



The Pharma Therapeutic Fruits: An Overview

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The term 'Pharma Fruits' means the fruits containing pharmacological properties and the term 'Therapeutic Fruits' means the fruits containing therapeutic properties. For the production of fruits, India is the 2nd largest country after China in all over the world. Many researchers are continuously trying to find out the therapeutic value of different types of fruits. The present review article provides some information about pharma-therapeutic fruits and their pharmacological and therapeutic properties. This review article concludes that the fruits that have pharmacological and therapeutic properties help to maintain good health by providing good nutrients.

Keywords: Common fruits, pharmacological properties, digestive system, human health, therapeutic activity.

ABBREVIATIONS

G : Gram
Mg : Milligram

Kcal : Kilocalorie
% : Percent
TPC : Total Phenolic Content
TAA : Total Antioxidant Activities

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TMAC : Total Monomeric Anthocyanin Concentration
 SJ : Sour Cherry Juice

maintain healthy bowel function by increasing stool weight and stimulate anaerobic bacteria fermentation [10,11]. Many researchers revealed that fruits are not only eaten to control mal-nutrition but also contain some natural chemicals compound called secondary metabolites.

1. INTRODUCTION

Since antiquity, fruits are providing good nutrition and therapeutic value for human health for controlling various disease conditions. Fruits are used as traditional medicine for various diseases. Fruits possess some natural chemicals called secondary metabolites that have biological activity that helps to prevent or control various diseases [1,2]. The fruits contain mainly vitamin, sugar, pectin, water, organic acid, carbohydrate and starch and doesn't contain adequate amount of protein and fat [3-9].

Some fruits also contain a high percentage of insoluble dietary fibre like cellulose that is good for digestive health for controlling constipation,

Adequate intake of fruits can reduce the rate of common illness like diabetes, heart disease; stroke, obesity, constipation and hypertension [12-15]. Some fruits also have anti-oxidant activity that also helps to reduce free radical from the human body. These anti-free radical properties are also helpful for preventing the process of ageing [16]. Papaya, guava, pineapple, mango, lemon fruits are good source of Vitamin- A, B, and C also minerals like Ca, Mg, Fe, K, P etc. Fruits like wood apple, litchi contains amino acid. Litchi is a good source of Ca and bael is the richest source of riboflavin [17].

Table 1. The nutritional value of common fruits (in each 100 g edible portion)

Name of fruits	Water (%)	Protein (g)	Fat (g)	Carbohydrate (g)	Fibre (g)	Energy (Kcal)	Vitamin-C (mg)
Amla	87.02	0.34	0.16	4.39	7.75	23.66	252
Apple	82.79	0.27	0.60	13.99	2.07	64.29	4.24
Bael	61.36	2.63	0.57	28.21	6.31	135.99	7.50
Banana	71.93	1.23	0.33	23.63	1.94	105.16	8.06
Cherry	83.61	1.49	0.46	11.87	2.12	59.75	8.82
Custard Apple	71.55	1.62	0.67	20.38	5.10	98.94	21.51
Dates	11.14	2.45	0.35	74.91	8.95	320.36	4.42
Grape red	75.30	1.41	0.46	20.48	1.64	94.40	27.32
Grapes green	85.55	0.62	0.26	11.81	1.28	53.53	16.47
Guava	83.79	1.44	0.32	5.13	8.59	32.26	214
Jackfruits	78.56	2.74	0.15	14.01	3.62	72.17	6.73
Kiwi fruits	84.00	1.10	0.5	15.00	2.1	9.56	70.00
Lemon	91.59	0.41	0.75	6.97	1.8	36.56	48.16
Lime	91.32	0.76	0.20	5.18	2.07	27.24	46.96
Litchi	85.56	0.99	0.26	11.41	1.34	53.77	33.82
Mango	88.44	0.54	0.55	8.18	1.88	41.82	32.97
Orange	89.61	0.72	0.13	7.92	1.29	37.28	42.72
Papaya	91.47	0.42	0.16	4.61	2.83	23.90	43.09
Pear	86.49	0.36	0.27	8.09	4.48	37.52	3.31
Pineapple	86.06	0.52	0.16	9.42	3.46	43.02	36.37
Plum	84.44	0.64	0.40	12.10	2.07	56.88	2.26
Pomegranate	83.55	1.33	0.15	11.58	2.83	54.73	12.69
Sapota	83.64	0.92	1.26	13.90	9.60	73.37	20.96
Star fruits	91.18	0.79	0.39	4.51	2.81	26.29	33.55
Strawberry	92.03	0.97	0.56	3.40	2.50	24.61	50.20
Watermelon	94.57	0.60	0.16	3.86	0.70	20.31	11.45

