

## Suitability of Concentrated Milk for Yoghurt Preparation.

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### Research Article

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#### ABSTRACT

Yoghurt was prepared from toned mixed milk (TS 11.5%) vacuum concentrated to 23% TS, using yoghurt culture ( mixed culture of *S. thermophilus* and *L. bulgaricus*) and its quality was evaluated by acidity, pH, penetrometer – hardness, wheying – off and sensory characteristics. The overall acceptability of yoghurt produced from concentrated milk was significantly low due to salty taste , very firm, leathery body and textural characteristics. Yoghurt produced from concentrated milk with 7.5% added sugar (sucrose) had less acidic taste and loose body and textural characteristics compared to control sample. However, the concentrated milk diluted to toned milk solids level, with and without added sugar yielded good quality yoghurt whose physico-chemical quality characteristics were comparable to those of toned milk yoghurt.

#### INTRODUCTION

Indian dairy industry is in a dynamic state with ever increasing market competition. Presently about 85 % of the milk procured by the dairies is utilized for market milk operations, which involves processing, packaging and transportation of liquid milk, bulk of which is constituted by water. This implies that most of the energy and money are spent for water which seems to be a redundant expenditure. Hence, it was proposed to reduce the water content of milk which could minimize wastage of energy and money in such operations. Further, this could aid in alleviating the environmental pollution problem, besides offering the consumer the convenience of having milk the composition of which can be altered as per the requirement. Moreover, the concentration of milk has the advantage of using the milk for production of various milk - based products. Yoghurt is one such product which is getting popularity particularly among urban consumers. The present study was therefore undertaken to assess the suitability of concentrated milk for the preparation of set yoghurt as it is gaining popularity with several entrepreneurs.

#### MATERIALS AND METHODS

##### Milk

Cow and buffalo milk received from the Institute farm was used in all the trials after mixing in equal proportion (mixed milk).

##### Standardisation

The mixed milk was standardized to 3 % fat and 8.5 % SNF by using skimmed milk.

##### Concentration

Standardised milk after heat treatment at 75 °C / 30 sec was concentrated by evaporation under vacuum (600 Hg) in a batch type vacuum evaporator (APV model) to half its volume so that the TS content was in the range of 23 %.

##### Culture

For the production of Yoghurt, the Visbyvac yoghurt - 709 culture (Germany) was used.

## **Preparation of Yoghurt**

Yoghurt was prepared from different types of milk as detailed below:

### *Concentrated milk (CM)*

CM was heated to boiling, cooled to about 40°C and inoculated with 3 % yoghurt culture and poured into polystyrene cups after thorough mixing and incubated at 45°C for about 5 h. The cups were then stored in a refrigerator (6 – 8°C).

### *Toned milk (TM) and diluted concentrated milk (dil. CM)*

Yoghurt was also prepared from toned milk and concentrated milk diluted to toned milk standards (dil. CM) by using potable water.

### *Preparation of sweetened Yoghurt*

To study the effect of sugar, Yoghurt was also prepared from CM, TM and dil. CM, each added with 7.5% sugar. All Yoghurt samples were evaluated for colour and appearance, body & texture, flavour and overall acceptability by a panel of judges on a 9 point hedonic scale.

## **Analysis <sup>[2]</sup>**

### *Acidity*

The acidity was estimated by BIS.

### *pH*

pH of yoghurt was measured by using a digital pH meter (Systronics – 41 model).

### *Firmness*

The firmness of Yoghurt samples was measured by using a cone penetrometer (AIMIL make, Calcutta) by using a cone weighing 24.5 gm. The depth of penetration measured in mm X 10<sup>-1</sup> indicated the firmness of the product. The values obtained were inversely proportional to firmness.

### *Syneresis*

The Wheying off of Yoghurt samples was evaluated by taking 10 g of yoghurt in solubility index tubes and centrifuging at 5000 rpm / 10 min. The amount of clear whey separated was measured.

### *Fat, TS and Ash*

The fat, TS and ash contents of the products were determined by BIS method.

