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## Pilot consumer study and costing of fortified whey kefir drink: A healthy substitute for carbonated beverages

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### Abstract

In this article, pilot consumer study of the developed fortified whey kefir drink is presented along with the calculation of its costing and nutritive value. Fortified whey kefir drink was prepared with the addition of inulin (4%), WPC (1%) and minerals like zinc (30ppm) and iron (20ppm) along with sugar and pineapple flavour to increase the palatability and was packed in 200ml poly ethylene pouches using the FFS machine. Consumer pilot study was conducted among 100 consumers using a performance questionnaire. The study revealed that the developed fortified Whey Kefir drink was well acceptable among the consumers for its thirst quenching effect and prickly sensation. The costing (₹10) and nutritive value (92.23kcal) also revealed that it is a cheap and healthy substitute for costly commercial carbonated soft drinks.

**Keywords:** Whey kefir, consumer study, questionnaire, nutritional analysis, costing

### Introduction

The ongoing pandemic situation has made us realize the importance of functional foods that has immense nutritional and health benefits. Consumers are in search for a one stop solution of food that satisfies their palatability along with providing them with the much needed immunity and health benefits. Henceforth, there has been a paradigm shift related to the consumption of foods, wherein consumers are trending to explore the newer face of traditional foods enriched with nutrients and improved functionality. One such functional probiotic drink with wide array of health benefits and nutritive value is Kefir, traditionally known as “drink of bliss”. Traditionally, kefir is made using kefir grains as a starter <sup>[1, 2, 3]</sup>. They are composed of an inert matrix made up of polysaccharides and proteins, in which a relatively uniform and definite microbial community exist together in a complicated symbiotic relationship having more than 30 micro flora which is mainly populated by lactic acid bacteria, followed by acetic acid bacteria, and then yeasts <sup>[4, 5, 6]</sup>.

Effective by-product utilization for the production of Kefir, gives an opportunity to reduce the cost, making it more affordable to the larger public and also helps in the efficient usage of its nutrients thereby reducing the environmental load. Whey, being the by product. Certain studies have also proved the suitability of whey for the preparation of Kefir like beverages <sup>[7, 8, 9]</sup>. India produces to about 3 million tonnes of whey per annum containing about 2 lakh tonnes of valuable milk nutrients which is mainly channa and paneer whey <sup>[10]</sup>. The growing menace of environmental pollution and the huge loss of nutritional solids resulting due to gross wastage of whey, stress the need to explore the possibilities of utilization for human use. Successful attempts were made for preparation of a novel Whey Kefir beverage from cheese whey and found it to be feasible and organoleptically acceptable and also suggested that the flavour could be further improved with the addition of 20% milk and the termination of fermentation at pH 4.1 <sup>[11]</sup>. Some researchers also tested the technological potential of various ratios of lactic bacteria, yeasts and acetic acid bacteria isolated from kefir grains starter culture for Cheese whey fermentation <sup>[12]</sup>. The best results were obtained when all the starter cultures were combined, i.e. bacterial mixed yeast fermentation. Thus the potential of kefir grains in production of healthy beverage from Cheese whey was instituted and the beverage was naturally carbonated with good organoleptic quality and tasted similar to that of artificial butter milk.

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The above results confirmed the good acceptability of usage of whey as a suitable replacement for milk for the preparation of Kefir by kefir grains containing mixed bacterial and yeast cultures.

In the present study, an attempt was made to develop fortified whey kefir drink with the addition of inulin (4%), WPC (1%) and minerals like zinc (30ppm) and iron (20ppm) along with sugar to increase the palatability and packed in 200ml poly ethylene pouches using the FFS machine.

## Materials and Methods

### Materials

Fresh cheese whey was obtained from Experimental Dairy of ICAR- National Dairy Research Institute, Bengaluru. Kefir grains were obtained from U.S. and was activated according to the available literature<sup>13</sup>. Additives like Inulin and WPC were procured from M/s DKSH India Pvt. Ltd., Bengaluru and were added to enhance the functionality of the product. Iron in the form of Ferric ammonium citrate and Zinc in the form of Zinc sulphate were procured from M/s Thermo Fisher Scientific, Mumbai. Food grade pectin, crystalline cane sugar and pineapple flavour were purchased from local market of Bengaluru, India for its use in Whey Kefir drink preparation.

