

## New Approach to Plant-Based Milk Alternatives – A Review

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### ABSTRACT

*Milk is a vital component of human diet. Mammal milk has been consuming by humans from ages. But just like any other food, milk often has allergic reactions such as indigestion, gastrointestinal problems, bloating of stomach etc. Milk allergy is not the only reason for people choosing plant milk over bovine milk. Low fat percent, high protein content and many other nutritional factors including cheaper prices and more availability is attracting people across the globe towards plant-based milk. Nowadays, Plant-based milk alternatives are in great demand. Soy milk, oat milk, rice milk, almond milk and various other types of plant based milk are being developed. Various alterations and fortifications are still being done while developing these plant based milk as this concept is relatively new that will make it a reality in future.*

**Keywords:** Vital, Allergy, Indigestion, Gastrointestinal, Alternatives, Fortifications.

### INTRODUCTION

Milk is a nutrient-rich, white liquid food produced by lacteal secretion of mammalian mammary glands of mammals in postpartum. It is an emulsion or colloid of fat globules containing dissolved carbohydrates and protein aggregates with minerals in a water-based fluid. It is the primary source of nutrition for infants before they are able to consume other nutrients. It has a balanced composition of nutrients that are easily digestible and result in a commodity of high biological value and is considered as a staple food for children and a vital supplement in adult diets. Milk provides significant amounts of high quality proteins an average of

3.5g to 3g of protein per 100g of milk. However, its consumption, in some cases, is associated with adverse reactions (Boston, 2004).

Milk, also called “Dairy milk or Bovine milk”, is derived as an agricultural product from farm animals during or shortly after gestation. Because it is produced as a food source for the young, all of its contents provide benefits for growth. The principal requirements include energy (lipids, lactose, and protein), biosynthesis of non-essential amino acids provided by proteins (essential amino acids and amino groups), essential fatty acids, vitamins and inorganic elements, and water.

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Milk is sometimes not accepted by the immune system due to body's inability to digest milk proteins, and thus causing allergic reactions. In developing countries, cow's milk protein allergy (CMPA) affects 2-7.5% in children, especially in the first months of life. About, 50% to 70% population have cutaneous symptoms, 50% to 60% gastrointestinal symptoms and 20% to 30% respiratory symptoms (Rangel et al., 2016). Lactose intolerance, cow's allergy, calorie issue, prevalence of hypercholesterolemia are some of the major concerns that has driven consumers towards choosing other cow milk alternatives (Sethi et al., 2016). With advancement in technology, milk production has also been improved over the years. Nowadays, milk can be processed with varying amounts of fat such as low fat milk, toned milk, full cream, standardized milk etc. Milk is also fortified with different minerals to cope up the needs of nutritional deficiency in large population. There are different flavors of milk are also available in the market such as chocolate, vanilla, strawberry etc., that make milk acceptable to people who don't like raw milk smell or flavor. Several different types of innovative food beverages from plant sources are being developed for cow milk alternative as they contain functionally active bioactive compounds that promote health security to the consumers. These plant-based milk alternatives are a growing trend nowadays, which not only serve as an inexpensive alternate to poor economic group of developing countries and in places, where cow's milk supply is insufficient but also solve

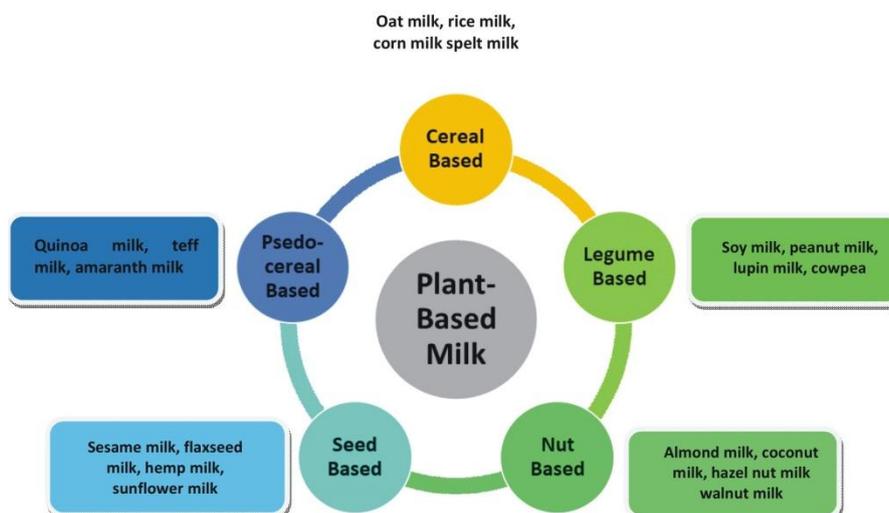
the major milk related health issues (Rangel et al, 2016).

## 1. PLANT BASED MILK ALTERNATIVES

Alternatives to plant-based milk arising from the breakdown (size reduction) of plant material (cereals, pseudo-cereals, legumes oilseeds, nuts) by various physical methods extracted in water and further homogenization of these fluids, results in particle size distribution varying from 5–20 $\mu$ m imitating cow's milk in appearance and consistency (Sethi, 2016). These plant based substitutes have either same or better nutritional composition to that of bovine milk. They usually contain less fat, high protein, better access to a wide range of flavors, relatively cheaper than bovine milk makes them more popular. This plant based milk can be used to make all types of milk based foods such as cheese, yogurt, paneer etc.