(Source:Nevo table 1996, Nevo Foundation, Netherlands Nutrition Centre)[18].

The above column diagram (Fig. 1) is showing that the watermelon contains a high amount of water (94.57 %), followed by strawberry and lime when compared to other common Indian fruits. Due to the presence of a high amount of water, watermelon provides a high amount of electrolytes, which can help to negate the effect of the heat during the summer season and potentially reduce the risk of sunstroke. Watermelon is a rich source of calcium and potassium. These two toxin fighting nutrients help to remove toxin from the body [19]. Some pulpy fruits like custard apple and bael have intermediate moisture content and least in the case of dates.

Collins et al., [20] reported that the watermelon (*Citrulluslanatus*) is a tropical fruit that comes from South Africa and belongs to the Cucurbitaceae family. It's a berry with a thick rind (exocarp) and meat mesocarp and endocarp, which botanists classify as a pepo. Pepos are unique to the Cucurbitaceae, as they are generated from an inferior ovary. Cucumis has a smooth external rind (green, yellow, and sometimes pale green) and a juicy, sweet internal flesh (often pink, but also orange, yellow, red, and green if not mature) and is considered a type of melon while not in the genus (usually pink, but sometimes orange, yellow, red and sometimes green if not ripe). It's also commonly used to make a variety of salads, the most popular of which is fruit salad.

Carotenoids are abundant in watermelon. Lycopene, phytofluene, phytoene, beta-carotene, lutein, and neurospirene are just a few of the carotenoids found in watermelon. Carotenoid content varies between 37 and 121 mg/kg fresh weight in red skinned watermelon, while lycopene level varies between 32-112 mg/kg fresh weight.

Carotenoids are antioxidants due to their ability to scavenge free radicals. Numerous studies have found a link between dietary lycopene consumption and a decreased risk of developing diseases such as prostate and oral cancer. Additionally, lycopene may help lessen the risk of cardiovascular disease [21].

All fruits contain less amount of protein and fat. Among the most common Indian fruits, jackfruits contain high amount of protein and sapota contains high amount of fat than other fruits. The above column diagram (Fig. 2) showing that jackfruit contains 2.74 (g) protein per 100 g, followed by bael (2.63 g per 100 g) and dates (2.45 g per 100 g). Proteins helps to prevent protein energy malnutrition. Incse of fat content, the above bar diagram (Fig. 2) showing that sapota have 1.26 g fat per 100 g, followed by lemon (0.75g per 100 g) and custard apple (0.67 g per 100 g).

