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RESEARCH ARTICLE

REVIEW ON: EXPLORING THE *SYZYGium SAMARANGENSE* (WAX APPLE) FRUIT AS A WINE IN HEALTH BENEFITS

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ABSTRACT

In this review article attention is put forward towards the largely growing throughout the year fruit *Syzygium samarangense* (wax apple). It has been traditionally used in South Asia as ornamental plant and consumed as raw fruit, pickle, juice, wine etc. It has got various active components phenolic, flavonoid, anthocyanin, quercitrin, ellagic acid, and myricetin. Wax apple has shown positive effect on hyperglycemia, anti-inflammatory, endocrine disorder. Wine consumption as a health diet is seems to be increasing and beside red wine fruit wines are also hiking in this race so wax apple wine can be potential option in this scenario too. A wide research activity in this to explore the potentiality of wax apple wine is needed to reveal a good functional food globally.

INTRODUCTION

Amid the increasing health concerns among consumers, preferences are changing toward healthier foods and beverages. Consumers are eating out less and have shifted their diets to include less saturated fat and cholesterol while increasing consumption of fibre (Jessica, 2014). In addition, there has been a marked growth in the demand for functional foods. Functional foods, defined as foods fortified for additional health benefits (Singer, 2011). The French paradox suggests that consuming red wine daily not only helps the cardiovascular system, but it also increases lifespan due to the resveratrol (found in the skins and tannins of red grapes) content in red wine (Das, 2011). Resveratrol has been linked to preventing decline in cardiovascular function caused by age (Catalgol, 2012). France surpasses many countries in average life expectancy partly due to the common practice of drinking red wine with meals (Brownlee, 2006). The French consume red wine moderately, at 2–3 glasses daily, reducing the unhealthy effects of high cholesterol foods common in the French diet, including breads, cheeses, and rich desserts (Rachel Golan, 2018). Wine is a beverage from the alcoholic fermentation of ripe and fresh grapes or fresh grape juice.

As a biochemical definition would be: drink from the alcoholic fermentation of grape juice sugars by yeast. Wine has always been linked in some way to the history of man, either because it is a beverage with its own flavor and personality or because of the benefits it brings to health. Important ancient civilizations, like the Egyptians, the Greeks and the Romans, besides the Hindus, used wine as medicine for the body and for the soul. Historical records show that the medicinal use of wine by man has been a practice made for over 2000 years (Rachel Golan, 2018). Both the alcoholic and polyphenolic components of wine are believed to contribute to these beneficial effects, observational studies and more recently, in experimental settings and randomized controlled studies suggested biological pathways include antioxidant, lipid regulating, and anti-inflammatory effects of wine (Rachel Golan, 2018). While grapes are the first preference of wine making but at same side other fruits are also gaining popularity in this area due to various active component present in them which can be consumed in the form of fermented product such as wine. Fruit wines (known as guoju in Chinese) are famous in the markets of various cities of China, such as wolfberry wine, cherry wine, lychee wine, mulberry wine, pomegranate wine, kiwifruit wine, berry wine, blueberry wine, and so on (Joshi, 2017).

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***Syzygium samarangense* (Wax apple):** *Syzygium samarangense* is a tropical fruit belongs to the genus *Syzygium* in the family *Myrtaceae* with evergreen character which belongs to the family *Myrtaceae*. It is of origin from Asia. It produces a pink fleshy fruit which is eaten fresh. The fruit is oblong, pear-shaped, and 5–12 cm in length, with four fleshy calyx lobes and 1–4 seeds. The tree can be grown as an ornamental, and attains a height of seven meters. In India, wax apples are found in Kerala, west Bengal, East Godavari district of Andhra Pradesh and in other humid places. In Telugu, these are called kammarikayalu. In Kerala it is commonly called as chambanga which is found in almost all the homesteads in Kerala. It is mainly eaten as a fresh fruit and also used to make pickles (Chambakka Achar). These fruits are also used to make wine and juice (Anandakumar Selvaraj, 2017). The fruit pulp of wax apple is a rich source of phenols, flavonoids and several antioxidant compounds and as a result it is believed to have great potential benefits for human health and used in traditional medicine to cure diabetes. It's been reported that wax apple fruit extract showed antihyperglycemic activity in allxan- induced (Type 1 DM) diabetic of mice (Resurreccion-Magno, 2015). The flavonoids, isolated from wax apple, were reported to possess antihyperglycemic activity, spasmolytic and immunomodulatory activity (Resurreccion-Magno, 2005; Kuo, 2004).

Taxonomic classification: The nomenclature of the *Syzygium samarangense* (Wax apple) is as follows:

KINGDOM	Plantae
SUB KINGDOM	Tracheobionta (Vascular plants),
SUPER DIVISION	Spermatophyta (Seed plants)
DIVISION	Magnoliophyta (Flowering plants)
CLASS	Magnoliopsida (Dicotyledons)
ORDER	Myrtales
FAMILY	Myrtaceae
GENUS	<i>Syzygium</i>
SPECIES	<i>Syzygium samarangense</i>

Common names of *S. samarangense*: wax jambu, wax apple, java apple (English); jambusemarang, jambuklampok (Indonesian); jambu air mawar (Malaysia); makopa (Filipino); chomphu-kaemnaem, chomphu-khieo (Thai); roi (Vietnamese); bellfruit (Taiwan) (El-Otmani, 1987).

