

Enhancing Milk Nutrition Value through Plant Sources

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Food serves as the primary reservoir of essential nutrients crucial for human growth and maintenance, encompassing water, carbohydrates, proteins, fats, minerals, and vitamins. However, the micronutrients present in our regular dietary intake may be insufficient or absent, leading to deficiency diseases. Recognizing this global health concern, the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) have identified over 2 billion individuals worldwide suffering from various micronutrient deficiencies. Statistical data reveals that approximately one in three people globally are at risk of iodine, vitamin A, or iron deficiency. To address these deficiencies, innovative approaches such as food fortification or value addition have been employed to augment the micronutrient content of common diets. Despite its nutritional richness, milk, often considered a nearly balanced food, may lack certain micronutrients such as copper, iron, vitamins C, D, K, and select B-complex vitamins. Furthermore, milk may not contain certain bioactive compounds known as nutraceuticals, including omega-3 fatty acids such as α -linolenic acid (ALA), eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), phytosterols, and dietary fiber. The present article focuses on the three plant sources (Avocado, pumpkin seeds and lemon) which are rich in minerals and vitamins (Fat and water soluble) along with bioactive compounds which have positive impact on the health. The nutritional status and health benefits and their applications in some dairy products are presented below.

Milk products as an ideal vehicle for value addition

Milk is the liquid food, secreted by the mammary gland for the nourishment of the newly born containing water, lactose, fat, protein, minerals and the minor constituents. It has long been recognised as the most comprehensive nourishment that nature offers for the maintenance of health and promoting growth' of the mammal. Some animals'

milk, particularly that of cows, buffaloes, goats, and sheep, is also used to make a variety of dairy products or consumed directly by humans. Milk serves as a convenient and effective medium for the incorporation of specific nutrients into the human diet. Value added milk products presents a promising avenue to provide micronutrient-rich foods to a broader population, serving as a viable solution in addressing various deficiency diseases. Milk emerges as a preferred candidate for value addition due to its widespread availability, widespread acceptance, and frequent consumption, particularly among young children. Additionally, it proves to be a cost-effective option compared to alternatives such as supplements and is a staple food in many households. Furthermore, the stability and bioavailability of supplemented micronutrients in milk remain notably high when compared to other food matrices. Milk-based beverages serve as an excellent vehicle for delivering a range of nutrients and bioactive compounds, including vitamins, minerals, antioxidants, peptides and amino acids, omega-3 fatty acids, plant extracts, prebiotics, and probiotics.

Plant Sources for Value Addition

Avocado: Health benefits and commercially available products

Persea americana is commonly known as avocado, avocado pear, or butter fruit, which is native to Mexico and Central America, a member of the flowering plant family *Lauraceae*. Botanically, avocado fruit is a berry with a single large seed. Mexico is the leading producer of avocados worldwide. The value of avocado market in India reached nearly 2.5 million US Dollars in 2021. The term "superfood" refers to foods that are beneficial to human health due to their high levels of nutrients and/or bioactive phytochemicals such as antioxidants. Avocados are one such foods which have been extremely popular nowadays due to their distinct phytochemical and nutritional composition in comparison to other fruits.

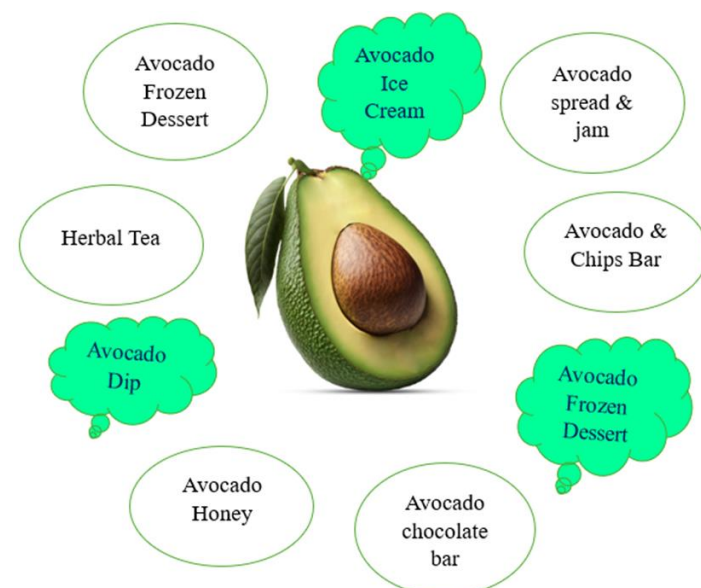
Vitamins such as β -carotene, tocopherol, retinol, ascorbic acid, thiamine, riboflavin, niacin, pyridoxine, and folic acid are abundantly found in avocado, which are of great importance for overall health and well-being (Duarte *et al.*, 2016).

