Ready to Reconstitute Kheer/Payasam Mixes

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Payasam and *kheer* forms an integral part of cultural ethos of south and north India, respectively and is an inseparable part of almost every ritualistic ceremony including weddings and religious functions. *Kheer* is a traditional Indian delicacy prepared from the partial dehydration of whole milk from the mixture of whole milk, sugar and cereal grain (rice being the most common), in an open pan over a direct fire (De *et al.*, 1976). The word *Kheer* is derived from the Sanskrit word '*ksheer*' for milk and '*kshirika*' for any dish prepared with milk. It has different names in different parts of India; such as in north western India, it's called as '*kheer*', in south, its named as '*payasam*', in eastern parts of India, its known as '*payas*', in northern region as '*phirni*', '*kheech* in Mewar region and '*payesh*' in Bengal (Aneja *et al.*, 2002).

History of consumption of kheer in Indian

Cereal based dairy desserts have a much-extended history of consumption and are an important segment of milk-based desserts relished by Indian population. Preparation of Indian traditional milk-based puddings include, mixture of cereals, millets, pulses and fruits with milk. Milk based puddings such as *kheer* and *payasam* are mentioned in the great Indian epics, Ramayana and Mahabharata of Hindu mythology. *Payasam* made with vermicelli, termed as *Sarvaligeya payasam* and sago or *sabudana payasam* referred as bead like *payasam* have been quoted in Kannada literature of the 13th century. *Phirni* is known to be introduced to India from Middle East and Persia by Moghuls during 14th century (Kumar *et al*, 2015).

Classification of Indian kheer types

The milk-based puddings are classified based on the raw material used, process involved in preparation and additives used. The raw material used in preparation plays a major role in the classification of milk-based puddings. The classification of milk-based puddings with respect to the characteristic ingredients used and region-specific terminology is given in Table 1. *Kheer* is majorly prepared using rice whereas, *payasam* is prepared using rice, pulses, millets, fruits and seeds. *Payasam* is similar in preparation to that of *kheer*. The extent of concentration of milk is more in *kheer* as compared to that of *payasam*. However, *dalia* is prepared using wheat and milk (Jha *et al*, 2012).

Table 1: Classification of Indian traditional milk-based puddings

Type	Characteristic ingredients used	Regional names of the puddings
Cereal based	Rice	*Kheer*, *Palada payasam*, *Paal payasam*, *Phirni*, *Avalakki payasam*, *Dodol*, *Chawak ki kheer*, *Gil-e-Firdaus*, *Halu kheeru*,
	Wheat	*Dalia*, Vermicelli *payasam*, *Godhi payasam*
Pulse based	Green gram Bengal gram	*Hesaru bele payasam* *Kadale bele payasam*
Millets based	Finger millet Barnyard millet	Ragi *payasam* *Navane payasam*
Seeds based	Poppy seeds	*Gasagase payasam*
	Bamboo seeds	Bamboo seeds *payasam*

Tuber based	Tapioca	*Sabakki payasam, sabudana payasam, Kaddu ki kheer*
Fruits based	Jackfruit Mango Apple	*Halasina payasam* *Mavinahannu payasam* Apple *payasam*
	Bottle guard Carrot Pumpkin	Bottle gourd *payasam* Carrot *payasam* Pumpkin *payasam*

(Unnikrishnan *et al,* 2000; Sinha, 2017; Jha *et al,* 2012)

Need for convenience mixes of payasam/kheer

Conventional *payasam/kheer* preparation methods are tedious and time consuming, as product preparation often involves slow cooking of the granules in milk and sugar, until desired product properties are achieved like colour, taste and consistency (Unnikrishnan *et al.,* 2000). Technical solutions in the form of dry mixes in this product category meet the specific consumer demand for convenient products with improved quality and shelf life. In addition, standardization of mechanical unit for process technology provides an opportunity to upgrade process technology for large-scale production in a controlled hygienic environment. Due to rapid urbanization and changing lifestyles, convenience foods are becoming increasingly popular. Convenience mixes for many traditional products have been developed because of their convenience in terms of easy preparation, improved quality, storage and ready availability. Various manufacturing processes are used for instant dry mixes such as dry blending method, dry blending method cum spray coating method, extrusion cooking method, spray drying method, tray drying method and dry crystallization method. Further, recently, consumers are becoming more inclined towards the convenience, ready to eat and ready to reconstitute instant dry mixes.