Flower and fruit: The flowers of rose apple tree are white in colour and measure about 2.5 cm diameter. Each flower has four petals and several stamens. The edible fruits of rose apple are bell-shaped and their colour varies from white to light green or green or red to crimson and purple, and from dark purple to black. The fruits of the wild plants measure about 4 cm to 6 cm in length. The flowers of wax apple and even the fruits that follow are not just confined to the leaf axils, but they may appear on any part of the tree's trunk and branches. The wax apple tree is regarded as a heavy bearer and each tree may yield as many as 700 fruits annually. The fruit tastes a little sweet and sour. The fruit that is found in Kerala are either pink or mauve coloured (Kuo, 2004).

Physiology: Fruit growth and development are associated in the morphological, anatomical and physiological changes (El-Otmani, 1987). Fruit maturation is associated with changes in rind texture, juice composition and taste (Mohammad, 2016).

Fruit quality is highly influenced by environmental characteristics, climate (Inglese, 2002) and orchard management and may change from year to year (Mokoboki, 2009). It has reported that major variation in fruit quality is not related to environment or edaphic factors but rather ascribed to genetic factors, and the majority of variation for fruit quality seems to be due to random error (Felker, 2002). Colour is probably the most important quality factor used by consumers for wax apple (Shu, 2001). They also reported that the cultivars of *S. samarangense* produces fruits varying from pink to deep red, depending on light, temperature, position on the tree, growing stage, leaf: fruit ratio. It was stated that Sucrose, glucose and fructose are important quality parameters that influence the anthocyanin biosynthesis in wax apple fruits (Moneruzzaman, 2011).

Chemical composition: Wax apple fruit dried powder (DP) contains moisture, crude fat, crude protein, ash, crude fiber, available carbohydrate, dietary fiber, phenolic, flavonoid and anthocyanin contents ascorbic acid, Lutein, β -cryptoxanthin and α -tocopherol, and γ -tocopherol. *S. samarangense* var. Taiwan pink fruit contains cyanidin 3-glucoside, quercitrin, ellagic acid, and myricetin. Wax apple fruit 'Masam Manis Pink' and 'JambuMadu Red' cultivars contain the highest sources of anthocyanin, carotene, and vitamin C (Al-Hayat, 2020).

Pharmacological benefits: The fruit can be used to treat high blood pressure and several inflammatory conditions, including sore throat, and can also be used as an antimicrobial, antiscorbutic, carminative, diuretic, and astringent (El-Otmani, 1987). Wax apple fruit dried powder reveal antidiabetic activity toward streptozotocin (STZ) diabetic rats through oxidative stress and pro-inflammatory cytokine inhibition, and anti-apoptotic protein activation. Wax apple treatment reveals lowered fasting blood glucose (FBG) and enhanced body weight of diabetic rats. Furthermore, improvement of pancreatic β -cell function is marked by enhanced HOMA-B and insulin level in the pancreas and serum of diabetic rats. Pancreatic apoptosis and dysfunction of the diabetic rats are prevented by caspase-3 and Bax protein down-regulated expression and Bcl-2 and Bcl-xl protein upregulated expression. In addition, oxidative stress and pro-inflammatory cytokine inhibition are developed by inducing CAT and SOD activities, and diminishing nitrotyrosine and TNF- α level (Khamchan, 2018).

Vescalagin of wax apple fruit can be developed as therapeutic value as anti-hypertriglyceridemic and anti-hyperglycemic effects. Vescalagin at 30 mg/kg administered to high-fructose diet (HFD)-induced diabetic rats can decrease fasting blood glucose, C-peptide, fructosamine, triglyceride, and fatty acid content. Meanwhile, high-density lipoprotein content enhances as 14.4% in the HFD rats (Shen, 2013). Wax apple fruit contained ellagitannin vescalagin (VES) is potential as antiglycation and antiinflammation in Methylglyoxal (MG)-induced carbohydrate metabolic disorder rats. VES induces insulin secretion of β -cells in the MG-rats and downregulates pro-inflammation factors implicated in MG metabolism. Therefore, VES of wax apple fruit can be used as supplements to prevent diabetes mellitus and its complications (Shen, 2013).

The whole plant has a variety of medicinal uses which range from dermatological, digestive, head and throat to endocrine remedy (Moneruzzaman, 2012). The flowers, which contain tannins, desmethoxymatteucinol, 5-O-methyl-40-desmethoxymatteucinol, oleanic acid, and β -sitosterol, are used in Taiwan to treat fever and halt diarrhea (Morton, 1987). In addition to their use as food; many of these fruits have been used in divergent traditional medical practices for a variety of illnesses and conditions. The fruit pulp of pink cultivar of *S. Samarangense* is a rich source of phenolics content, flavonoids and several antioxidant compounds (Shen, 2013). They also reported that edible fruits of *S. samarangense* represent potential benefits for human health because they are rich source of polyphenolic antioxidant (Shen, 2013).

Conclusion

As the health benefit seeking activity goes up different source of plant and their part will be kept on discovering in the form of all sort of food in which wine is also a potential candidate due to its wide benefits. As fruit wine as now gaining popularity among health seekers wax apple fruit belonging to the family of *Myrtaceae* which is evergreen plant with rich content of anti-oxidants, phenolic, flavonoids etc. components can also be a good source of tonic for treating various health related problems in the form of wine. A detailed research is needed on this area as this could be opening a new source of functional food with an ampule therapeutic property to treat diseases related to diabetes, heart, liver, atherosclerosis etc. with great amount of supply throughout the year adding a little more commercial benefit too.

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