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## Process optimization for preparation of Khoa utilizing whey protein concentrate

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### Abstract

Khoa was prepared by incorporating WPC. Whey proteins could be produced with wide range of functional properties. Considering excellent functional characteristics of WPC, the efforts were made to assess the "Sensory qualities of Khoa prepared by using WPC". According to treatments, samples of Khoa were prepared and evaluated for sensory and physico-chemical quality. The present study was found that the WPC added at the level of 3%, 5% and 7% Sensory evaluation was carried out and data obtained were analyzed by Completely Randomized Design (CRD).

The treatment T<sub>2</sub> (Khoa + 5% of WPC) was rated best among all Khoa samples and was comparable to control Khoa. The chemical composition of Khoa prepared with 5% addition of WPC contain 19.20% fat, 0.69 acidity, 27.57% protein, 19.13% lactose, 4.67% ash, 6.00 pH, 77.01% total solid, 23.00% moisture.

It was observed that the mean score for overall acceptability for treatments T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 8.17, 8.34, 8.48 and 7.94 respectively. The maximum score was obtained for the treatment T<sub>2</sub> (8.48) and the minimum score was obtained for the treatment T<sub>3</sub> (7.94). The addition of WPC in Khoa affected the colour and appearance, flavour, body and texture significantly.

**Keywords:** khoa, WPC, sensory evaluation

### Introduction

India produces approximately 165.4 million tonnes milk production and per capital availability of milk is 355gms/day (Anonymous, 2017)<sup>[1]</sup>. Around 50 per cent of total milk produced in India is converted to traditional milk products (Bandopadhyay *et al* 2006). Khoa or Mawa is an important indigenous heat desiccated, partially dehydrated milk product which is very popular in large section of population throughout the country.

Dairy industry has emerged as a fast growing and large scale producer of novel and nutritionally enriched milk based products. Byproduct utilization is gaining significance for profitable running in dairy industries. Whey is one of the important byproduct and is of great concern as it possesses high BOD ranging from 30 to 60g O<sub>2</sub>/L. Indigenous milk products i.e. fermented, acid coagulated and byproducts like whey, skim milk, butter milk, ghee residue are noticeable since time immemorial. Right now these milk based products and byproducts are reproducing into various newer generation products with improving its characteristics and dietetic properties.

Depending on the end use and the quality of the milk used, mainly 3 commercial types of Khoa are identified namely Pindi, Dhap and Danedar which differs in composition, texture and quality (Sawhney *et al* 2000)<sup>[11]</sup>.

Khoa is highly nutritious food having 90% digestibility coefficient of proteins and 69% biological value. Although milk is a poor source of iron, Khoa provides adequate amount of iron which is incorporated during the process of Khoa preparation in an open vessel made up of iron.

Whey proteins are supplemented to provide antimicrobial activity, immune modulation, improved muscle strength and body composition, and to prevent cardiovascular disease and osteoporosis.

Whey proteins have different fractions, some of them are in large concentration like ( $\beta$ -lactoglobulin,  $\alpha$ -lactalbumin, serum albumin, immunoglobulins) and others are in low concentration, such as (lactoferrin, lactoperoxidase, lysozyme, etc). WPC is rich in essential amino acids such as lysine, tryptophan, cysteine and methionine. Whey protein is an acceptable protein source for healthy pregnant women and children provided they are not allergic to dairy

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proteins. It is highly soluble and very easy to digest. This is one of the reasons it is commonly used in infant formula and protein supplements for medical use. It was found to inhibit the growth of tumors more effectively than other food proteins (Kassem, 2015) [7].

Whey Protein Concentrate-80 (WP-80, which means it contains 80% proteins in its composition) is a rich source of peptides and amino acids obtained from milk, which are used in the production of functional food (Krol, *et al.* 2008) [8].

Whey protein concentrates (WPC) are an important protein source having excellent functional characteristics such as emulsification, gelling and foaming. An important functional property of WPC is their ability, under appropriate conditions to form heat induced viscoelastic gels capable of immobilizing large quantities of water and other food components (Ikeda and Foegeding, 1999) [5].