### Whey Kefir drink preparation

Cheese whey forewarmed (35-40 °C), filtered and added with 0.25% pectin to stabilize the product. Inulin @ 4%, WPC @1%, zinc as Zinc sulphate at 30 ppm and iron as Ferric

ammonium citrate at 20ppm were dissolved in calculated amount of whey and added to the forewarmed cheese whey. The contents were then subjected to heat treatment to 72-75°C for 5-7 min. with intermittent stirring followed by cooling (28-30 °C) and filtration to remove any coagulated particles. Kefir grains was inoculated to the whey at a level of 4 g/L of whey and incubated at 30 ± 2 °C for about 22-24 h. The product was thoroughly stirred and sieved through nylon sieve of 1/20 inch mesh size. After the separation of kefir grains, the product was again incubated for 22-24 h at 30±2 °C for the production of prickly sensation. Concentrated sugar syrup of 50 ° Brix was added to the finished product @ 15% along with pineapple flavour. The resulting fortified Whey Kefir drink was then packed in polyethylene pouches and stored at 7-8 °C. Control Whey Kefir drink was prepared without the addition any additives except pectin @ 0.25% and sugar and flavour using the same above procedure.

A performa questionnaire (Table 1) was prepared describing the characteristics and intended use of the product followed by a questionnaire to record the details of the consumers and their reaction towards the served fortified Whey Kefir drink, which were distributed during summer to potential consumers of SRS, NDRI and through milk parlour of the Station. Consumers were first briefed about the health benefits and the nutritional aspects of the prepared whey kefir drink and the suitability of it as a replacement for commercially available carbonated beverages.

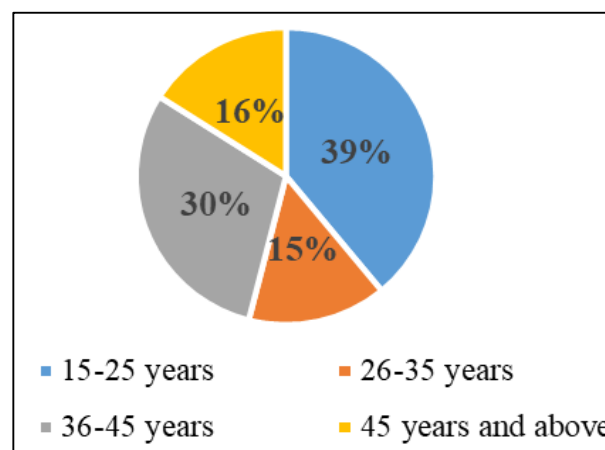
**Table 1:** Questionnaire on the quality attributes of fortified whey kefir drink

1.	Preference of the product	Like Dislike
2.	Degree of likeness of the product	Excellent Very good Good Satisfactory
3.	Willingness to buy the product	Will buy May buy Will not buy
4.	Thirst quenching effect of the product	Yes No
5.	Your suggestions to improve the taste of the product	
6.	Name:	Age:
	Occupation:	
	Place:	

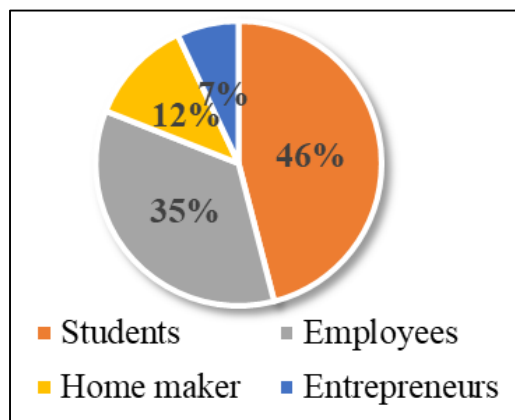
## Results and Discussion

### Pilot Consumer Study

The developed fortified Whey Kefir drink was prepared by the incorporation of 4% inulin, 1% WPC, 30ppm zinc sulphate and 20ppm of ferric ammonium citrate and packed in 200ml poly ethylene pouches using the FFS machine. The packets were then thermized at 55°C for 5min. and then cooled and stored at refrigerator. A performa questionnaire (Table 1) was prepared describing the characteristics and intended use of the product followed by a questionnaire to record the details of the consumers and their reaction towards the served fortified Whey Kefir drink, which were distributed during summer to potential consumers of SRS, NDRI and through milk parlour of the Station.