Approaches for development of convenience mixes of payasam/kheer

The different methods used for preparation of convenience mixes of kheer are listed in Table 2. Instant mixes have been formulated using dry-blending technique, which is one of the most acceptable methodologies offering industry friendly solutions. The technique involves mixing of solid or powdered ingredients in optimized proportions which reduce labour, increase convenience and provide easy adaptation. The instant *kheer* mix based on pearl millet was optimized by Bunkar *et al., (*2014). In this process, pre-treated *pearl* millet grains were prepared from hulled and washed grains, which were dried under the sun for 1 hour, followed by autoclaving (121°C/15 min) to soften the grains. The satisfactory quality instant RTR blend was formulated by dry blending pre-treated pearl millet seeds (20g), powdered sugar (15g) and dairy whitener (30g). Kashyap *et al.,* (2018) developed the technology to produce a dried *kheer* mix based on kodo millet. The dry blending approach has certain limitations such as the final reconstituted product is not very similar to traditionally prepared *kheer/payasams*.

There is another approach of dry crystallization, which helps in developing instant convenient dry mixes. The resulting reconstituted product prepared by this method is very similar to the traditionally prepared *kheer/payasam* (Deshmukh *et al.,* 2020). This process is commonly used to create sugar-rich milk-based instant mixes. It involves using thermal energy to mix the ingredients and concentrate them into a uniform mass, followed by cooling, seeding and crystallization by cooling. The desired particulates are obtained by this process, which retains their shape even after reconstitution, thereby resulting in an acceptable quality

kheer/payasam (Deshmukh *et al.,* 2020). Some of the *payasams* developed by the dry crystallization approach include *palada payasam* dry mix (Unnikrishnan *et al.,* 2003), *gasagasa payasam* dry mix (Nath *et al.,* 2004), *avalakki payasam* dry mix (Nath *et al.,* 2008) and *pal payasam* dry mix (Aisha, 2019).

Conclusion

Milk based pudding are being currently prepared in domestic level with regional and seasonal importance. The nutritional properties of the milk-based puddings lead commercial manufactures to explore technologies for the production on a commercial scale with improved shelf life. Combination of characteristic ingredients in the milk-based puddings, enhances the nutritional profile of the product with enhanced bioavailability and digestibility. The method of manufacture employed, enhances the sensory and rheological properties of the milk-based puddings. There is a huge scope for development of convenience mixes for millet based *payasam or kheer*. Among the various approaches used for preparing instant mixes, dry crystallization is expected to yield good quality product in terms of better appearance, reconstitution and sensory attributes. The process also extends shelf life of dry mix with a possibility of mechanization and scale up.

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Table 2: Methods of kheer mix preparation

S. No	Method of preparation	Important features
1	**Dry blending**	Ingredients are dried and then mixed together to obtain the ready to reconstitute mixes. This technology would make the product much cheaper, less laborious, convenient, and easily available at all places.
2	**Drying - cum-instantization technique**	In this approach, first the raw material is cooked or semi-cooked and later it is dried to attain an instant powder formulation. It involves the use of novel techniques such as roller drying, tray drying (both atmospheric and under vacuum), spray drying, dry-blending and drying-cum-instantization processes to convert dairy products to shelf stable dry mixes.
3	**Dry-crystallization process**	Dry crystallization is a concentration process that has recently been reported to produce quick dry mixes of dairy confections such as *payasam/kheer*. The process involves the concentration of the solid food ingredient along with milk and sugar to the supersaturation stage and then cooling, so that the sugar crystallizes over the surface of the solid food ingredient. The importance of using this method stems from its better reconstitution, easier manufacturing, mechanized manufacturing and higher shelf life.

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