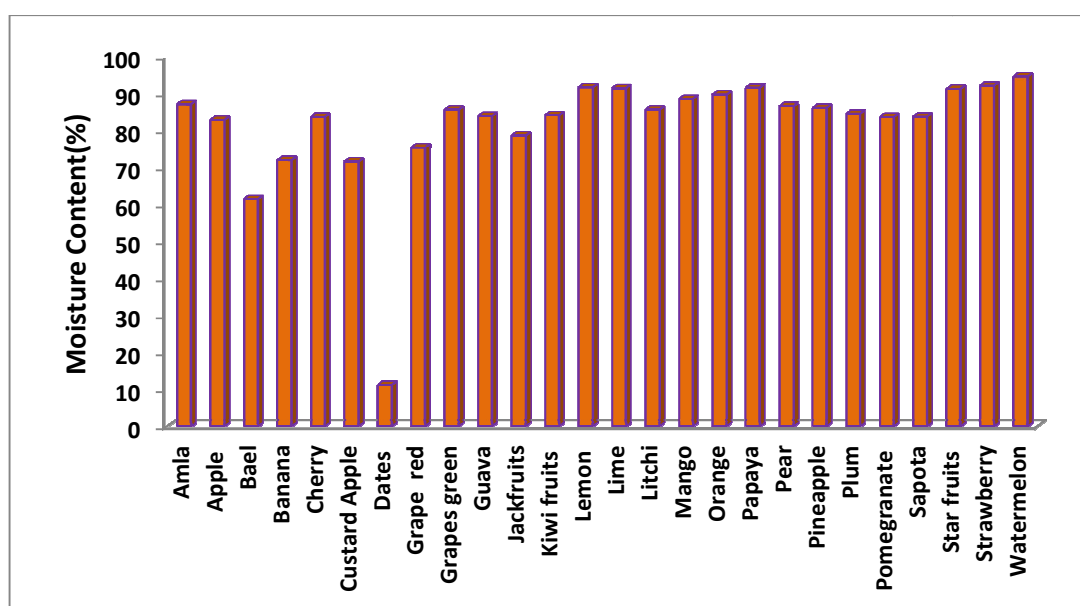


Fig. 1. Common fruits and their water (%) content (in each 100 g edible portion)

