Avocado: A Storehouse of Phytochemicals and Nutraceuticals

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Avocado (*Persea americana* Mill) also known as Butter fruit, fruit of the new world or the 21st century fruit. It is a tropical evergreen climacteric fruit crop, originally from Mexico and Central America belonging to the family Lauraceae. The genus *Persea* comprises of two subgenres *Persea* and *Eriodaphne*. *Persea americana* grown for commercial production are divided into three botanical varieties: *Persea americana* var. *drymifolia* (Mexican species); *Persea americana* var. *american* (West Indian species); and *Persea nubigena* var. *guatemalensis* (Guatemalan species).

Avocado has a wide distribution and is gaining popularity worldwide, it is extensively marketed owing to its nutritional benefits for human health, especially due to the compounds present in the lipidic fraction, such as omega fatty acids, phytosterols, tocopherols and squalene.

Consumption of avocado helps in maintaining the balanced diet, especially in reducing cholesterol and preventing cardiovascular diseases. It is a milliondollar fruit that fetches high price from the fresh produce costing about Rs. 150-400/kg in the metro cities of India to Rs. 700/kg fruit in towns like Pasighat, Itanagar etc., of Nort East India. Besides being used as fresh, the fruit and the biowaste also find its way in food, cosmetics, nutraceutical, textile industries etc., thus making this fruit a high valued crop and hence the name "Green Gold of Africa" been rightly given to it.

Distribution

Avocado is grown in tropical or semi-tropical areas experiencing little rainfall in summer. In India, it is grown in small localized pockets of Tamil Nadu, Kerala, Maharashtra, Karnataka in the south-central part and in the eastern Himalayan state of Sikkim, Darjeeling and Kalingpong hills of North Bengal, and few pockets of Arunachal Pradesh.

Area and production

Mexico is the largest producer of Avocado in the world followed by Colombia, Dominican Republic, Peru, Indonesia, Kenya, Brazil, Ethiopia etc. The global production of avocado in 2020 was 8.06 million tonnes of which Mexico accounted for 45 percent of total avocado production in international market. Avocado production in Asia is limited to Indonesia, China, Israel, Vietnam, Philippines, Korea. The USA is the number one importer of avocado in the world, followed by the Netherlands, which plays an important role as transit country in the international trade. The top-ranking avocado exporting countries in world are Mexico, Peru, Colombia and Chile.

In India, the production is very limited. The cultivation is confined to states of Tamil Nadu, Kerala, Karnataka and Maharashtra and few patches of North East India that accounts for 5000 tonnes of avocado production. The wide agroclimatic conditions prevailing within the country and availability of high yielding improved varieties are highly favorable for area expansion and bringing avocado under cultivation.



Nutritional Values

Avocado have remarkedly higher fat content than most other fruits, ranging from 14% to 32%, for which it is called butter fruit, it is low in carbohydrates but high in calorie. As per USDA report in 2004, each 100g of avocado pulp gives 670KJ energy thus suitable for person on diet, total sugar content ranges from 3-8mg/g, dietary fiber 3.7- 4.7% and protein from 2.9-3.6mg/g. The fruit is predominantly rich in fatty acids such as oleic acid, palmitoleic acid, linoleic acid, linolenic acids and palmitic acid that are good fats and is free of cholesterol. Avocado is also highly rich in minerals such as calcium, copper, iron, magnesium, phosphorous, potassium, silicon that helps in maintaining good bone health, muscle contraction,



nervous and immune system, regulating body temperature, oxygen transport, electron transport, combating hypertension etc. The avocado fruit is also rich in vit. B complex; thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, and folate, vitamins C, E and K. The fruit is highly nutritious and fiber rich, it is considered to have nutrients four times more than any other fruits, three times proteins more than apple, 35% potassium (358mg/100 g) higher than banana thus making it a superfood. The nutrient and mineral composition of avocado fruit is given below in Table.

