Nutricereals Incorporated Probiotic Convenience Foods for Improved Human Health

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Introduction

In the present scenario, consumers are becoming more health conscious hence the demand for healthy and convenience foods is increasing rapidly (Singh, 2013). The global functional food market is expected to reach USD 275.77 billion by 2025; it is anticipated to expand at a CAGR of 7.9% during the forecast period. The processed food industry is growing worldwide due to changing consumer preferences and increasing purchasing power. A variety of probiotic dairy spread have been introduced with different characteristics and forms to cater to the demand for enhanced flavor and texture as well as health promoting benefits. This is expected to drive the demand for dairy spreads among consumers across the world (Anonymous, 2006). The India spreads market is projected to grow at a CAGR of over 16%, in value terms, during 2017- 2022, on the back of increasing demand for convenience food and innovative food items. The increasing trend of consuming these products is expected to sustain throughout the forecast period, thereby favoring market growth.

India is among the leading producers of Nutri cereals and millets, though the production and consumption are limited to certain geographical locations. They are relatively rich in proteins, minerals and vitamins in comparison to conventional cereal crops. The nutritional connotation of these crops lies in their richness in micronutrients like calcium, iron, phosphorus, zinc, vitamins and sulphur containing amino acids (Panda, 2020). People are vouching for healthier foods which are less time consuming to prepare but definitely provide more nutrients, energy and mental well-being. The concept of nutri-cereals in the human diet is not new. Millets are rich in anti-oxidants, when compared to other major cereals. Thus, they are termed as nutri-cereals (Karunakaran and Urooj, 2020). The year of 2018 was celebrated as the 'International year of millets' to support and boost the production and commercialization of millet grains. Also, the formulation of probiotics with millets will be beneficial because of phytochemicals, prebiotics, minerals and dietary fiber present in them. In addition to this, millets and milk are the preferred delivery vehicles for probiotics having a synergistic effect on probiotic microorganism's growth. The human health benefits associated with the consumption of probiotic foods include reduction of serum cholesterol, control of blood pressure and improved GI balance. Probiotic cultures of *Lactobacilli* have the potential to bring substantial health benefits to the consumer Considering the nutritional and health benefits associated with consumption of nutri-cereals incorporated probiotic composite-based products, it could be useful to develop highly valued nutri-cereal based probiotic products.

Probiotics

Probiotics are live, single or mixed and concentrated form of bacterial cell threshold (1×10^9cfu), which, when administered by the different ways in humans and animals, grant cogent, aspired and site-targeted health benefits (Hill *et al.,* 2014). The global fermented foods market is expected to grow significantly at a compound annual growth rate (CAGR) of 4.3% during the forecast period of 2019–2024 and reach USD 1.08 billion. Astonishingly, probiotic dairy foods market value reports 43 per cent of functional foods market value with a chief contribution from fermented products sector. Further, the probiotics market is projected to grow at a CAGR of 7.0% from 2018, to reach a value of USD 69.3 billion by 2023 (Voidarou *et al*., 2021). The most widely marketed probiotic dairy products are from probiotic strains of genus *Lactobacillus* and *Bifidobacterium*. The fermented milk products are the most accepted food delivery system for probiotic bacteria. The human

health benefits associated with the consumption of probiotic foods include reduction of serum cholesterol, control of blood pressure and improved GI balance. Probiotic cultures of *Lactobacilli* have the potential to bring substantial health benefits to the consumer. Probiotic organisms grow slowly in spreads due to their semi-solid consistency, moreover their low viability during processing, storage and distribution remained a major challenge in their marketing. Considering the nutritional and health benefits associated with consumption of composite based products, it could be useful to develop highly valued probiotic product.

Convenience Foods

Convenience foods are defined as food products that save time in acquisition, preparation, and cleanup. Consumers' eating habits are constantly evolving, with an increasing preference for ready-to-eat products and a growing demand for handy, on-the-go food options. These trends are key drivers projected to fuel market expansion throughout the forecast period. The rising urban population and growing industrialization are further contributing to the demand for packaged and processed food items, thereby sustaining global market growth. This is expected to drive the demand for dairy spreads among consumers worldwide (Anonymous, 2006).