Table 1: Major and Minor Nutrients of Avocado, Pumpkin Seeds and Lemon

Major Nutrients (g/100 g)	Avocado Pulp	Pumpkin Seeds	Lemon juice
Water	72.30	0.06	92.30
Protein	2.00	18.55	1.10
Fats	20.41	19.40	0.30
Carbohydrates	8.53	53.75	9.32
Calories (kcal)	160	446	29
Fiber	9.0	18.4	2.8
Minerals (mg/100g)			
Calcium	12	55	26
Iron	0.55	3.31	0.60
Magnesium	29	262	8
Phosphorus	52	92	16
Potassium	485	919	138
Sodium	7	18	2
Zinc	0.64	10.30	0.06
Copper	0.19	0.69	0.04
Manganese	0.14	0.50	0.03
Vitamins (mg/100g)			
Vitamin A (IU)	146.00	62.00	22.00
Vitamin E	2.07	0.01	0.15
Vitamin C	10.0	0.30	53.00
Vitamin B1	0.07	0.04	0.04
Vitamin B2	0.13	0.05	0.02
Vitamin B3	1.80	0.30	0.10
Vitamin B5	1.39	0.06	0.19
Vitamin B6	0.26	0.04	0.08
Folate (μ g)	81.00	9.00	11.00

Avocados contain several minerals, including potassium, phosphorus, magnesium, calcium, sodium, iron, and zinc. It is one of the few fruits in the human diet with a high content of both water and fat-soluble vitamins along with health-related

compounds. This fruit has been recognized for its health benefits, especially due to the compounds present in the lipidic fraction, such as omega fatty acids, phytosterols, tocopherols and squalene.

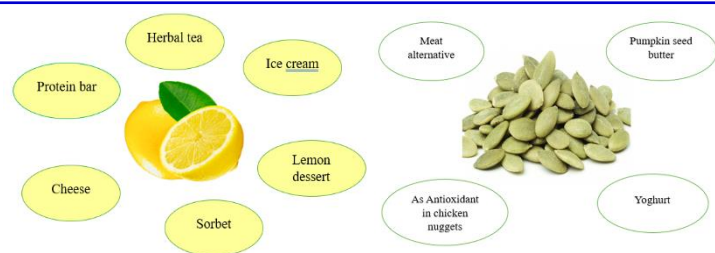


Pumpkin seeds: Health benefits and commercially available products

Although pumpkin seeds are small, they contain an extensive number of beneficial nutrients and nutraceuticals, including essential minerals, amino acids, phytosterols, unsaturated fatty acids, phenolic compounds, tocopherols, and cucurbitacins. Each one of these bioactive substances is essential to overall health and wellbeing. They are rich in carotenoids, iron, calcium, salt, phosphorus, zinc, manganese, and other minor minerals. They are also strong in vitamin E. (Amin *et al.*, 2019). Pigments, pyrazine, squalene, phytosterols, triterpenoids, phenolic substances, and their derivatives, coumarins, unsaturated fatty acids, flavonoids, and proteins are also abundant in pumpkin seeds. It has beneficial effects on blood glucose level, immunity, cholesterol, liver, prostate gland, bladder, depression, anti-diabetic, anti-fungal, anti-bacterial, anti-inflammation activities and antioxidant effects.

Lemon juice: Health benefits and commercially available products

Lemon is a citrus fruit belong to the species of small evergreen tree in the flowering plant family *Rutaceae*, which is native to Asia. Lemons have a special flavour and aroma and are widely consumed globally. Ascorbic acid in lemon juice act as an oxygen



scavenger, does not improve viability of *bifidobacteria* in yoghurt, but it can be applied to ensure better survival of *L. acidophilus* and *B. bifidum* in yoghurt. Ascorbic acid and citric acid were effective in preserving the colour of avocado yoghurt, especially against enzymatic browning. As of 2020, India is the highest production, which contribute 17.42 % of total production in the world (Lemon Council of Agriculture, 2020). Lemon juice, known from traditional medicine, include treatment of high blood pressure, the common cold, and irregular menstruation, scurvy, sore throats, fevers, rheumatism, high blood pressure, and chest pain. Vitamin C prevents the formation of free radicals and protects DNA from mutations. It also causes reduction in blood glucose, a reduction in wound healing time, and an increase in tissue growth rate, collagen synthesis, and protein and hydroxyproline levels (Klimek *et al.*, 2020).

Conclusions

Plants are very good sources of micronutrients (vitamins and minerals) and Phyto bioactive chemicals which can enhance the health benefits and nutritional

value of the products in which it is fortified into. Value addition by plant sources can attract the major population both vegetarian and non-vegetarian groups by promoting the sales of basic products in the market. Avocado, pumpkin seeds and lemon serve as a source of minerals and both water- and fat-soluble vitamins and provide nutraceutical properties to the value-added food products. Value addition in food products may create many novel functional foods which benefits the larger population.

References

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