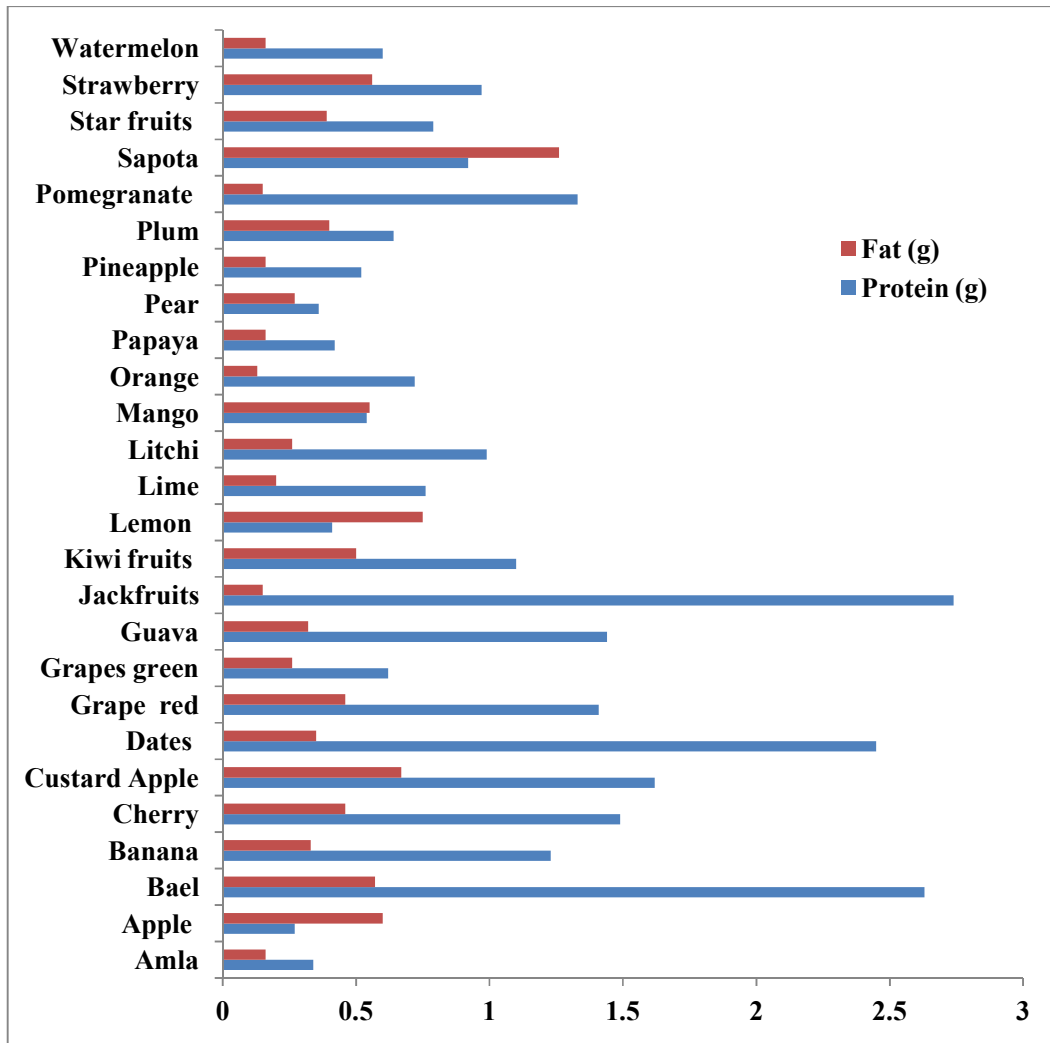


Fig. 2. Common fruits and their protein & fat content (in each 100 g edible portion)

The tropical climacteric fruit *Artocarpus heterophyllus Lam.*, sometimes known as jackfruit, is endemic to India's Western Ghats and widely dispersed throughout Asia, Africa, and parts of South America. It is known to be the largest edible fruit in the planet. Among other nutrients, jackfruit is strong in carbs, proteins, vitamins, minerals, and phytochemicals. Both the seeds and the meat of jackfruit are eaten in curries and boiling forms, and the flesh can be eaten as a fruit when completely ripe. Using pureed jackfruit, several countries have developed a variety of food products such as jams, jellies, marmalades, and ice creams. Because of its anti-carcinogenic, antibacterial, antifungal, anti-inflammatory, wound healing, and hypoglycaemic properties, the fruits, leaves, and barks of the jack tree have been widely utilized in

traditional medicine. Despite these advantages, the fruit is underutilized in commercial processing in the locations where it is cultivated [22]. Arginine, cystine, histidine, leucine, lysine, methionine, threonine, and tryptophan are among the amino acids found in jackfruit [23].

Ripe jackfruit has 1.9 grams of protein per 100 grams of flesh. The protein content of jackfruit seeds can range between 5.3 and 6.8 percent. The protein content of the flesh of several types of mature jackfruit has ranged from 0.57 to 0.97 percent, according to Goswami et al., [24-25].

Apple is the most common Indian fruits. Several studies revealed that composition of apple helps to reduce the risk of cancer specially lung cancer [26] Apples, particularly apple peels, have been

discovered to have potent antioxidant activity and can significantly slow the growth of liver cancer and colon cancer cells [27-28].

Apple consumption is helpful for the reduction of cardiovascular disease [29]. Apple consumption has been showed that for the controlling of asthma and also has been positively associated with general pulmonary health. In a recent Australian study involving 1600 adults, apple and pear consumption was linked to lower asthma risk and bronchial hypersensitivity, but overall fruit and vegetable consumption was not linked to asthma risk or severity [30].

Several epidemiological studies have connected apples to a lower risk of chronic diseases like cardiovascular disease, cancer, and asthma. Apples have been found in vitro and in animals to exhibit significant antioxidant activity, inhibit cancer cell proliferation, reduce lipid oxidation, and lower cholesterol, which could explain their role in decreasing chronic disease risk. Apples contain a variety of phytochemicals, many of which have been shown to have antioxidant and anticancer properties [31].

The above column diagram (Fig. 3) is showing that sapota is high fibre rich fruit than the other common fruits. Sapota contains 9.60 (g) fibre per 100 g.

Dietary fibre is the most important nutrient for the good digestive health. Fruits are the crucial source of dietary fibre [32].