Table 1: Proximate and mineral analysis of avocado
fruit (per 100 g edible part)

Nutrients	Qty	Minerals	Qty
Protein (g)	1.70	Calcium	10.00
		(mg)	
Fat (g)	26.40	Chlorine	11.00
		(mg)	
Total	5.10	Copper (mg)	0.45
carbohydrates			
(g)			
Crude fiber	1.80	Iron (mg)	0.60
(g)			
Vitamin A	0.17	Magnesium	35.00
(mg)		(mg)	
Ascorbic acid	16.00	Manganese	4.21
(mg)		(mg)	
Niacin (mg)	1.10	Phosphorous	38.00
_		(mg)	
Riboflavin	0.13	Sodium (mg)	368.00
(mg)			
Thiamine	0.06	Sulphur	28.50
(mg)		(mg)	

(Source: Madhav Rao and Abdul Khader, 1977)

Bioactive compounds:

Polyphenols- Apigenin, Catechin, Cinnamic acid, Chlorogenic acid, Coumaric acid, Epicatechin, Ellagic acid, Ferulic acid, Gallic acid, Gentisic acid, Homovanillic acid, Hydroxybenzoic acid, Luteolin, Naringenin, Protocatechuic acid, Procyanidins, Resorcylic acid, Sinapic acid, Quercetin, Rutin, Tyrosol glucoside, Vanillic acid, Vanillin.

Carotenoids- Lutein, Zeaxanthin, α -carotene, β carotene, β -criptoxanthin, Neoxantin, Neochrome, lutein, chrysanthemaxanthin

Tocopherols- α -tocopherol, γ -tocopherol, δ -tocopherol

Sterols- β-sitosterol Pulp, Campesterol, Stigmasterol **Pharmacological properties**

The fruit has high level of High-Density Lipoproteins (HDL) that helps in lowering the blood cholesterol levels there by acting as antihyperlipidemic, it also has anti-inflammatory, antimicrobial, anti-hypertensive, anti-oxidant, antiproliferative, anti-dyslipidemia, anti-diabetic, antibacterial, anti-cholinesterase, hepatoprotective and neuroprotective properties owing to the presence of polyphenols, carotenoids, tocopherols and sterols. The β-sitosterol in avocados has a special effect on immunity, contributing to the treatment of diseases such as cancer, HIV and other infections. The presence of Chrysanthemaxanthin, a major carotenoid in avocado along with other carotenoids helps in conversion of vitamin A that is facilitated with the help of the rich fat available in the fruit and is considered to be good for eyes. With all these health benefiting properties of the fruit, avocado becomes a great boon for a healthy body.

Industrial application of avocado:

In the recent years avocado have become widely popular not only due to its immense health benefits but also because of its wide spectrum of application in the cosmetic industry. The fruit is highly rich in fat; thus, oil is extracted out of it which is employed in preparation of cooking oil for baking, roasting, sauteing, and frying due to high smoke point, in cosmetics industries for preparation of body oil, lotions and creams, face and hair mask due to high vit E content which has moisturizing and antioxidant properties. Avocado, being a seasonal fruit, to take the advantage of year-round availability value addition is done to the fruit, which is available in the market in the form of avocado oil, guacamoles, dry avocado powder, dehydrated products and avocado blended ice creams, juice, sauce, dried and shredded avocado pieces, chutneys etc. Tonnes of waste is released from the processing industries in the form of seed, skin, rotten avocado fruits etc., that create environmental pollution thus to avoid such situation and earn extra income, valorization of these waste is done by extraction of vital parts like starch, protein and phytochemicals, which have different industrial



applications such as in textile industries, the starch obtained from seed is used as a sizing, stiffening agent and as thickener. The avocado seed is used in preparation of biopolymer that has industrial application in textile, plastic, medical, electronics, constriction, packing and agricultural sectors, the seeds can be used in production of bioenergy such as biogas, biodiesel, ethanol production, paper and pulp production, seeds also find its application in brewery industry, food industry as food colorant and preparation of food formulation etc.

Conclusion

Avocado being a highly nutritious fruits, area under its cultivation in India can be expanded and the fruits may be sold at affordable price so that it is available to all section of the Indian population helping them to meet good health and also to combat the environmental pollution, valorization of biowaste from processing industries may be carried out both in cottage and large-scale industries which would help in facelifting of the country's economy.

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