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Preparation of whey based beverage called Wheynut with enhanced nutrition by coconut water and study of its protein composition

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Abstract
This study was conducted to utilize whey which is the main dairy by-product during cheese production. As proteins are the building blocks of the body, it is very essential for body to get nourished. The DRI of protein intake recommended is 0.8 g of per kg mass of body. The main raw materials used in this beverage are whey which is rich in protein and coconut water which is rich in electrolytes. Combining these two with added flavours gives a beverage which is refreshing property and also of minimal processing along with low processing cost. This study focuses on preparing whey based beverage with three different flavours. The obtained beverage was subjected to different quality tests, proximate test and microbial tests in order to know the behaviour of the beverage in different flavours. The beverage was prepared with food grade raw materials and contains class 1 preservatives. The study was conducted to know the self-storage period of beverage without adding the chemical preservatives. Study on proximate composition revealed that the beverage contains 0.85 to 0.93g of protein/ 100ml of beverage. Observation was conducted till Week 2. The results were decrease pH and increase in titratable acidity along with microbial contamination.

Keywords: Whey, coconut water, Wheynut, whey beverage, refreshing drink, by-product utilization

1. Introduction
Whey is the aqueous protein of the milk. It compromises approximately 20% of the protein in milk, albumins and globulins, lactose and water soluble nutrients. A study by Dr. J.N de Wit 2001 explains that whey contains β-lactoglobulin (3.0), αlactalbumin (1.2), serumalbumin (0.4), immunoglobulin-G(0.7), protease pepton (0.6), other proteins (0.3) g/litres. The disposal of whey, the liquid remaining after the separation of cheese from the whole milk which is a major by-product in the dairy industries, it requires convenient and economic solutions to use it as valuable products and overcome the management issue of large production of whey. Whey is the greenish translucent liquid, the greenish colour of most types of whey, regardless of the processing conditions used it is due to the water-soluble and heat-stable riboflavin. Whey is characterised by different mixed flavours like acidic flavour due to volatile and non-volatile acids, saltiness and astringency. Generally 100 liters of milk produces about 12 kg of cheese or about 3 kg of casein. In either case about 87 liters of whey is made as a by-product. There is 0.9 g of protein is present per 100 g of whey. The protein in dairy milk is of 20% whey and 80% protein. In coconut water there are important electrolytes primarily from minerals like calcium and potassium.
Whevit is the term used for beverages produced from whey. This product is called as WHEY NUT which is the product obtained from whey and coconut. Variation in composition of the whey is due to the process involved in the production. Whey produced from rennet coagulated cheeses and casein is sweet whey, but in the production of acid casein and fresh acid cheeses, such as Ricotta or Cottage cheese, yields acid whey. When we use rennet, most part of calcium and phosphorus of the casein complex remain with the curd. Production of chhana and paneer yields medium acid whey. Based on acidity, whey can be conveniently classed into three group's namely sweet whey, medium acid whey and acid whey.

Table 1: Composition of whey from different sources

Constituents %	Cottage cheese	Acid casein
Total solids	6.4	6.9
Fat	0.5	0.1
Protein	0.4	1.0
Lactose	5.0	5.1
Titratable acidity	0.2	0.4

Table 2: Classification of whey based on acidity

Classification	Titratable acidity	pH
Sweet whey	Less than 0.20%	5.8 to 6.6
Medium acid whey	0.20 to 0.40	5.0 to 5.8
Acid whey	More than 0.40%	Less than 5.0

2. Nutritional properties and quantities of raw materials used

500 ml of toned milk used and 180ml whey was obtained. Milk fat is 3.0% and SNF is 8.5%**.** 60g of sugar was added to the whey and coconut water mix. 200 ml of coconut water used.

Table 3: Nutritional composition of milk used

Constituents	Quantity per serving
Total fat	3 g
Trans fat	0.1 g
Cholesterol	10 mg
sodium	40 mg
Total carbohydrate	5 g
Total sugars	5 g
Protein	3 g
Iron	0 mg
Potassium	130 mg
Calcium	112 mg
Calories	60 calories

Table 4: Nutritional composition of coconut water

Constituents	Values per 100g
Protein	3.330 g
Total lipid	33.490 g
Carbohydrate	15.230 g
Fibre	9 g
Calcium	2.430 mg
Iron	2.430 mg
Phosphorous	113 mg
Sodium	20 mg
Zinc	1.100 mg
Copper	0.435 mg
Vitamin C	3.300 mg
Riboflavin	0.020 mg
Niacin	0.540 mg

3. Flavor selection

With reference from journal by Jelen P the beverage was experimented with different types of flavour including kokum, chocolate, vanilla, lime and apple flavour. But finally most promising flavour that stood out were,

