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Composite dairy foods-scope and market scenario: A review

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Abstract

Milk nutrients are efficient in providing nutritional adequacy but is associated with some health related issues attributed to high level of saturated fatty acids and lack of dietary fibre in milk. Traditional practices of fortifying milk with cereals, pulses and fruits, considered helpful in supplementing dietary fibre as well as other micronutrients in the form of composite dairy foods. The objective of this review is to provide knowledge about the traditional composite dairy foods which are manufactured round the globe, novel possibilities developed by utilizing underutilized coarse cereals and millet crops under the category of composite dairy foods and also the popularity gained by the foods based on the synergy of dairy and non-dairy ingredients in food processing market of India and Abroad.

Keywords: composite dairy foods, cereals, millets, whey proteins, fruits and vegetables

Introduction

Among the foods of animal origin, milk occupies a special position in human diet as it is efficient in providing nutritional adequacy and sustaining life during the period of growth and development. Although milk is considered as a complete food but is associated with some health related issues attributed to high level of saturated fatty acids and lack of dietary fibre in milk (Raju and Pal, 2014) [18]. Thus, traditional practices of fortifying milk with cereals, pulses and fruits, considered helpful in supplementing dietary fibre as well as other micronutrients in the form of composite dairy foods.

Composite dairy foods are defined as the foods in which the milk, milk products or milk constituents are integral part of the final product and the constituents not derived from milk are not intended to take the place of milk, milk products or milk constituents. Amongst the traditional composite dairy foods some of the examples are milk-based desserts like kheer (rice pudding), Paysam (southern Indian counterpart of kheer), tarhana (dried food based on a fermented mixture of grain and yoghurt, usually made into a thick soup), kishk (dried fermented cereal-milk mixture) and raabdi (sweet, condensed-milk-based dish) etc. From the last few years, interest has been increased in utilization of millet crops and unprocessed whey for production of composite dairy foods and beverages through entrepreneurship programmes as a source of income to under privileged groups.

The review provide information about the traditional composite dairy foods, novel techniques developed under the category of composite dairy foods, market gained by various foods based on the synergy of dairy and non-dairy ingredients in the food processing market of India and Abroad.

Milk/ millet based complementary foods and beverages

By the age of 6 months, child requires energy dense foods in diet which are commonly known as weaning or complimentary foods. Round the globe, ready-to-eat complementary foods are mostly blends of cereal malt and milk solids because malt prepared from cereals such as wheat and barley is rich source of critical micronutrients which are often found deficient in milk. Wheat gruel is the common complimentary food prepared at home as soft porridge to feed toddlers. Murthy (2015) [14] prepared a complementary food by using malted foxtail millet flour, wheat flour, skim milk powder, whey protein concentrate (WPC), ghee and sugar and compared it with commercially available cereal and milk solid based complementary food (Cerelac). According to his report, maximum overall acceptability was recorded with malted foxtail millet: wheat flour (30:40), 30% skim milk powder, 7% ghee, 2% WPC and 12% sugar in comparison with commercial sample (Cerelac). The storage studies revealed that product was found to be acceptable up to 45 to 60 days and can be produced at industrial as well as household level, due to its simple formulation and good nutritional properties. In this aspect, Modi (2009) [13] manufactured spray or tray dried complementary food based on blends of whey,

skim milk, germinated barley malt, pearl millet and corn flour. Optimized product was heated at 80°C for 15 min by mixing germinated and roasted pearl millet flour @ 20%, barley malt extract @ 15%, maltodextrin @ 5.69%, corn flour @ 5% and whey-skim milk blend (in ratio of 4:1). The heated mix was dried using cabinet drying (70°C for 48 h) or spray drying with inlet air temperature 195°C and outlet air temperature 95°C to obtain a dried product having moisture content < 4 percent. The cabinet dried complementary food contained 1.24, 12.82, 2.02, 0.86, 2.64 and 81.28 percent and spray dried product contained 0.96, 12.83, 2.09, 0.84, 2.57 and 81.55 percent of fat, protein, ash, crude fiber, moisture and carbohydrate respectively. Technology developed is quite simple and moreover, lower processing and raw material cost made it suitable for industrial production.

Traditional milk-cereal based beverages like raabdi is popular among people of Hayana, Rajasthan and Punjab. Shelf life of this popular beverage is limited to two days which makes it unsuitable for industrial production. In this aspect, a product similar to raabdi was manufactured by Modha and Pal (2011)^[12] using pearl millet and shorgum commonly known as bajra and Jowar respectively along with easily available skim milk instead of sour buttermilk for increasing the suitability of industrial production of bajra/ jowar lassi. Barley-milk based probiotic beverage was also developed under the project of ICAR "A value chain on composite dairy foods with enhanced health attributes" by using *L. plantarum* Lp9 strain which possess phytase activity for reducing phytate levels in fermented millet products. Fasreen (2017)^[3] formulated finger millet based probiotic beverage which comprises of health benefits from both finger millet and probiotic. The beverage was formulated with cooked finger millet inoculated with *Lactobacillus casei*431® with the addition of sucrose, fresh cow milk, and cocoa powder, and incubated at 37°C for 2 h, 4 h, and 6 h. Sensory evaluation recorded highest acceptability with fermentation for 4 h.