Liu et al., [33] noted that adequate intake of dietary fibre helps to reduce the risk of developing the Coronary Heart Disease (CHD) Dietary fire also helpful of the prevention of stroke, diabetes, hypertension and certain gas problems [34-38].

Kulkarni et al. [39]. concluded that sapota has free radical scavenging properties to reduce the free radical particals. Ascorbic acid, phenolic and carotenoids are important free radical scavenging compounds, that are present in sapota.

Sapota is a highly nutritious fruit that contains dietary fiber, fructose, glucose, sucrose, vitamins, minerals, and a variety of phytochemicals, fatty acids, and polyamines, among other nutrients. The nutritional composition of sapota fruit and juice. Minerals such as potassium, calcium, iron, copper, and zinc, as well as phenolic components, are abundant in fruit [40-42]. A decrease in astringency during fruit development and ripening has been linked to polymeric modifications, interactions with other components including sugars, and a decrease in polyphenol concentration as fruit size grows [43-44].

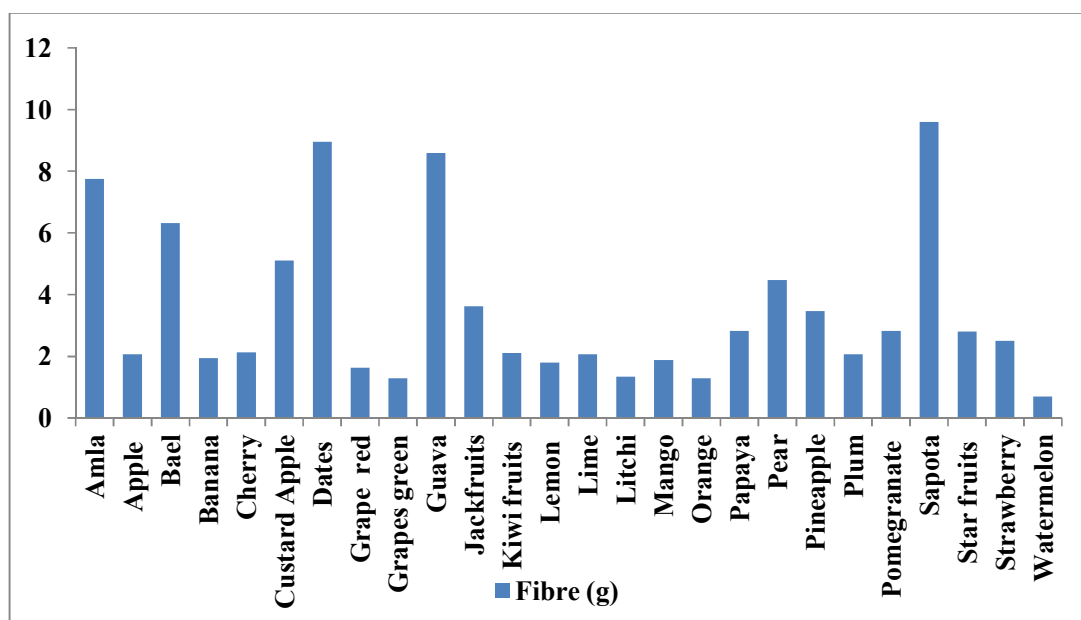


Fig. 3. Common fruits and their fibre (g) content (in each 100 g edible portion)

