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Myriad of benefits of whey: A review

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Abstract

Whey has all along been considered as a waste product and looked upon seriously by the environmentalists and technologists due to its potent polluting strength. However, it is no longer considered a waste product but a treasure chest of nutritionally rich whey protein, which has been unlocked by the modern processing technology, enabling them to recover economically in their native form. Whey is the watery part of milk that remains after separation of curd / coagulated products that result from acid or proteolytic enzyme mediated coagulation of milk. Two types of whey available, acid whey that is generated as a result of paneer, channa, chakka and acid casein manufacture and rennet whey, which is produced during cheese manufacture and is sometimes regarded as a waste and constitutes a major problematic disposal if not processed further to valuable products. Modern sciences has unraveled the secrets of whey proteins and other components and established a sound basis for their nutritional and functional value.

Keywords: Whey, waste, utilization, paneer

1. Introduction

Today's health conscious consumers are increasingly making food choices based on a food's ability to provide health benefits, such as enhancing body functions or reducing the risk for certain disease. Whey has all along been considered as a waste product and looked upon seriously by the environmentalists and technologists due to its potent polluting strength. However, it is no longer considered a waste product but a treasure chest of nutritionally rich whey protein, which has been unlocked by the modern processing technology, enabling them to recover economically in their native form.

Whey is the watery part of milk that remains after separation of curd / coagulated products that result from acid or proteolytic enzyme mediated coagulation of milk. It is major by-product of dairy industry, during manufacture of products like paneer, channa, chakka, cheese, casein, etc. In the manufacturing of these products, about 10- 20 per cent portion of milk is recovered as the desired end product and remaining 80-90 per cent liquid portion is the whey. It is considered to be reliable source of number of high quality and biological active proteins, carbohydrates and minerals. The current world production of whey is estimated at about 165 million tones. (Anonymous, 2010) ^[1] in which about 68 per cent is produced in European countries and 24 per cent in North America. In India, nearly 5 million tones whey is produced of which channa and paneer whey contributes around 80 per cent of total whey (Gupta, 2008) ^[5]. Whey is one of the largest by-products of world dairy industry. Whey, extracted from milk, is a wholesome protein source known to be "high quality protein," as it contains all nine of the essential amino acids. Whey proteins are especially high in essential amino acids such as tryptophan, which helps enhance brain serotonin levels (Delgado-Andrade and others 2006. Whey contains most of the water soluble vitamins, lactose, minerals (Sahu *et al.*, 2005). This represents a significant loss of resources and causes serious pollution problems since whey is a heavy organic pollutant with high biochemical (BOD) and chemical oxygen demands (COD), with values of 40000-60000 mg/l and 50 000-80 000 mg/l, respectively. More than 90 % of whey BOD is due to lactose (Canli, 2005) ^[3]. Approximately 50% of worldwide cheese-whey (CW) production is treated and transformed into various food and feed products. About half of this amount is used directly in liquid form, 30% as powdered cheese-whey, 15% as lactose and its byproducts and the rest as cheese whey- protein concentrate (Spalatelu, 2012).

2. Whey production and its utilization

In search of the alternative whey disposal methods by the dairy industry, whey utilization has served as an exciting opportunity for its financial benefits. Since utilization of raw unprocessed

Whey has several limitations such as high transportation cost, susceptibility to deterioration during storage and lack of appropriate mechanism for its utilization, the focus was much on maximizing the value of whey solids through greater utilization of whey components. In India there has been a substantial increase in the production of Paneer in organised sector resulting in increased availability of whey. It is estimated that about 5% of milk produced in India is converted to Paneer (ICMR 2000, Chandan 2007) ^[6], the figure being 4,493 Metric Tonnes in the year 2003-04 (Srivastava and Goyal 2007) ^[19] and production of whey due to this is estimated at around 4.84 million tonnes per annum, consisting 290 million kgs of valuable milk nutrients. Considering the nutritional and functional virtues of whey, several attempts have been made earlier to utilize whey solids for the extraction of whey protein (Werner, 1981) and for preparation of soups (Arora and Jha, 2005), beverages (Keerthana and Reddy, 2006) Bakery Products (Jarita and Kulkarni, 2007) ^[7]. However, considering the quantum of whey production and the problem associated with its disposal, many more efforts should be made to utilize this important byproduct

3. Chemical composition of whey

Whey contains highly nutritious constituents. The most valuable components of whey are whey proteins. Whey proteins have been regarded superior to most of the other proteins such as egg, beef, Casein and soya proteins in nutritive value. The amino acid profile of whey protein shows that they contain all essential amino acids in excess of FAO standards. Biological value of whey protein is higher (104) as against whole egg (100), rice (74), soya (59), wheat proteins (54) and casein (77) (Poonam, 2007) ^[12].