Whey based snack foods and beverages

Course cereals and millets are healthy, non-glutinous grains and its demand for gluten free is also increasing in bakery formulations, however, only 50 percent of wheat flour replacement is possibly reported because of binding issues associated with non-glutinous millets (Gayathri, 2011)^[4]. Incorporation of skim milk powder, whey proteins or some enzymes along with millet flour in bakery formulations could effectively overcome the binding problems and might help in development of entirely millet based non-glutinous bake house products. Gayathri (2011)^[4] formulated whey protein enriched bajra biscuits with shelf life of 6 months for patients suffering with celiac disease.

Recently, snack foods and RTE puffed, roasted, flaked, shredded and granulated breakfast cereals based on extrusion cooking has gained popularity. Extrusion cooking is versatile in itself and as compared to other cookery procedures; its productive cost is lower. Post-Extrusion changes in food are improvement in protein digestibility, starch gelatinization, destruction of anti-nutrients present in millet crops, thereby enhancing foods digestibility. As per extensive scientific studies, addition of whey proteins in daily consumed snacks is responsible for reducing hypertension, cholesterol, dental problems and cardiovascular disease etc. Onwulata (2001)^[16] recommended the use of whey obtained from cheese for preparation of snack meals to increase the nutritional value of common snack foods. Meena (2016)^[11] formulated a simple technology for manufacturing healthy

snacks with lower cost of processing. These snacks are based on Whey proteins, SMP and pearl millet. She further concluded that extruded snacks based on whey nutrients and millets with lower proportion of fat and moisture could also be marketed as protein rich healthy snack food.

Whey based energy drinks have a huge potential to provide consumer a healthy choice at affordable price. Whey based fruit beverages are usually blends of fruits in juice/pulp form like mango, pineapple, banana, lemon, citrus fruits and berries etc with processed whey. Fruits effectively mask the smell as well as flavour of fresh whey. Naik *et al.* (2009)^[15] manufactured whey based watermelon beverage which is blends of chhana whey and watermelon. Flavor and overall acceptability of such beverage was found to be excellent at refrigerated temperature. Kumari (2009)^[9] prepared whey guava beverage and found that blends of paneer whey and guava in pulp form was acceptable even after 45 days of storage. Kapil (2017) developed a delicious and nutritious beverage from the ripe pineapple juice and whey using *M. arvensis* extract as a natural flavoring agent. The stability of the beverage was found to be excellent for 2 months. Thus, whey based beverages have excellent nutritional and organoleptic properties. Whey beverages are suitable for wide range of consumers - from children to the oldest ones. They have very high nutrient value and good therapeutic characteristics.

Composite milk sweets and desserts

Traditional milk sweets like rasmalai, jalebi, gulabjamun and khoa sweets are popular south-Asian sweets. Sweets with vast variety of ingredients like raw or roasted nuts, different kinds of flour, milk and milk solids, seasonal fruits and dry fruits are best examples of composite milk sweets. Some sweets and desserts are cooked like kheer and Dalia dessert. Milk kulfi is prepared as frozen sweet. Likewise, burfi is a sweet made from milk solids and other ingredients including nuts. Some are based on flours like besan burfi and similarly jalebi is prepared from fermented mix of yoghurt and wheat flour. Dry fruits and nuts are added to sweets as they are considered rich source of protein and also helpful in lowering high cholesterol levels. Mamtha *et al.* (2003)^[10] manufactured burfi by replacing 57% of Bengal gram flour with foxtail millet flour and observed decreased serum glucose and cholesterol levels at significant rate due to addition of foxtail millet flour in burfi. Satyanarayana *et al.* (1990) and Gupta *et al.* (2010)^[5] prepared dehydrated coconut burfi with shelf life of 6 month in laminates which was highly accepted by consumers on sensory evaluation. Kadam *et al.* (2009)^[7] used mango pulp @ 15 percent in preparation of mango burfi which gave natural yellow colour to burfi. Talwar and brar (2015)^[20] prepared pinni by using different combinations with flours. Pinni prepared from wheat flour was highly acceptable on sensory basis where as gram flour based pinni was found to be high in protein content. Milk sweets are popular all over India, and they are manufactured round the globe at large scale.

Scope for composite dairy foods

Expecting profitability for a long term, Indian food industry witnessed encouraging growth in health foods market with introduction of dairy foods and beverages, confectionary products, energy drinks, fruits and vegetables based drinks, Ca fortified juice and ready to eat extruded snacks and breakfast cereals targeting specific health benefits. Utilization of millet crops and unprocessed whey for production of

composite dairy foods and beverages through entrepreneurship programmes is a great source of income for under privileged groups. In this aspect, composite dairy food entrepreneurship unit was established at Amritpur village of Karnal district, consisting of a group of 14 women who earned their livelihoods by selling composite dairy foods with a profit of 8000 per month per women. A lot of technology related to composite dairy foods has already been developed under "National Agricultural Innovation Project of Indian Council of Agricultural Research" and attempts are being made to transfer the technology to potential buyers like industry, SHG, entrepreneurs etc.