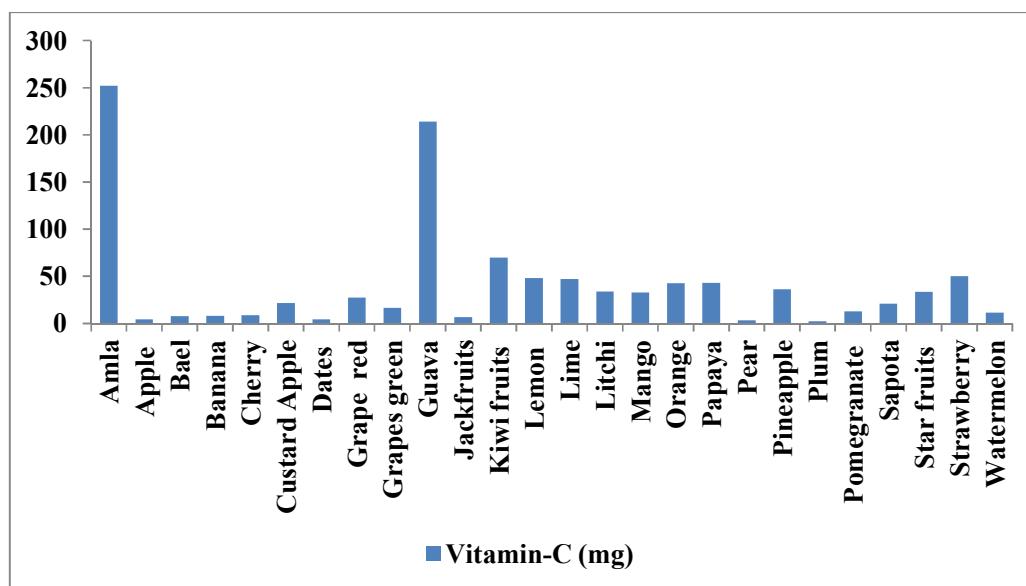


Fig. 4. Common fruits and their vitamin C (mg) content (in each 100 g edible portion)

Vitamin C is the most important antioxidant for preventing various diseases. The above column diagram (Fig. 4) is showing that amla contains high percentage (252 mg per 100 g) of vitamin C than other common Indian fruits.

Amla has many medicinal properties to control and prevent many diseases [45]. Amla is an immune-booster, which helps to increase immune power. Amla helps to prevent respiratory disorder specially in the case of tuberculosis of lungs, asthma and bronchitis. The fruit also known as anti-diabetic fruits due to presence of high amount of vitamin C. In case of anaemia, amla play a crucial role to control anaemia, due to presence of vitamin C, because vitamin C helps in the absorption.

Amla balances the three doshas, according to Ayurveda. Indian gooseberry is a popular ingredient in Ayurvedic polyherbal preparations. It can be used to promote longevity, improve digestion, treat constipation, reduce fever, purify the blood, relieve cough, relieve asthma, strengthen the heart, benefit the eyes, encourage hair development, and improve cognition. Amla fruit, whether eaten raw, combined with other herbs, or dried and used as a condiment, is one of the healthiest fruits. The vitamin C content of the amla fruit is 30 times that of an orange, making it one of the most vitamin C-dense fruits available. Vitamin C has been shown to lessen the intensity of colds, function as a natural antihistamine, and enhance the immune system

in studies. Because it is high in antioxidant and anti-inflammatory compounds including quercetin, gallic and ellagic acids, and corilagin, research has shown that amla can help avoid free radicals, fight cancer, and reduce inflammation caused by a variety of illnesses. Scientists from Nagasaki University's Faculty of Pharmaceutical Sciences determined through preliminary research that amla fruit extracts inhibit the formation of malignant cells in a study conducted in Japan. A human pilot study found that treatment decreases blood cholesterol levels in both normal and hypercholesterolemic males, as well as arthritis-related inflammation and joint pain. Other benefits of eating and drinking amla fruit include controlling bowel movements and relieving constipation thanks to its high fiber content, as well as preventing cataracts in diabetic patients by blocking aldose reductase, which causes cataracts in diabetics. Amla can also help to relieve stress. According to studies, amla fruit is a sedative that improves sleep, relaxes muscles, and has a peaceful, soothing effect [46].

The above column diagram (Fig. 5) is showing that cherry is high TPC rich fruit than the other common fruits. Cherry contains 114.56 mgGAE TPC per 100g.