### *Protein Content*

The protein content was measured by formal titration method.

### *Sensory Evaluation*

The sensory evaluation of yoghurt was carried out by a select panel of judges from the Dairy Technology Section of the Institute by using a 9 point hedonic scale. A score of 1 indicated least acceptability (lower end) and a score of 9 indicated most acceptability (higher end) on the hedonic scale.

## **Statistical Analysis**

The data was subjected to Randomised Block Design Analysis using MSTAT package.

## RESULTS AND DISCUSSION

The sensory scores of yoghurt made from Concentrated Milk (CM), toned milk (TM) and dil CM indicate that the yoghurt prepared from CM scored significantly lower score for overall acceptability in comparison to the other two samples (Table 1). This was mainly attributed to the salty and acidic taste of the CM - yoghurt as reflected in significantly lower flavour scores. However, there was no significant difference between the samples with respect to body and texture and colour and appearance. Further, no significant difference was observed in any of the sensory characteristics between the TM and dil CM indicating that it is possible to obtain good quality yoghurt by diluting concentrated milk to TM composition. The physico chemical characteristics showed a marked difference in pH and acidity between the samples (Table 2). The whey separation was significantly lower in the case of yoghurt prepared from concentrated milk compared to other two samples and the penetration value which is inversely proportional to firmness was lower compared to the TM and dil CM samples. The results were on expected lines as reported earlier that increasing solids level increases firmness and decreases whey separation [1,4]. The increase in acidity in concentrated milk could be attributed to the increase in the milk solids not fat which contributes for higher titre value [6]. This variation could be ascribed to higher buffering capacity of CM caused by the increase in solids level [3].

The CM yoghurt was criticized as acidic and salty which could be ascribed to higher acidity and higher mineral content; the mineral content of concentrated milk was almost twice that of toned milk (Table 3).

Addition of sugar did not markedly alter the trend in the sensory scores than that of the products prepared without the addition of sugar (Table 4). However, there was significantly lower score observed in the case of concentrated milk yoghurt with respect to flavour and body and texture scores. One of the reasons which could be ascribed for the lower scores of yoghurt with added sugar could be due to the lower acid development in concentrated product. Even though the acidity values were higher due to increase in the solids level, that did not contribute towards minimum acidic flavour required in a product like yoghurt. The lower acidity also could be due to the reduced level of lactose fermentation due to higher solids level as has been observed by Ray and Srinivasan [5] that the lactic acid bacteria produced maximum acidity in the absence of sugar and increase in sugar concentration decreased the acid production. The flavour of yoghurt with added sugar from other two milks, was however, well accepted without any significant difference. The firmness and syneresis observations were similar to those of yoghurt produced without the addition of sugar (Table 5). The physico-chemical characteristics of yoghurt with added sugar indicated that the acid development was lower in CM + Sugar as reflected by pH and acidity.

**Table 1: Sensory scores of yoghurt made from toned milk, diluted concentrated milk and concentrated milk**

Sensory characteristics	Toned milk $\pm$ sd	Diluted concentrated milk $\pm$ sd	Concentrated milk $\pm$ sd	Isd 0.05
Colour & appearance	7.15	7.33	7.88	-
Flavour	7.35 $\pm$ 0.44 <sup>a</sup>	7.60 $\pm$ 0.37 <sup>a</sup>	6.33 $\pm$ 1.19 <sup>b</sup>	1.023
Body & texture	6.98 $\pm$ 0.57	7.30 $\pm$ 0.44	7.05 $\pm$ 0.76	-
Overall acceptability	7.00 $\pm$ 0.71 <sup>a</sup>	7.53 $\pm$ 0.26 <sup>a</sup>	6.53 $\pm$ 0.78 <sup>b</sup>	0.813

Note : Values with a different superscription in a row are significantly different at  $P \leq 0.05$

**Table 2: Physico-chemical characteristics of yoghurt made from liquid milk, diluted concentrated milk and concentrated milk**