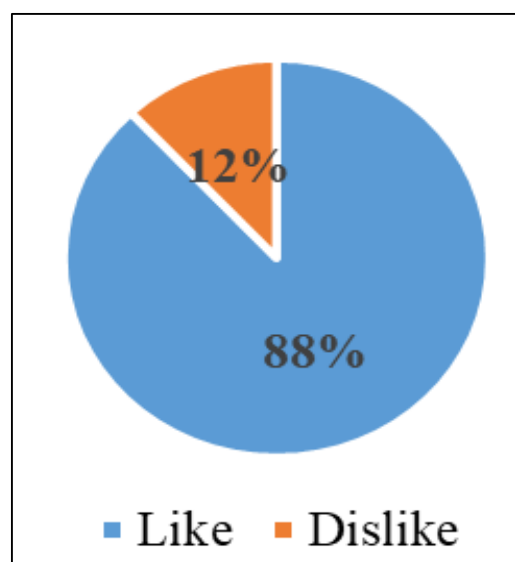


**Fig 1:** Age group of consumers



**Fig 2:** Occupation of consumers

The consumer pilot study was conducted among 100 consumers who used to consume dairy beverages regularly to quench their thirst during summer normally by buttermilk and other dairy drinks. Among the consumers, nearly 39% percent belonged to 15-25 age group, 15% were of 26-35 age group; 30% were of 36-45 age and 16% were above 45 years (Fig: 1). The breakup of consumers presented in Fig: 2 showed that 46% of them were students, 35% were employees, 12% were homemakers and 7% were entrepreneurs

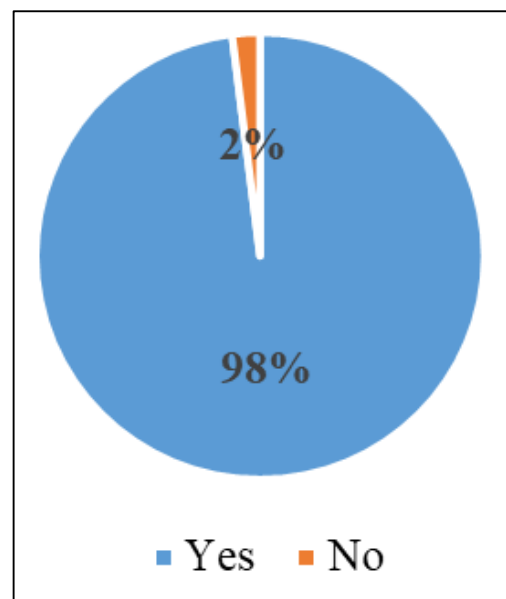


**Fig 3:** Degree of likeness

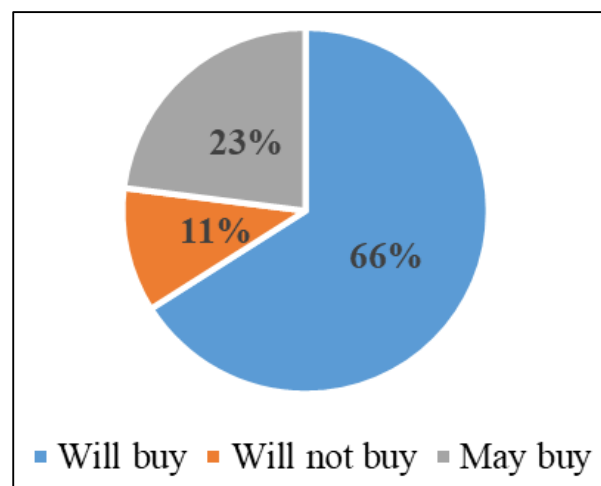


**Fig 4:** Preference of the product

Among the consumers, 88% liked the fortified Whey Kefir drink indicating that the developed product was highly acceptable among the consumers while 12% of the consumers did not like the product mainly due to its high acidic taste (Fig:3). The product was rated as excellent by 7%, very good by 40% of consumers, 35% rated the product good while 18% mentioned the product to be satisfactory (Fig:4). Majority (98%) of the consumers rated that the product was a good thirst quencher, while 2% of them did not perceive the drink as a good thirst quencher (Fig:5). When the consumers were asked whether they will buy the product if launched in the market, 66% replied that they will buy the product, 23% said they may buy the product while 11% of the consumers said that they will not buy the product (Fig:6).



