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Antilipidemic activity of arecanut, *Areca catechu* L.: A valuable herbal medicine

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Abstract

Antilipidemic activity of several plants is well documented. The arecanut palm, *Areca catechu* L. which is grown mainly in several South and Southeast Asian countries is a valuable herbal medicine with lots of pharmacological properties. The nuts of this palm are popularly chewed along with several other ingredients, including the leaves or inflorescence of *Piper betle*, slaked lime, tobacco, etc. The extracts of both nuts and leaves of areca palm are reported to decrease the level of plasma cholesterol and triglyceride by inhibiting their absorption in small intestine. It was reported that arecanut extract was antilipidemic at a dose of 100mg/kg or more. The unsaturated fatty acid such as linoleic acid of arecanut might be responsible for reducing cholesterol level as the cholesterol lowering effect of linoleic acid is already established in human conditions. The nut of this plant is also reported to maintain healthy fat metabolism and reduce the conversion of carbohydrates into fats, thereby decrease the body weight. On the other hand, chewing of betel quid which contain several other ingredients such as betel leaf or inflorescence, slaked lime, catechu, other condiments and even tobacco, is reported to increase cholesterol and obesity in human being. It might be the synergistic activities of all these ingredients which contributed for the elevation of cholesterol. Detailed studies on these lines are warranted before coming to any solid conclusion.

Keywords: Cholesterol, obesity, arecanut, *Areca catechu*, betel quid, medicinal plants

1. Introduction

Areca palm, *Areca catechu* L., is widely cultivated in several South and Southeast Asian countries such as India, China, Bangladesh, Indonesia, Myanmar, Thailand, Malaysia, Vietnam, the Philippines, etc. [1]. Its fruit or seed is called as arecanut, betel nut or 'supari'. It is a fibrous, ovoid drupe with a central ruminant endosperm or nut covered by pericarp (husk) which is green in color when unripe and orange-yellow when ripe. The nut has a characteristic astringent and slightly bitter taste [2]. Some minimum processing of arecanut is being done in most parts of India for its marketing. One type called as 'red supari' is obtained by boiling and drying unripe dehusked nut at different stages of its maturity. Another type called as 'white supari' is obtained by mere drying ripe nut and dehusking it later on [3].

The major constituents of arecanut are: polyphenols - mostly flavonoids and tannins (11.1 – 29.8%), polysaccharides (17.3 – 25.7%), proteins (6.2 – 9.4%), fats (8.1 – 15.1%), fibers (8.2 – 15.4%), alkaloids (0.11 – 0.24) and minerals (1.1 – 2.5%) [4]. Polyphenols, which constitute a large proportion of the nut, are responsible for its astringent taste. The mineral matter includes calcium (0.05%), phosphorus (0.13%) and iron (1.5 mg/100g). It also contains Vitamin B6 (286.9 mg %) and Vitamin C (416.2 mg %) [5] among the alkaloids present in arecanut, arecoline is the main and physiologically the most active one and has a stimulating effect. Polyphenols decrease with maturity, whereas polysaccharides, fat and fiber contents increase with maturity of the nut [6].

Since time immemorial, arecanut is being used for chewing as it is believed to have lots of medicinal properties [7]. These nuts are also being used as medicine in several parts of the world including India, China and other South and Southeast Asian countries [8-12]. In India, the antiquity of chewing arecanut goes back to 650BC as mentioned in the work of Magha in 'Shishupala Vadha' [13]. In other countries such as Vietnam, the antiquity of arecanut even goes back to the Bronze Age [14]. It has an important place in the ancient Indian system of medicine such as Ayurveda, Unani and Homeopathy [15, 16]. Chewing arecanut sweetens the breath, removes bad taste from the mouth, strengthens the gums and checks perspiration [17]. It is traditionally used in a number of ailments due to its laxative, digestive, carminative, anti-ulcer, anti-diarrheal, anthelmintic, anti-malarial, anti-hypertension, diuretic, prohealing, antibacterial, hypoglycemic, anti-heartburn activities [18, 21]. All the seven alkaloids (arecoline, arecaidine, guvacine, guvacoline, isoguvacine, arecolidine and homoarecoline) present in arecanut possess good drug-like properties [22].

2. Cholesterol lowering effects of arecanut

The cholesterol reducing properties of plants are well documented [23, 24]. Arecanut palm is not an exception to this. Most of the direct studies using arecanut or its extract were carried out on laboratory animals such as rats, mice and hamsters.

The arecanut extract supplemented food was reported to decrease the concentrations of plasma cholesterol and triglycerides significantly in rats [25]. Feeding rats for six days with food containing cholesteryl oleate (0.5g/100g body weight) resulted in the increase of plasma cholesterol and triglyceride concentrations by 13.6% and 15.9%, respectively, compared with the pre-experimental values. When such food was supplemented with arecanut extract, the figures were reduced by 13.4% and 36.9%, respectively, compared with the earlier values. The intestinal pancreatic cholesterol esterase enzyme (pCEase) which is primarily responsible for the absorption of cholesterol in small intestine was found to be significantly lower in the group supplemented with the arecanut extract (37.8%) than in the group with no supplement of arecanut extract was given (83.2%). Hence, arecanut extract may be useful as therapeutic for limiting cholesterol absorption [25].