Sensory characteristics	Toned milk $\pm$ sd	Diluted concentrated milk $\pm$ sd	Concentrated milk $\pm$ sd	Isd 0.05
pH	4.29	4.25	4.59	-
Acidity (% lactic acid)	0.86	0.92	1.60	-
Penetration value (mm X 10 <sup>-1</sup> )	242.16 $\pm$ 8.01 <sup>a</sup>	221.33 $\pm$ 30.99 <sup>a</sup>	111.83 $\pm$ 17.47 <sup>b</sup>	40.93
Wheying off (ml)	4.33 $\pm$ 8.01 <sup>a</sup>	4.23 $\pm$ 0.25 <sup>a</sup>	1.7 $\pm$ 0.29 <sup>b</sup>	0.73

Note : Values with a different superscription in a row are significantly different at  $P \leq 0.05$

**Table 3: Composition of toned milk and concentrated milk**

Sample	Fat, %	Protein, %	Lactose, %	Ash, %	Total solids, %
Toned milk	3	3.49	4.84	0.72	12.05
Concentrated milk	6	6.97	8.67	1.58	23.23

**Table 4: Sensory scores of yoghurt made from toned milk, diluted concentrated milk and concentrated milk with added sugar (7.5%)**

Sensory characteristics	Toned milk $\pm$ sd	Diluted concentrated milk $\pm$ sd	Concentrated milk $\pm$ sd	Isd <sub>0.05</sub>
Colour & appearance	7.13	7.43	7.55	-
Flavour	7.08 $\pm$ 0.75 <sup>a</sup>	7.53 $\pm$ 0.38 <sup>a</sup>	6.35 $\pm$ 0.98 <sup>b</sup>	0.868
Body & texture	7.11 $\pm$ 0.69 <sup>a</sup>	7.38 $\pm$ 0.37 <sup>a</sup>	6.85 $\pm$ 0.72 <sup>b</sup>	0.418
Overall acceptability	7.23 $\pm$ 0.40 <sup>a</sup>	7.55 $\pm$ 0.30 <sup>a</sup>	6.48 $\pm$ 0.85 <sup>b</sup>	0.627

Note : Values with a different superscription in a row are significantly different at  $P \leq 0.05$

**Table 5: Physico-chemical characteristics of yoghurt made from liquid milk, diluted concentrated milk and concentrated milk with added sugar (7.5%)**

Sensory characteristics	Toned milk $\pm$ sd	Diluted concentrated milk $\pm$ sd	Concentrated milk $\pm$ sd	Isd <sub>0.05</sub>
pH	4.31	4.24	5.09	-
Acidity (% lactic acid)	0.726	0.690	0.996	-
Penetration value (mm $\times 10^{-1}$ )	249.80 $\pm$ 12.00 <sup>a</sup>	214.50 $\pm$ 8.85 <sup>a</sup>	182.83 $\pm$ 37.22 <sup>b</sup>	49.12
Wheying off (ml)	4.33 $\pm$ 0.29 <sup>a</sup>	4.30 $\pm$ 0.76 <sup>a</sup>	2.7 $\pm$ 0.25 <sup>b</sup>	0.67

Note : Values with a different superscription in a row are significantly different at  $P \leq 0.05$

### CONCLUSION

Yoghurt produced from concentrated milk diluted to toned milk standards was similar to yoghurt in physico-chemical and sensory characteristics in comparison to the one produced from fresh toned milk. The overall acceptability of yoghurt produced from concentrated milk was significantly lower due to salty taste, leathery body and texture characteristics. Yoghurt prepared from concentrated milk with the addition of 7.5% sugar resulted in least overall acceptance scores due to inferior flavour and body and texture characteristics. The physico-chemical properties of yoghurt prepared from toned milk and concentrated milk diluted to toned milk standards were similar. Addition of sugar at 7.5% level did not result in any marked difference in quality parameters in comparison to yoghurt produced without the addition of sugar. The results indicate the possibility of utilizing concentrated milk after dilution for yoghurt making with quality as good as yoghurt prepared from toned milk.

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