**Fig 5(e):** Thirst quenching effect



**Fig 5(f):** Willingness to buy

The pilot scale consumer study revealed that the developed fortified Whey Kefir was well acceptable among the consumers for its thirst quenching effect and prickly sensation. According to the study, it can be concluded that willingness of the respondents to buy the products were increased when they were briefed about the health benefits of the product. Some consumers could even relate the taste of the product to that of the regional fermented drinks obtained from coconut and palm trees like 'Nira' and 'Thari', which further increased the likeness of the product.

### Nutritional Analysis

Nutritional value of all the control and fortified Whey Kefir were calculated based on its proximate composition (Table:2).

**Table 2:** Nutritional value per 100 ml of Control and Fortified Whey Kefir drink

Compositional Parameter	Control Whey Kefir drink	Fortified Whey Kefir drink
Total Fat (g)	0.18	0.19
Protein (g)	0.69	1.27
Carbohydrate (g) (by difference)	8.5	12.05((8.5×4)+(3.55×1.5))
Energy value (kcal/100ml)	38.38	46.115

Energy value of fortified Whey Kefir drink (Table 5.10) was higher than the control Whey Kefir drink. Control Whey Kefir drink provides 38.38 kcal/100ml whereas inulin, WPC and micro mineral added fortified Whey Kefir drink provides 46.115 kcal/100ml. Fortified Whey Kefir drink provides maximum calories compared to control due to the higher carbohydrate and protein content owing to the added additives. The energy from total carbohydrate includes the energy provided by lactose, sugar and inulin in the fortified Whey Kefir drink sample and the energy of inulin is assumed to 1.5 kcal/g. Since the products were packed in 200ml polyethylene pouches, we can say that per servings of control

The energy value was calculated as,

Energy value (kcal) = (Fat x 9) + (Protein x 4) + ((sugar and lactose x 4) + (inulin x 1.5))

and fortified Whey Kefir drink has a calorie content of 76.76 and 92.23kcal respectively.

### Cost evaluation

Cost is the important factor for determining the feasibility before launching the product. The cost of the control and fortified Whey Kefir drinks was calculated based on the cost of ingredients and assuming 20% of processing cost including the cost of whey, kefir grains, flavour and preparation cost (Table:3). Packaging cost per unit for 200ml was taken as Re 20 paise.

**Table 3:** Cost calculations of control and fortified Whey Kefir drinks

Ingredients	Fortified Whey Kefir drink
	Whey(1L) + Kefir grains+ Additives
Quantity	1L whey+4g grains+ 40g inulin+ 10gWPC+ 2.5g pectin+ 0.003g Zn+0.002g Fe+ 6.5g sugar
Ingredient cost (₹)	0+0+20+6.7+11.3+0.022+0.021+0.3
Total Cost (₹)	38.34
Processing cost (₹) (20%)	7.67
Total Production cost (₹)	46.1
Packaging cost (₹)	20 paise/pouch
Production cost per 200ml(₹)	10

Assuming the cost of ingredients per 100g to be as follows: Inulin: ₹ 50; WPC: ₹ 67; Pectin: ₹ 452; Zinc sulphate: ₹ 72; Ferric ammonium citrate: ₹ 110 and Sugar: ₹4. Calculated cost of the fortified Whey Kefir drinks is ₹10.

### Conclusion

Consumer study (yeasty and prickly sensation) of the developed fortified Whey Kefir drink revealed that it was in line with the Indian taste and palatability. The nutritional analysis and costing also proved that the product is comparatively cheap with high nutritional value relative to the other carbonated beverages available in the market. Hence, the developed fortified Whey Kefir drink can be a suitable healthier alternative to *commercial carbonated soft drinks*.

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### Ethics statement

This research did not include any human subjects and animal experiments.

### Conflict of Interest

The authors do not have any conflict of interests with the contents in the paper.

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