Owing to the lack of cholesterol and lactose, the intake of of plant-based milk has been expanded, making it appropriate for a demographic community suffering from lactose intolerance and heart disease and in general for all. The plant-based milk alternatives is projected to grow at a CAGR of 15% from 2013 to 2018 and is expected to reach a value of \$14 billion. The global dairy industry stood at USD 12.8 billion in 2018 and is expected to reach USD 25.18 billion by the end of 2026, displaying a CAGR of 9.79% during 2019-2026 projection era.

Plant based milk alternatives are categorised as follows:



## 2. NUTRITIONAL COMPOSITION OF VARIOUS PLANT-BASED MILK

Plant-based milk alternatives now commands 21% of the "milk" market, which leads the dairy industry to sue producers of dairy substitute manufacturers, to have the name "milk" limited to animal milk, so far without success. The FDA supports the restriction of the term "milk", while the USDA supports the continued use of terms such as "soymilk". In the EU, terms such as milk, butter, cheese,

cream and yogurt except coconut milk, almond milk, peanut butter, and ice cream are legally restricted to animal products. Plant milk yogurts are full of probiotic bacteria, which is perfect for human digestive system for example, nut milk based yogurt is rich in healthy fats, antioxidants, protein, fibre, calcium, vitamins C and E, zinc, iron and magnesium. Other products made from plant milk do have similar types of beneficial nutritional properties.

**Table 1: Nutritional composition of various plant based milk per 236g**

PLANT-BASED MILK				
	Almond milk (unsweetened)	Soy milk (unsweetened)	Rice milk (unsweetened)	Coconut milk (unsweetened)
<b>Calories</b>	40 cal	80 cal	120 cal	50 cal
<b>Total Carbohydrates</b>	1 g	4 g	22 g	2 g
<b>Sugars</b>	0 g	1 g	10 g	0 g
<b>Total Fat</b>	3 g	4 g	2 g	5 g
<b>Protein</b>	2 g	7 g	0 g	0 g

The most common replacement of bovine milk substitute is soya milk. It is a low cost (especially protein) nutritious food available almost all over the world. Soybean usually contains 14g protein, 5g carbohydrate, 7g fat per 100g. It also contains minerals such as 12% calcium, 20% iron 23% magnesium per 100g. Vitamin content of soybean per 100g is 15% thiamin, 8% riboflavin, 21% niacin etc. Other than these, soybean also contains phospholipids that are essential for the better functioning of brain (Fehily, 2003). The health benefits of soy milk include lactose-free, cholesterol-free, high nutritive value, high digestibility and low cost. Owing to these health benefits, soy milk has also found its applications as a functional ingredient in preparation of processed food products.

Chickpea is another alternative to produce plant-based milk. Chickpeas are low in fat content and contain both the soluble and insoluble fibre that contributes in lowering both total and LDL cholesterol. Chickpeas are rich in folate and protein content, which reduces the risk of colorectal cancer. Chickpea

is valued for its nutritive seeds with high protein content of 25.3-28.9%, after dehulling. The formulated chickpea based infant formula meets the WHO/FAO requirements on complementary foods and also the EU regulations that uses chickpea as a common source of carbohydrate and protein making it more economical and affordable for the developing countries without compromising the nutrition quality (I. N et al, 2014). Chickpea milk has been shown to be highly effective in treating persistent diarrhoea. Chickpea is a good source of important vitamins such as vitamin A precursor  $\beta$ -carotene, vitamin B1, vitamin B2 and folate. It may have beneficial effects on some of the important human disorders such as CVD, diabetics Type-2, digestive diseases and other cancers.

Both types of milk may be combined to produce a different type of milk with several benefits. A growing number of consumers prefer milk based substitutes for medical reasons or as a lifestyle choice. Lactose intolerance with a worldwide 75% prevalence

and cow's milk allergy. Plant milk substitutes also provide a more economical choice in countries where mammal milk is scarce and expensive choice. Plant based milk options leads to improved digestion promoting weight

loss, improvement in metabolism and energy levels and does not cause any inflammation. But this is mainly an alternative source of milk for people who are lactose intolerant or have milk allergies.

**Table 2: Composition of various types of milk**

VARIOUS TYPES OF MILK				
	Bovine milk	Human milk	Soy milk	Chickpea milk
Water (g/100g)	88.7	88	90.8	77.9
Calorie (g/100g)	247	272	192	199
Protein (g/100g)	2.9	1.1	3.6	1.51
Lipid (g/100g)	3.2	7.2	2	2.2
Carbohydrate (g/100g)	4.5	7	2.9	4
Ash (g/100g)	0.7	0.2	0.5	0.6
Calcium (mg/100g)	100	27	15	12.8

(Source: Mahmood, 2003 and Odo, 2003)

### CONCLUSION

Milk is a complete food in itself. Both bovine and plant-based milk provide nutritional benefits to the body. Bovine milk has long been used as the population grow so does demand for milk. However, humans have developed certain allergies to cow milk protein or lactose intolerance etc which opens an alternative idea of plant-based milk. This plant based milk has similar or better nutrition content like low fat content and high protein content than bovine milk which make it more beneficial than cow milk. Also, these plant based milk are lactose-free can be altered to meet the needs of consumer market. About 68% of the people around the world have consumed plant milk over dairy milk which opens up a huge market for plant-based milk and its product. But it is an individual choice about which milk to be consumed according to their needs.

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