WPC have been used in Khoa, not with an intention to reduce the fat content of product, but to improve the physical attributes particularly of cow milk Khoa (Patel *et al* 1993) [9].

## Materials and Methods

### Milk

The fresh clean, composite cow milk was procured from Research cum Development Project on Cattle, Department of Animal Husbandry and Dairy Science, M.P.K.V., Rahuri.

### Whey Protein Concentrate

The 80% whey protein concentrate was made available from market, Ahmednagar.

### Chemicals

All the chemicals used in study for the analytical purpose were of analytical (AR) or guaranteed reagent (GR) grade by Merk, India Ltd and Glaxo India Ltd.

### Beaker trials

Khoa was prepared by using cow milk. The resultant Khoa blended with WPC of various levels in preliminary trials based on weight of Khoa. Accordingly, 0% (Control), 1%, 3%, 5%, 7%, 9% and 11% WPC was used in the preliminary trials. On the basis of sensory evaluation the final experimental trials were selected for further study.

### Main experimental trials

On the basis of sensory evaluation in preliminary trials 3%, 5% and 7% level were finalized. The Khoa was prepared as per the procedure described by Sachdeva and Rajorhia, (1982) [10] with some modification.

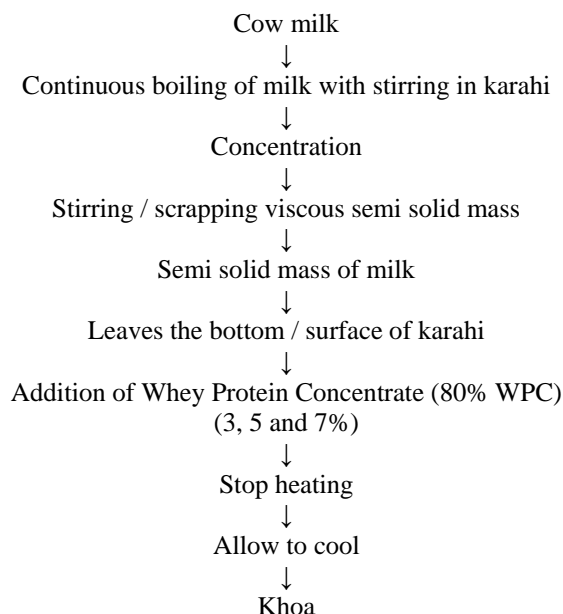
## Sensory analysis

The sample of Whey Protein Concentrate added Khoa were subjected to sensory evaluation for colour and appearance, body and texture, flavour and overall acceptability by adopting 9- point Hedonic scale as per IS: 6273, Part- II (1971). A panel of semi-trained judges carried out the sensory evolution.

## Statistical design

The experiment was laid down in Completely Randomized Design (CRD) with four replications. Data obtained were analysed as per Snedecor and Cochran, 1994.

## Flow Diagram for Preparation of Khoa using WPC



## Result and Discussion

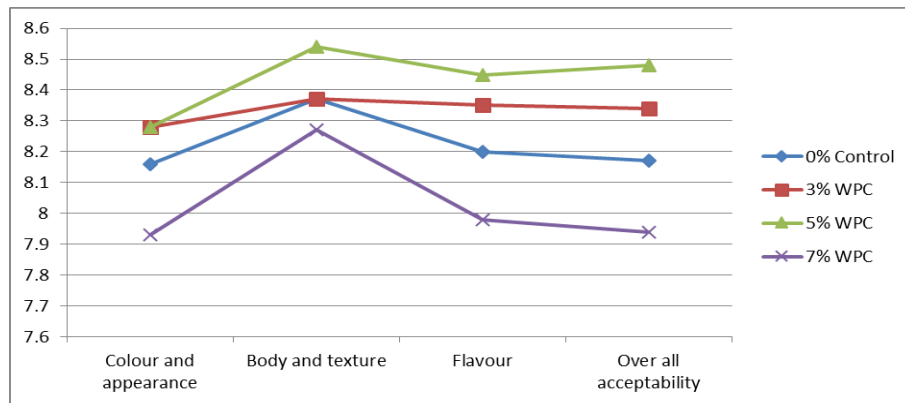
In order to determine the quality as well as acceptability of WPC added Khoa a sensory evaluation has been carried out.

