

Veritable Treasure Trove of Nutraceuticals Properties: *Malus domestica*

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ABSTRACT

Malus domestica (Apple) a popular fruit that is a great source of phytochemicals. Several phytochemicals found in apples, such as quercetin, catechin, phloridzin and chlorogenic acid, are potent antioxidants. These antioxidants aid in reducing cholesterol, preventing lipid oxidation and limiting the emergence of cancer cells. Apple consumption has been linked to a reduced risk of chronic conditions like diabetes, cancer, asthma and cardiovascular disease. The phytochemical composition of apples fluctuates significantly with different apple varieties and there are also minute variations in phytochemicals as the fruit ages and ripens. Apple phytochemicals are hardly ever affected by storage, but they can be significantly impacted by processing.

INTRODUCTION

Currently, an increasing percentage of consumers significantly choose functional food over conventional snacks in order to sustain and improve their diets and health. Fruits and vegetables are crucial components of a healthy diet and have a potential to prevent numerous kinds of ailments. Fruits are typically regarded as nutritious foods that are essential to a healthy

diet (Gupta *et al.*, 2023). The apple, with its crisp texture and sweet flavour, is the most well-known temperate fruit in the world. The states of Jammu and Kashmir, Himachal Pradesh and Uttarakhand are where apples are mostly cultivated for commercial purposes, making India the fifth-largest apple producers in the world. Apples are an essential component of the human diet as they serve as

a good source of dietary fibre, ascorbic acid and other useful components (Bondonno *et al.*, 2017). The main ingredients in apples such as sugars, organic acids and phenolic compounds, give the fruits their flavour, bitterness and astringency. Additionally, apples contain minerals (particularly potassium), polyphenols, vitamins (particularly vitamins C and E), and other nutrients. Any fruit's mineral profile is significant as minerals are deemed to be crucial for controlling a number of metabolic activities (Kumar *et al.*, 2018). Its ingestion enhances lung, gastrointestinal and bone health. Apples can be used in both sweet and savoury dishes, they are typically eaten as fresh or snacks or used as ingredients in juice, marmalade, jam, concentrate, compotes, dried fruits and cider (Fotiric Aksic *et al.*, 2022). Apple eating results in numerous health benefits, it can be eaten a variety of ways and still have the same positive health impacts as whole fruits (Marcotte *et al.*, 2022).

Nutritional profile of apple

Apple fruit has 0.27% acidity, 21.60 mg/100g ascorbic acid and 42.57 mg/kg total carotenoids. It consists of several nutrients such as calcium (20.94 mg/100g), iron (1.32 mg/100g) and zinc (0.45 mg/100g) (Kumar *et al.*, 2018). According to Doryanizadeh *et al.* (2017), it comprises 15.18% TSS, 40.31% antioxidant activity, 14.69 mg/g Anthocyanin, 644.75 mg/100g potassium and 151.13 mg/100g phosphorous.

Parameters	Apple
TSS (°B)	15.18
Titration acidity (%)	0.27
Ascorbic acid (mg/100g)	21.60
Antioxidant activity (µmole Trolox equivalent/g)	40.31
Total carotenoids (mg/kg)	42.57
Anthocyanin (mg/g)	14.69
Potassium (mg/100g)	644.75
Calcium (mg/100g)	20.94

Phosphorous (mg/100g)	151.13
Iron (mg/100g)	1.32
Zinc (mg/100g)	0.45

Health benefits of apple

Cancer: A better diet, especially one that includes more fruits, vegetables and whole grains, is believed to diminish cancer mortality by approximately one-third. According to strong evidence, diets rich in fruits and vegetables may contribute to reduced rates of cancer in the colon, stomach, oesophagus, lung and oral cavity (Hyson, 2011). Apples are one of the specific fruits that are associated with lowering the risk of lung cancer, while just a handful of the fruits and vegetables analyzed had a substantial impact on lung cancer risk. According to Feskanich *et al.* (2000), a person's risk of lung cancer was lower if they ate at least one serving of apples and pears daily. When comparing individuals who consumed more apples, onions and white grapefruit with those who consumed the least of these fruits, there was a 40-50% drop in the risk of lung cancer (Charde *et al.*, 2014).

Cardiovascular disease: Apple eating has been somewhat associated with lowering the risk of cardiovascular disease. Interestingly, consumption of broccoli and apples have been proven to lower risks of cardiovascular disease. The risk of cardiovascular disease was reduced by 13-22% in women who consumed apples. Apple consumption delivered around 10% of the total amount of consumed flavonoids and results in lowering the risk of dying from coronary heart disease (Charde *et al.*, 2014). Due to ROS's disruption of DNA, protein, lipids, and other cellular components, oxidative damage emerges as a beginning factor in a number of chronic diseases, particularly cardiovascular disease. Dietary antioxidants are critical as they strengthen the body's natural ability to remove ROS and nitrogen-free radicals from

surroundings and directly thwart lipid peroxidation activities (Hyson, 2011).

Asthma and pulmonary function: The intake of apples has been positively correlated with overall lung health as well as negatively correlated with asthma. Consumption of apples exhibited an elevated inverse connection with asthma than the consumption of other fruits and vegetables altogether. In the individuals who ate at least two apples a week, the positive impact was most noticeable. In a study conducted in Finnish by involving 10,000 men and women, concluded that consumption of apples and oranges had contributed in lower the prevalence of asthma (Knekt *et al.*, 2002). Even when potential confounders like smoking, body mass index, social class and exercise were taken into account, apple consumption continued to be favourably associated with lung function.

Diabetes and weight loss: The consumption of apple has also been connected with a decreasing probability of diabetes, in addition to the reduction of possibility of cancer, heart disease and asthma. As per Charde *et al.* (2014), an increased intake of quercetin-a vital compound found in apple peels is believed to result in a lower risk of type II diabetes. The only food with a high level of flavonoids that may provide protection was found to be apples. Brazier and Veazey (2023) reported that those who consume whole fruits like apples regularly had a 36% lower chance of acquiring type II diabetes than people who do not consume fruit. Intake of apple cider vinegar, which has been shown to have a antihyperlipidemic, satiating impact, hypoglycemic effect and also tends to minimize atherogenic risk, has been found to hinder the metabolic problems brought on by high fat diet (Bouderbala *et al.*, 2016).

Inflammation: Dried apple peel powder improves joint flexibility and range of motion by inhibiting certain enzymes such

as lipoxygenase and lowering the production of ROS (Jensen *et al.*, 2014). According to research by Lee *et al.* (2014) and Hyun and Jang (2016), apple polyphenols inhibit COX-2 expression and activity, down-regulate NK- κ B transcription factor activity and up-regulate Nrf2 expression to attenuate kidney inflammation response in unilateral ureteral obstruction rats.

CONCLUSION

Apples are rich in a range of phytochemicals, many of which have been proven to have potent anti-inflammatory and anti-cancer properties. Apples provide a wide range of potential health advantages. In an effort to comprehend and promote the health advantages of apples, many elements that have an impact on the phytochemical composition of apples must be taken into consideration. A nutritious diet that includes regular servings of fruits and vegetables, especially apples, may help to avoid chronic disease and maintain good health. The intake of apples and apple products has been scientifically observed to have favourable effects on the risk, markers and etiology of cancer, cardiovascular disease, asthma and Alzheimer's disease.

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