The sour cherry has a high total phenolic content (TPC) as well as a high total monomeric anthocyanin concentration (TMAC). Sour cherry TPC is made up of anthocyanin, hydrocyanic

acids, and flavonoids, while cyanidin-3-glucosyl rutinoid is the major anthocyanin compound in sour cherry juice. Global sour cherry fruit production was 1.362.231 tons per year, with Turkey coming in third with 192.500 tons after Russia and Poland. These three countries are responsible for 44 percent of global sour cherry juice output. The entire volume of sour cherry juice (SJ) produced is almost half of total cherry production [3].

The ability of phenolic compounds to scavenge free radicals by donating hydrogen atoms, electrons, or chelate metal cations is credited with their antioxidant action [4].

The above column diagram (Fig. 6) is showing that cherry is high TAA rich fruit than the other common fruits. Cherry contains 14.56 $\mu\text{mol Fe/g}$ TAA.

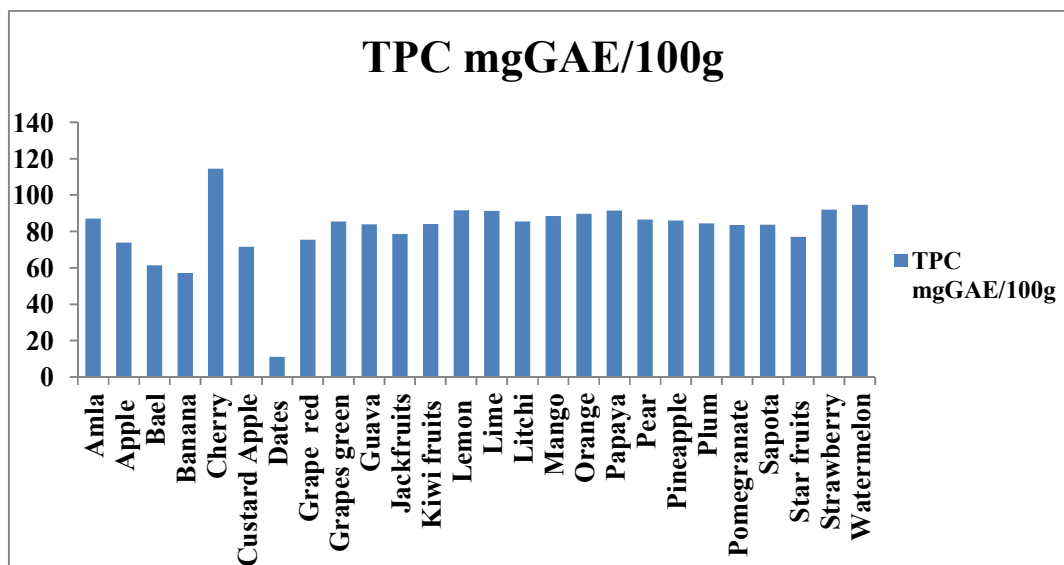


Fig. 5. Common fruits and their vitamin TPC (mgGAE) content (in each 100 g edible portion)