The India spreads market is projected to grow at a CAGR of over 16% in value terms during 2017–2022, driven by increasing demand for convenience and innovative food products. This upward trend in the consumption of such products is expected to continue throughout the forecast period, thereby supporting overall market growth. These developments have led to the emergence of a wide variety of food products offering multiple benefits, including functional foods, value-added foods, foods with medicinal properties, and convenience foods.

Convenience foods are characterized by their ease of preparation, requiring minimal time and effort. Examples include precooked or ready-to-eat meals. Such products are currently dominating the global food market. Due to dynamic and busy lifestyles, people often lack the time to procure fresh ingredients and prepare meals from scratch on a daily basis. As a result, by choice or necessity, they increasingly rely on ready-to-eat or precooked foods to satisfy hunger and meet their nutritional needs.

Among these convenience foods, dips have seen a surge in market demand. Dips are foods with a liquid to semi-solid consistency that are commonly consumed with bread, snacks, or chapatis as accompaniments or flavor enhancers. However, depending on their composition, dips can offer significant nutritional and health benefits—sometimes even more than the primary food items they accompany.

Preparation of dairy spread

Dairy spread, which is spreadable at refrigeration temperatures having appearance, flavour, consistency, rheology and mouth-feel which is similar to conventional butter has been developed and patented by miller *et al.* (1998). The formulation of the dairy spread comprises of butter fat (50%), milk solids (25%) and water (25%) along with colour, flavour and preservatives. The pre-mix was subjected to high heat treatment to denature the protein and then homogenized to produce stable spread like product. Similarly, another US patent has been filed in 1988 by Johansson *et al.*, for the development of dairy spread which is spreadable at refrigeration temperature. The cream having iodine value of about 28-38 and a liquid vegetable fat (around 40 per cent of the total fat), viz. soy oil, sunflower oil etc., preferably having a high amount of linolenic acid, was subjected to churning process in a butter making machine and churned at a temperature of about 4-10 °C. Which produces the butter like dairy spread that can be spreadable at refrigerated temperature. Low calorie, high protein table spreads were produced from sweet milk protein concentrates (MPC) obtained from UF retentate of cow milk. The MPC was heated to 80°C and emulsified into an edible oil to form 60 per cent aqueous phase and 40 per cent oil phase water in oil emulsion. The final product contains 35 per cent fat and 18 per cent protein (Strinning, 1977). Angela *et al*. (1994) developed and patented spreadable low-fat cheese. Wherein the pasteurized milk (standardized to get 8 per cent fat in the final product) was added with usual starter culture and rennet and incubated for 18 hours at 23°C, until the pH value is about 4.6. After a quick heat treatment at 48°C the curdled cheese milk is ultrafiltered until the solids content of the retentate reaches to 28%. After addition of flavouring ingredients, the mixture is heated to 70°C and homogenized at 20 MPa to get spread like product. Buecker *et al*. (1995) patented a novel method of production of dairy spread using skimmed milk, enriched with milk protein and milk fat and the product is stabilized by mechanical treatment (homogenization) at elevated temperatures at around 80 °C.