1. Orange flavour (2 g from RTD powder)
2. Coconut flavour or no flavour
3. Spicy and tangy flavour. (4 g a blend of chilly, salt, clove, cinnamon, cumin seeds, tamarind paste and curry spice mix)

4. Method of preparation

500 ml pasteurized toned milk was collected from market and it was preheated at 92 °C. Then a freshly harvested tender coconut was deshelled to collect water and of 200 ml of water was later filtered and stored. The milk is coagulated in order to get whey separation from milk and to produce cheese. It was done by adding a 1% citric acid of 6 g for preheated milk at pH of 5.2 to 5.4. The yield of whey was increased by adding lime juice while boiling. Then the coagulation process takes place and the cheese is separated and whey of 180 ml was collected by filtering twice through kitchen filter cloth.

The filtered whey was allowed to cool at room temperature. Then the both ingredients were mixed thoroughly. Later 60 g of sugar was added to the mix and stirred well with low heat supply to make sugar dissolve completely. Later the flavor was added. Then the product was again filtered to remove large particles from spice ingredients. Pre sterilized PET bottled were taken as a container for the product. The product was filled carefully into product. Later it was sealed by cap. It was stored in cool conditions. Flavors used are, Orange flavor, Coconut flavor or no flavour, Spicy and tangy flavour.

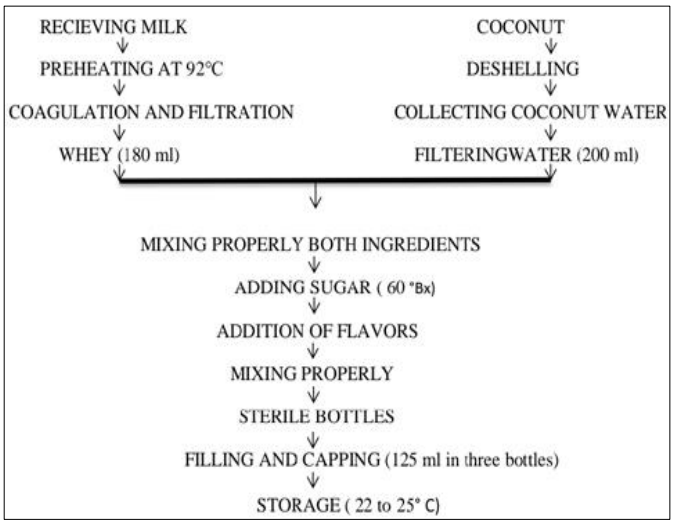

Fig 1: Process flow chart

Fig 2: Images of Wheynut products

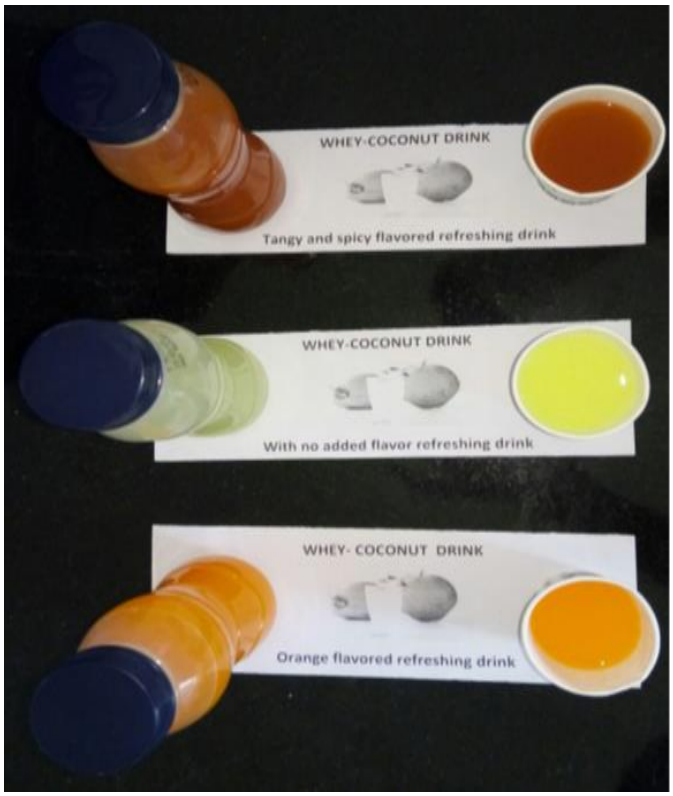

Fig 3: Images of Wheynut samples

5. Quality control of the flavoured products

As this value added product is richer in sugar, protein and moisture it has a chance of deteriorating in its quality. Hence in order to analyse change in quality over the storage period the study conducted few of the quality analysing experiments.