Although there is bright scope for value addition, but there are some issues which are concerned with production of composite dairy foods:

- Whey based drinks, a good substitute for carbonated drinks have been associated with some defects like denaturation of whey proteins during heat treatment, whey protein insolubilisation upon thermal processing, salty flavor due to higher mineral content, crystallization of Lactose at refrigerated storage, quality deterioration at room temperature and defect like sedimentation
- Composite foods based on blends of acidic fruits and milk/cereals, curdle milk and also destroy enzymes present in cereals mainly responsible for digesting starch.
- According to Ayurveda, sour fruits in yoghurt can result in alteration of intestinal flora, cause sinus congestion, cold, cough and allergies.
- Also anti-nutrient factors present in nutriceals are responsible for decreasing digestibility and bioavailability of nutrients.
- Micronutrients like iron effects fat rich dairy products by enhancing oxidative reactions. Thus, affects flavor and stability of composite foods.
- Extruded snack food with addition of milk proteins decreases expansion and increases hardness, both of which are highly undesirable in production of composite snack foods. (Choudhury & Gautam, 2003; Onwulata *et al.*, 1998; Choudhury *et al.*, 1998; Onwulata *et al.*, 2001; Heni *et al.*, 2014) ^[1, 2, 16, 17].

Composite dairy foods have a long way to go before they are established as a different category just like functional foods and for achieving consumer acceptance in long run, such issues need to be addressed with scientific knowledge, research and policies before being launched in market place and if not, may cause product failure at market place due to lack of knowledge in product development.

Market of composite dairy foods

Dairy based companies work in coordination with NDDB to alleviate problems of malnutrition in India. They have their own R&D centers where they work, strictly adhering to international standards for developing novel healthy foods based on dairy. Popular foods based on the synergy of dairy and non dairy ingredients are found in the food market of India as well as abroad under various brand names and such foods are relished by group of all ages.

Kwality milk foods limited is highly trusted company which is working since 1996. Recently a composite milk processing plant is set up under this company which manufactures all the dairy products with brand name 'Sona'. They have launched a range of new composite products like badam milk shake, chocolate milk shake and strawberry milk shake with future plans of launching other milk drinks based on blends of milk

and fruits. They are also involved in production of malt based foods which come in market with name of 'MALTO'.

AMUL is a dairy cooperative, having strong hold in the Indian food market, established in 1946 in Anand of Kaira district, Gujrat. By 2001 it achieved the leadership position in marketing of ice-creams and range of other dairy products. Amul markets wide range of fruit based ice-creams and flavoured milk like alphanso mango, fresh litchi, santra mantra, fresh pine apple ice-creams, mango and strawberry based Amul kool flavoured milk, Nutramul malted milk food as a brown beverage.

Mother dairy was established in 1974 and is popular dairy company in India It produces quality products like mother dairy mango lassi, mother dairy blueberry yoghurt, mango yoghurt, strawberry lassi, mango milkshake etc.

Multinational food companies like kraft Cadbury, Glaxo Smith klin and Heinz are major players for malt based foods like bouranvita, horlicks, boost, maltova and complan. Small organizations like Trimona foods inc. owned Trimona Bulgarian yoghurt, flavoured yoghurt like honey ginger cinnamon, raspberry coconut, mango passion fruit and blueberry lavender yoghurt in addition to other varieties sold in stores across the US. Nestles extra creamy and fruity yoghurt like fruit of the forest yoghurt and Yoplait smoothie made with greek yoghurt with mixed berries, frozen fruits and fruit juices are few examples of composite smoothies. Apart from multinational companies, popular restaurants overseas like Blue hill have introduced fruit, vegetable and oat based yoghurts like carrot, tomato, beet root yoghurts and Yummia's apple and cinnamon, date and coconut, fig and cranberry, strawberry and beetroot, apple and carrot based yoghurts are few examples of ready to eat breakfast meals in international market.

Conclusion

Fortifying milk with cereals, pulses and fruits in the form of composite dairy foods is an ancient practice in many regions of the world, known for promoting health attributes by supplementing micronutrients in milk beverage. In addition to traditional composite dairy foods, there have recently been innovative efforts to develop novel composite foods from a variety of substrates, including millets and unprocessed whey which are gaining popularity due to increase in awareness about health foods. On the basis of recent developments, it is anticipated that addition of millet or malt components to milk or milk whey will continue to be a significant component in the area of functional food market. Considerable progress has been made and further more is required to exploit full potential in this area ranging from selection of appropriate concentration of material, hygienic production with appropriate processing parameters, sensory evaluation by testing consumer acceptance, improvement in shelf life by production of long life instant mix and developing technology with scientific knowledge.

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