Preparation of Dairy dip

Cheese dip is an oil-in-water (o/w) emulsion that can be made from a variety of different aged cheeses or by combining various dairy-based substances with cheese to create a distinctive cheese flavor , cheese dips were made by Bansal et al., (2016) reported how WPC-70 and sodium caseinate are the major components. These are combined in an 80:20 ratios. Response surface approach was used to create a protein blend, and the amount of this protein blend, Cheddar cheese, and milk fat was changed (RSM). Glycerol monostearate (GMS) and carboxymethyl cellulose (CMC) were used (0.5 percent). Water is also added to enhance bulkiness. To make WPC-70, sodium caseinate, and CMC+GMS solutions, the whole volume of water was divided into approximately three equal parts. WPC-70, sodium caseinate, CMC, and GMS aqueous solutions were made separately in warm water (35–40^{0}C) for each ingredient to make cheese dip. In the other container, weighed and shredded Cheddar cheese was cooked with a weighed amount of tri-sodium citrate (1%) until it reached a pasty consistency. The WPC-70 solution was combined with sodium caseinate solution and thoroughly mixed. CMC (0.5%) and GMS (0.5%) were added to this mixture and thoroughly mixed to achieve a homogeneous mass. The tempered (25^{0}C) cream was added, followed by the melted Cheddar cheese, in the amount required to supply the milk fat. With the addition of 0.5 percent sodium chloride, the mixture was thoroughly blended. For homogenization, the mixture was heated to 65°C. The cheese slurry was filtered using muslin cloth before homogenization to remove any foreign particles. The first stage of homogenization of the cheese slurry was done at 1,500 psi, while the second stage was done at 500 psi. The homogenized cheese dip was heated to 75°C for 5 minutes, then cooled to 5–7°C before being packaged in polyethylene terephthalate bottles. The packed product was kept cool (at 5 degrees Celsius). Gadewar, G.R. (2021) developed sorghum incorporated protein rich composite dairy dip. By combining two distinct domains—milk and milk-based goods, along with sorghum—the composite dairy dip was developed. The sorghum grains were first steeped in water at room temperature for 24 hours, then they were germinated for 48 hours, and finally they were instantly dried for 7-8 hours at 80^{0}C. Then, a fine mesh sieve was used to separate the flour from the dry grains. During this time, the specified amounts of butter, MPC-80, curd, Cheddar cheese, salt, water, and stabiliser were weighed. Tri-sodium citrate was the stabiliser utilised. While the butter melted in the double-jacketed steel container, the stabiliser was blended with the water. The stabiliser solution was properly combined with the melted butter after being added. All the dry ingredients were weighed together and mixed in a separate beaker. The dry mix was added to the butter and stirred properly, at set intervals so as to facilitate proper mixing. The heating was continued until the product reached a temperature of 80^{0}C and then the curd was added to it. The whole mix was properly homogenized and then was hot-filled in PP cups and was stored at refrigeration temperature until further analysis.

Effect of Probiotic on Human Health

There are lots of studies on searching the health benefits of fermented foods and probiotics. The list of health benefits accredited to functional food continues to increase and the probiotics are one of the fastest growing categories within food for which scientific researchers have demonstrated therapeutic evidence. Among several therapeutic applications of the probiotics can be cited the prevention of urogenital diseases, alleviation of constipation, protection against traveller's diarrhoea, reduction of hyper cholesterolaemia, protection against colon and bladder cancer, prevention of osteoporosis and food allergy (Krasaekoopt et al., 2003). Host immune modulation is one of the suggested benefits of the consumption of probiotic functional food. Ingestion of LAB has been suggested to confer a range of health benefits including immune system modulation (Bielecka et al., 2002; Tannock, 2001), increased resistance to malignancy and infectious illness (Krasaekoopt et al., 2003). Clinical studies have suggested the efficacy of the administration of probiotics in maintaining the remission of the pouchitis, ulcerative colitis, and Crohn's disease (Gupta and Garg, 2009). Recent studies have also suggested that probiotics could have beneficial effects beyond some metabolic disorders such as hypertension. Primary hypertension is caused by various factors and the predominant causes include hypercholesterolemia. Rising evidence has indicated that lactobacilli and bifidobacteria could cause, when ingested, a significant reduction in serum cholesterol. This is because cholesterol synthesis mainly occurs in the intestines, hence the gut micro flora promote effect son lipid metabolism. Some studies demonstrated that probiotics could promote a decrease in the blood cholesterol levels and increase the resistance of low-

density lipoprotein to oxidation, therefore leading to a reduced blood pressure.

Conclusion

It is concluded that the nutritional and health benefits associated with consumption of nutri cereals incorporated composite based products, it could be useful to develop highly valued probiotic product. proper millet utilization can help us easily to overcome many pre and post transition diseases and can create a healthy and disease-free environment in our country. however, bio –fortification and development of some functional foods can also be a potential alternative.

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