It was also reported that the supplementation of water soluble arecanut extract significantly lowered the absorption of triglyceride and plasma lipid concentrations in rats fed with high cholesterol diet [26]. Further, the supplementation of arecanut extract significantly lowered the activities of hepatic and intestinal ACAT (acyl-CoA: cholesterol acyltransferase), an intracellular protein involved in cholesterol metabolism [26, 27]. In another study it was noticed that arecanut extract (0.5%, w/w) significantly reduced the absorption of intestinal free cholesterol compared to that of the control group [28]. The absorbed cholesterol that appeared in the blood after an oral feeding of free cholesterol was significantly lower in rats supplemented with the arecanut extract compared with that of the control. Thus, the arecanut extract by inhibiting the activity of pCEase and intestinal ACAT effectively demonstrated its cholesterol lowering ability.

Arecanut contains up to 15.1% fats and 15.4% fibers [4]. The fatty acids include lauric acid (19.5%), myristic acid (46.2%), palmitic acid (12.7%), hexadecenoic acid (7.2%), oleic acid (6.2%), linoleic acid (5.4%) with minor proportions of stearic, decanoic and monoethylenic C₁₂ and C₁₄ acids [29]. Both arecanut oil (fatty oil) and arecoline were found to lower cholesterol levels in rats [30]. They reported that feeding of a low dose of arecanut oil (0.335g/kg) plus arecoline (3mg/kg) significantly reduced the level of total cholesterol and arteriosclerosis index and increased the level of high density lipoprotein cholesterol in rats compared to control groups. Both arecanut oil and arecoline played a synergistic role in reducing cholesterol in these animals. The unsaturated fatty acid such as linoleic acid of arecanut might be responsible for reducing cholesterol level as the cholesterol lowering effect of linoleic acid is already established in human conditions [31, 32]. The arecanut also contains good amount of fibers which may also contribute to lower cholesterol level as plant fibers are known to reduce cholesterol levels in human being [33].

Apart from arecanut, its leaf extract also reduces cholesterol. In a study on Sprague dawley rats, it was found that the ethanolic extract of areca leaves at doses of 100mg and 200mg/kg significantly reduced ($p < 0.001$) the triglyceride and cholesterol levels when compared to the control group [34]. Several other solvent extracts (petroleum ether, chloroform and methanol) of the leaves of areca palm were also found effective in reducing cholesterol levels in diabetic wistar rats

as well [35].

In spite of these observations, certain conflicting results were also reported on the hypolipidemic effect of arecanut. In a study conducted by oral feeding of water suspension of the nuts of arecanut to sprague dawley rats it was observed that at a feeding dose of 30mg/day there was significant increase in the concentration of total cholesterol compared to control, but in the higher dose of 60mg/day there was no significant difference [36]. However in this study, higher doses (beyond 60mg) were not tried. It was already established that arecanut extract was antilipidemic at a dose of 100mg/kg or more in these rats [34]. This shows that arecanut is active as antilipidemic only at a dose of 100mg/kg or more.

3. Obesity management using arecanut

Obesity is a chronic disorder of carbohydrate and fat metabolism. The main factors for obesity are either genetic or manmade due to increased food intake especially fats, sugars and salts but less of vitamins, minerals and other nutrients and less exercise due to sedentary life style especially in urban areas. It is characterized by abnormal or excessive fat deposition in adipose tissue and certain internal organs such as liver, heart, muscles, etc., leading to several chronic diseases including diabetes, hypertension, cardiovascular diseases and even cancer [37, 38]. The chemical compounds having anti-obesity potentials in plants are mainly flavonoids, terpenoids, polyphenols, alkaloids, tannins, etc. [37].

A. catechu which is rich in tannins and alkaloids is one of the herbal plants used in Ayurveda for the treatment of obesity [37, 38]. The nut of this plant is reported to maintain healthy fat metabolism and reduce the conversion of carbohydrates into fats [25]. The chewing of this nut reduces false hunger and augments exercise resulting in the reduction of excess body fat and overweight. It was reported that arecoline and betel nut extract inhibited the formation of lipid droplets in adipocytes and reduced obesity [39]. It was noticed that in animals such as hamsters, chewing betel quid or arecanut for a continuous period of four months or more, there was significant reduction in body weight [40].

Contrary to these observations on arecanut, its common chewing form, the betel quid is reported to increase cholesterol and obesity in human being [41, 45]. It is a known fact that the betel quid invariably contains, apart from arecanut, several other ingredients such as the leaf, inflorescence, fruit or stem of *Piper betle*, slaked lime, catechu (*Acacia catechu*), certain spices, artificial sweeteners such as saccharin and essences in different proportions [46]. The betel quid is either chewed as such or chewed along with a piece of tobacco (*Nicotiana tabacum*) as per individual preference. Though there are several such ingredients present in betel quid, it is sad to note that most of the researchers neither took care to study the effects of other ingredients nor gave the details of such ingredients but blamed only arecanut for all the adverse effects [47, 51]. Probably it is the effects of other ingredients of betel quid or the synergistic actions of all the components which lead to the increase of cholesterol and obesity in human being. Hence, proper studies may be carried out to assess the effects of individual components of betel quid and also their synergistic effects on human health before tagging any one of the ingredients as harmful.

4. Conclusion

Hyperlipidemia and obesity are the two major health problems of human being in modern days. Though several synthetic chemical medications are presently advocated for the treatment of such malady, the high cost and serious side

effects of these drugs improved the scope for the invention of effective plant products which are less costly and at the same time equally effective with fewer side effects. Areca palm, which is a reservoir of several useful phytochemicals is an ideal choice for this. The knowledge on its cholesterol lowering ability may be properly utilized for the benefit of mankind.

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