable especially for the children.

- Sitaphal firni: Milk thickened with rice flour is flavoured with custard apple pulp and refrigerated to enhance the flavour and get the perfect consistency. It is served chilled for a fruitilicious experience, which is much healthier than regular custards and puddings.

- Sitaphal cream: The cream of the four to five fruits is mixed with cream of cashew with added saffron and vennila, sugar if needed.

- Sitaphal Rabdi: Mix saffron, cardamom after simming almonds, pista in stove. Combine with the pulp of sitaphal and can be served hot or cold.

- Sitaphal kheer: It is a mixture of cooked rice and sitaphal in specific proportions with added flavor with cardamom. Sitaphal milk shake and halwa with sugar free recipes have been described [29,30].

Resurgence

Only a very few fruits have the wide range of bioactivity exhibited by custard apple fruit. Those which are already considered great fruits such as blueberry and pomegranate are also comparable. Even though there are limited animal and human studies, custard apple fruit appears to be have excellent health benefits which needs to be further studied. With such a potent medicinal value still the fruit is not available freely in the market. We suggest for multicentric large human trials testifying the effects of custard apple. There is a definite need for a reemergence or resurgence of this fruit. Certain suggestions are put forth here under. The Government can come up with certain subsidies to increase the use of sitaphal. The growers of this plant can be given awards as is now given for bamboo growers. They can also be supplied with free nutrients for the growth of these plants. The Govt. can give advertisements to take this fruit regularly as they give for eggs. The advertisements can be made as such that big sportspersons take the fruit daily They can give the fruit as gifts for winners in competitions on nutrition in school and college level. The fruits can be sold at very cheap prices at Government outlets. Sitaphal milk shake can be given to hospitalized patients free of cost instead of other tinned beverages. Certain marketing strategies can be encouraged like giving Sitaphal free for a purchase of other fruits. It must be made mandatory to have Sitaphal recipes inside all cinema halls and to promote the consumption of the same. Generous scholarships should be offered to those students who attempt and do genuine research on the benefits of custard apple. Researches can go in the direction of making seedless Sitaphal retaining the medicinal properties.

CONCLUSION

Custard apple or the sugar apple is the fruit of Annona squamosa, which is one of the most widely grown species of Annona and a native of the tropical Americas and West Indies It has been also grown in India, china etc. The fruit pulp has shown numerous medicinal properties which include antioxidant, anti-diabetic, anti-infective and anti dyslipidemic properties. Still the pulp of the fruit is not very easy for intake. There are a variety of recipes to overcome the problem and increase intake. The government should come up with subsidies, advertisements with film personalities to make it more popular. There should be resurgence of intake of this fruit especially in the wake of increased percentage of diseases due to improper dietary habits.

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