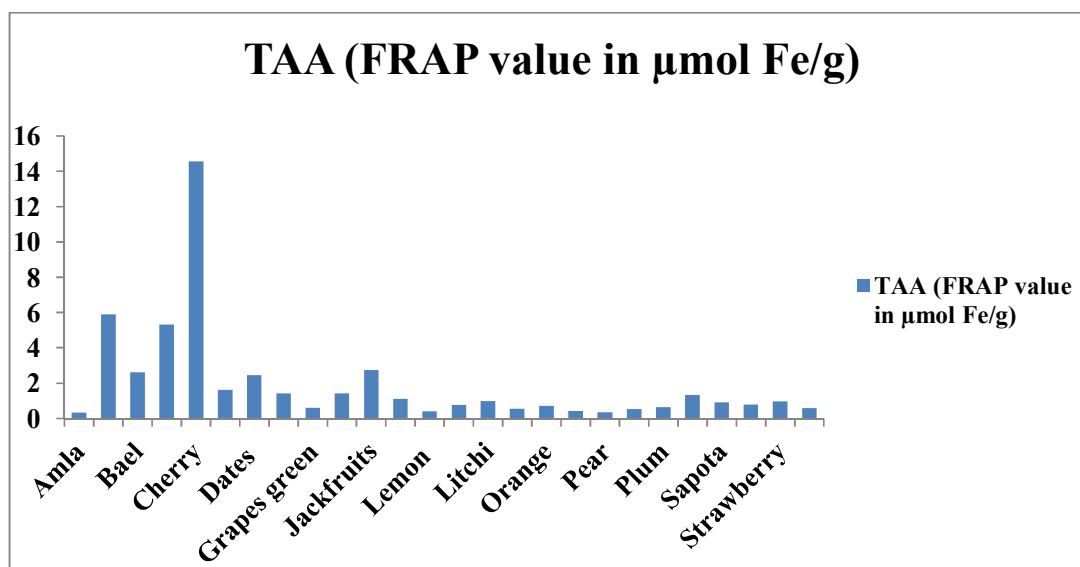


Fig. 6. Common fruits and their vitamin TAA ($\mu\text{mol Fe}$) content (in each 100 g edible portion)

TPC and TAA values of different fruits:**Table 2. TPC and TAA values of Common fruits**

Name of fruits	TPC mgGAE/100g	TAA (FRAP value in $\mu\text{mol Fe/g}$)
Amla	87.02	0.34
Apple	73.96	5.90
Bael	61.36	2.63
Banana	57.13	5.33
Cherry	114.56	14.56
Custard Apple	71.55	1.62
Dates	11.14	2.45
Grape red	75.30	1.41
Grapes green	85.55	0.62
Guava	83.79	1.44
Jackfruits	78.56	2.74
Kiwi fruits	84.00	1.10
Lemon	91.59	0.41
Lime	91.32	0.76
Litchi	85.56	0.99
Mango	88.44	0.54
Orange	89.61	0.72
Papaya	91.47	0.42
Pear	86.49	0.36
Pineapple	86.06	0.52
Plum	84.44	0.64
Pomegranate	83.55	1.33
Sapota	83.64	0.92
Star fruits	77.00	0.79
Strawberry	92.03	0.97
Watermelon	94.57	0.60

(Source: Nevo table 1996, Nevo Foundation, Netherlands Nutrition Centre) [18].

2. CONCLUSION

Fruits have provided good nutrition and medicinal value for human health, helping to control a variety of medical conditions. Fruits are utilized in traditional medicine to treat various diseases. Fruits include secondary metabolites, which are natural compounds with biological activity that can help prevent or control a variety of ailments. The fruits are mostly composed of vitamin, sugar, pectin, water, organic acid, carbohydrate, and starch, with insufficient amounts of protein and fat. A healthy diet rich in fruits can help to prevent diseases such as diabetes, heart disease, stroke, obesity, constipation, and hypertension. Antioxidant activity is found in several fruits, which aids in the reduction of free radicals in the human body. These anti-free radical characteristics are also beneficial in delaying the aging process. It is concluded that, when compared to other common Indian fruits,

watermelon has the most water (94.57 percent), followed by strawberry and lime. Watermelon contains a lot of water, therefore it has a lot of electrolytes, calcium and potassium. Some pulpy fruits, such as custard apple and bael, have medium moisture content, whereas dates have the lowest. Fruits have a lower protein and fat content than vegetables. Among the most popular Indian fruits, jackfruits have higher protein content and sapota has a higher fat content than other fruits. The protein content of jackfruit is 2.74 g per 100 g, followed by bael (2.63 g per 100 g) and dates (2.63 g per 100 g). When compared to other common Indian fruits, sapota has 1.26 g fat per 100 g, followed by lemon (0.75 g per 100 g) and custard apple (0.75 g per 100 g) (0.67 g per 100 g). Sapota contains high dietary fibre than the other fruits. In case of TPC content, cherry is high TPC rich fruit than the other common fruits.

CONSENT

Not applicable.

ETHICAL APPROVAL

Not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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