### Sensory evaluation of WPC Khoa

Sensory evaluation of any consumable product is the best method of judging its acceptability by the consumers. The assessment was carried out by studying the characters like colour and appearance, body and texture, flavour and overall acceptability of product by the panel of judges by using "Nine Point Hedonic Scale" score card. Each sample was bearing a code number so as to avoid its identity and have impartial results.

**Table 1:** Effect of addition of whey protein on sensory attributes of Khoa

Percent addition of WPC	Sensory characteristics			
	Colour and appearance	Body and texture	Flavour	Over all acceptability
T <sub>0</sub> (Control)	8.16 <sup>a</sup>	8.37 <sup>b</sup>	8.20 <sup>c</sup>	8.17 <sup>c</sup>
T <sub>1</sub> (3%)	8.28 <sup>a</sup>	8.37 <sup>b</sup>	8.35 <sup>b</sup>	8.34 <sup>b</sup>
T <sub>2</sub> (5%)	8.28 <sup>a</sup>	8.54 <sup>a</sup>	8.45 <sup>a</sup>	8.48 <sup>a</sup>
T <sub>3</sub> (7%)	7.93 <sup>b</sup>	8.27 <sup>c</sup>	7.98 <sup>d</sup>	7.94 <sup>c</sup>
SE	0.068	0.022	0.026	0.025
CD@5%	0.210	0.068	0.080	0.078



**Fig 1:** Effect of addition of whey protein on sensory attributes of Khoa

### Colour and appearance of WPC added Khoa

Colour and appearance is important sensory attributes of milk product. Acceptance of any milk product by customer largely depends upon colour and appearance of the product. Colour of normal cow milk Khoa is slightly yellowish. Any alteration in this colour may indicate addition of foreign colouring matter or microbial growth

The score obtained at 3% and 5% incorporation of WPC is more than the control, which indicated that the product was superior to control, further addition to 7% did not aid in improving the score. From the results, it was observed that the Khoa with 3 and 5 per cent WPC showed pale yellow colour with clear and clean appearance which was liked very much by the judges.

### Body and texture score of WPC added Khoa

Body and texture are another most important criteria to judge acceptability of the product. Smooth texture is the desirable feature of Khoa

The highest score (8.54) was obtained by the added Khoa 5% WPC which was more than the control. This could be due to the increased water holding capacity, fine granular texture and good mouth feel imparted by the whey protein concentrate. It seems that WPC provided adhesive and binding action up to 5 per cent level of its addition. At 7 per cent level of addition, Khoa become sticky. WPC acts as binding force and helps in improving body and textural attributes of Khoa only up to certain limit. Its addition beyond certain point may adversely affects on the final product.

### Flavour of WPC added Khoa

Flavour is an important criterion for acceptance of any food article. Flavour is combined effect of "taste" and "smell". Every milk product has its typical flavour. Cow milk has got typical salty flavour.

The score with respect to flavor increased with increase in level of WPC from 3% (8.35) to 5% (8.45) further addition to 7% WPC caused decrease in score(7.98). The increase in the score could be due to functional properties of whey protein concentrate.

### Overall acceptability of WPC added Khoa

The overall acceptability of the Khoa as influenced by different levels of WPC have been recorded and statistically analyzed. Increases in WPC level up to 5% there was significant effect on the quality of Khoa as compared to control.

### Conclusion

It is concluded that, the Khoa prepared with addition of 5% WPC was found to be highly acceptable. Whey solids in the form of whey protein concentrate can effectively be used in the Khoa preparation, without having any adverse effect on sensory attributes.

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