5.1 Titratable acidity

It is the difference in natural acidity to developed acidity. It was done by titrating against 0.1 N NaOH using phenolphthalein indicator.

$$TA = \frac{\text{titre value} \times \text{N of alkai} \times \text{volume made upto} \times \text{eq.wt of alkai} \times 100}{\text{Volume of sample for estimation} \times \text{wt or vol of sample} \times 1000} = \%$$

Observations

In burette = 0.1N NaOH
Indicator = phenolphthalein indicator
In conical flask = 10 ml of sample + indicator
Titratable acidity of samples during Week 2
Orange flavour = 0.42%
No flavour = 0.24%
Spicy flavour = 0.52%

Values of trials in titratable acidity of samples during Week 1

Table 5: Orange flavour, Average = 5.6

	Trial 1	Trial 2
Initial burette reading	0	0
Final burette reading	5.5	5.7
Volume of NaOH consumed	5.5	5.7

Table 6: No flavour, Average =2.75

	Trial 1	Trial 2
Initial burette reading	5	5
Final burette reading	8	7.5
Volume of NaOH consumed	3	2.5

Table 7: Spicy and tangy flavour, Average = 5.7

	Trial 1	Trial 2
Initial burette reading	8	8
Final burette reading	13.5	13.9
Volume of NaOH consumed	5.5	5.9

5.2 pH

Orange flavour = 4.83
No flavour = 5.8
Spicy flavour = 4.14

5.3 Serial dilution

Microbial analysis of WHEY NUT was done by a serial dilution of the pour plate method. The number of colony forming units per ml was calculated. Results of the microbiological analysis to find the microbial stability of 3 samples under different treatment combinations are shown,

Sample
A= Orange flavour
B= No flavour
C= Spicy flavour

Table 8: Results of serial dilution

Sample	CFU/ml Week 1	CFU/ml Week 2
A	NO	25×10^2
B	NO	10×10^2
C	NO	14×10^2

According to tables no microbial growth within Week 1 was observed in samples which have undergone thermal treatment. The CFU values of sample A, B and C during the second week was within the acceptable level (less than 50 CFU in 1 ml). But during second week the microbial growth has been seen but of less units. As taste test was performed there was slight increase in pH during second week and taste was acidic as compared to freshly prepared. But the overall acceptance was good.

5.4 Estimation of protein

Our laboratory used the Kjeldahl Method for estimation of protein content from samples. The method protocol requires the analyses of an ammonium salt solution and a tryptophan solution as internal quality control standards with a minimum nitrogen recovery between 99%-100% for the check of the distillation step using ammonium salt solution, and at least 98% for the check of the digestion step using tryptophan solution Because of the lack of tryptophan we used acetanilide reagent instead for the control of the digestion step. The duration for sample digestion was 2 hours. The use of the copper sulphate as catalyst for the protein determination in milk was previously proposed and our lab has widely used the copper sulphate as a catalyst for a large number of food samples and the results have been more than acceptable. A quantity of 5 ml thoroughly mixed sample was used for test. To avoid the impetuous digestion, some moderated temperature ramps were used. The samples remained in 150 °C for 15 minutes and then the temperature was allowed to rise up to 400 °C. The digestion continued for 20 minutes more in the temperature 400 °C. Some H2O2 addition improved quite well the digestion intensity. The method protocol requires the analyses of an ammonium salt solution and a tryptophan solution as internal quality control

standards with a minimum nitrogen recovery between 99%-100% for the check of the distillation step using ammonium salt solution, and at least 98% for the check of the digestion step using tryptophan solution.

Table 9: Sample results= g protein/ 100 ml of beverage.

Sample	Orange flavour	No flavour	Spicy flavour
Trial 1	0.86	0.91	0.85
Trial 2	0.85	0.93	0.88
Average value	0.855	0.92	0.865

6. Results and Conclusion

This study have shown that the acceptance of whey based beverages as drinks are not commonly found in market there is a lot of modern techniques and awareness need to be given. The beverage was considered as refreshing drink. Hence there is opportunity to let this protein based drink into many age based foods. The DRI of protein intake recommended is 0.8 g of protein per kg mass of body and this product gives 0.85 to 0.93 g of protein/100 ml of beverage. During storage the decrease in pH and increase in titatable acidity and microbial contamination was seen in Week 2. As this product do not contain any chemical preservatives to prevent it from deterioration in terms of quality, this product shown results under acceptable rates. The process needs even more standardization to enter the beverage market. The protein foods in market are usually mixed with other fat rich foods which lead to junk consumption. The access to protein rich foods in market for these sport or healthy eating people is very costly. As there are few whey based beverages the product stands with more demand. The study helps in further more utilization of whey which is by-product in dairy industry and its utilisation through value enhancement.

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