4. Nutraceutical value of whey

Whey protein comprises 20% of total milk and it is rich in branched and essential amino acids, functional peptides, antioxidants and immunoglobins. It confers benefits against a wide range of metabolic diseases such as hypertension, obesity, diabetes and cancer.

The natural antimicrobial action of lactoperoxidase is being used in a range of oral healthcare products and is finding application in such products directed toward the prevention and treatment of xerostomia (dry mouth). The lactoperoxidase containing products have been clinically proven to inhibit harmful microorganisms associated with gingivitis and oral irritation, to promote the healing of bleeding gums and reduce inflammation, and combat both the causes and effects of halitosis (bad breath) Tnevu (2002) ^[20]. α -LA, a whey protein in cow's milk with a high content of tryptophan (a precursor of serotonin) improves cognitive performance (i.e. memory scanning) in stress-vulnerable individuals. α -LA rich whey protein increases serotonin activity. Stressed individuals were less stressed when they fed α -LA Markus *et al.* (2002) ^[10]. Whey are known to be involved in the antioxidant activity, anticarcinogenic effects, immunomodulation, passive immunity, anti-microbial effects, binding of toxins, promotion of cell growth, platelet binding, anti-inflammatory and anti-hypertensive action McClements *et al.* (2009) ^[11].

5. Food Products

The various edible products from whey include:

5.1 Bakery Products

Whey is one of the least expensive potential ingredients in

baker's formulation and experiments reported from USSR have shown that addition of 20- 30% of whey to bread formulations improved the nutritional value of bread as well as its porosity, volume and resulted in reducing the processing time by 12- 13%. High protein cake was developed by incorporating WPC up to 30% with improved sensory characteristics and functional properties (Raju, 2004) ^[14]. A number of researchers have investigated the possibility of replacing egg white with whey proteins in the manufacture of cakes with varying degree of success (Raju *et al.*, 2005) ^[15]. Because of high functionality of whey proteins, WPC has been used in the production of functional bakery products like high protein products and fat replaced products (Kamaliya and Subhash, 2005) ^[8].

5.2 Whey based soups

Soups are served as appetizers before meals all over the world. Kamar *et al.* (1999) ^[9] found that paneer whey could be successfully utilized for the preparation of nutritious and delicious soup by blending it with tomato pulp at 25 % level and beetroot pulp at 20 % level. Jarita and Kulkarni (2009) reported that paneer whey concentrated to 30 % total solids can effectively be used as diluent without adversely affecting the sensory attributes in the production of soup sticks.

5.3 Fruit flavoured whey beverages

India has not only made great progress in milk production, but it has also emerged as the top fruit producer in the world (FAO, 1995) ^[4]. However, as much as 25-30 per cent of the total fruit produced in India gets spoiled in the absence of infrastructure for appropriate post-harvest technology. Another distressing aspect is that, the whey, which contains 6-7 per cent of milk solids, is considered as a waste product because of its low concentration of milk constituents (Sienkiewicz and Riedel, 1990) ^[17]. Hence, formulation of new products in the form of nutritious and refreshing beverages by using suitable combination of whey and fruit juices both in concentrated and dried forms would permit economic utilization of whey and value addition to guarantee high income. Whey beverages have been recognized as a genuine thirst quencher, light, refreshing, healthful and nutritious (Prendergast, 1985) ^[13]. Reddy *et al.*, (1987) ^[16] reported 8 per cent lemon juice and 14 per cent sugar level for developing acceptable quality beverage. In general, the total solid level above

15 per cent, sugar level between 7-10 per cent and pH below 4.5 is required for developing acceptable quality beverage. Beverage with 10 per cent sugar and orange flavor received highest score.

The review of the available literature shows that though extensive works has been carried out on utilization of whey in various food products and its nutraceutical value. Hence aim is achieved and proofed that whey is gold.

4. Conclusion

The variety and availability of products incorporating whey protein as a primary ingredient will undoubtedly increase as research continues to substantiate the health benefits and as the consumer becomes increasingly aware of these benefits. By staying abreast of this research and being informed of the specific types of whey protein products and their components you will be in a strong position to make the most appropriate recommendation to meet the needs and goals of individual clients and patients.

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