Development of Whey with Apple Juice and Appraisal of their Nutritional Qualities

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Abstract

This study was conducted at the Department of Food Science and Nutrition, Banasthali Vidyapith, Newai, Tonk, Rajasthan, India in 2006. A dairy by-product can be used to enrich fruit juices to enhance their therapeutic and nutritional value. This study was carried out to develop beverages using apple juice and incorporating whey at various percentage level and to conduct nutritional analysis. Protein value was varied between 0.72–1.9. Fat content was 0.50–1.10. The ascorbic acid level in the juices ranged between 2.97–0.85 and it was found to be decreasing with an increasing amount of whey. Acidity ranged was 0.20–0.34, it was increasing with the increasing amount of whey. Ash content level was also increased, the range was 0.20–1.50.

Keywords: Apple, Beverages, Juice, Nutrients, Whey.

Introduction

In recent years, a lot of interest has been gained in the development of fruit juices with dairy products. Fruit juices and fruit-based beverages are popular products appealing to a broad demographic group, particularly children and young adults and represent an important segment of the domestic and international market. In the global market, fruit beverages are important commodities. They are providing an opportunity for innovative, value-added products to meet health and nutrition.

Fruits and vegetable juices play an important role in delaying the onset of Alzheimer's disease, particularly among those who are at high risk for the disease (Qi Dai et al., 2006). Apples are fat and cholesterol-free fruit packed with vitamins and nutrients. Apple juice contains a significant amount of vitamin C but is also a natural source of niacin, phosphorus, magnesium, potassium, and calcium. Something in apple juice appears to protect the brain against oxidative damage. Something is the apple's naturally high level of antioxidants (Hackers, 2004). Thus the saying proves itself correct that 'an apple a day keeps the doctor away'. Fruits are important in our daily life because they contain a good amount of vitamin and minerals but these are generally a poor source of protein. This inherent lack of protein can be made up by the addition of some other ingredients which provide good protein and does not negatively affect the flavor and color of the product. Hence, fortification of whey with fruit juices can be an excellent way to make them reach society. Whey is a dairy by-product which is obtained from the preparation of channa and paneer. Disposal of whey poses a serious problem to the dairy industry all over the world because of high organic matter in it (Kar and Mishra 1998). Whey proteins are one of the highest quality proteins. Whey contains water-soluble vitamin and minerals. Long term use of whey depicts its therapeutic value in aging, cancer, and AIDS helps in the proper functioning of the liver, kidney and also reduces stress (Jakhar and Jain 2018). Whey based fruit beverages are more suitable for health as compared to other drinks (Sarvana and Manimegalai 2005). The manufacture of whey-based beverages requires the mixing of appropriate fruit juices and minimally processed whey with a selection of suitable stabilizers and acidulants to develop acceptable whey-based fruit beverages (Singh et al 2015).

Therefore, to make the use of dairy by-product, the present study was proposed to supplement them with fruit juices to prepare a delicious, drink and full of nutrients.

Methods and Materials

This study was an attempt to develop beverages based on fruit juice with nutritive ingredients like incorporated in them. These had to be processed to enhance shelf life and evaluated for nutrient composition.

In primary processing, we made fruit juice, whey, and sugar syrup. Household methods were used for the preparation of juices, whey, and sugar syrup.

Preparation of Apple Juice

- Fresh apple was procured from the local greengrocer.
- These were washed thoroughly and peeled.
Flow Chart Elucidating the Experimental Plan

Phase 1
- Selection of apple fruit
- Preparation of fruit juice
- Incorporation of whey
  - 10%
  - 20%
  - 30%
  - 40%

Phase 2
- Chemical Analysis
  - Total solids
  - Fat
  - Protein
  - Ascorbic acid
  - Acidity
  - Ash

Preparation of Whey
- Milk (1 L) was brought to a boil.
- A pinch of citric acid was added to it.
- It was allowed to simmer for five minutes.
- The whey was collected by straining and was immediately cooled.

Preparation of sugar syrup
- 400g of sugar was taken.
- 250ml of water was added to it and the mixture was put on a flame.
- It was heated with continuous stirring for 15 minutes.

To come up with a standard product the pre-measured ingredients were mixed in the ratios. These were blenderized in a semi-automated food processor. In totality four recipes were standardized.

List of ingredients of the product:

| S. no. | Ingredients    | Amount (Ml) |
|--------|----------------|-------------|
|        |                | 10%  | 20%  | 30%  | 40%  |
| 1.     | Apple Juice    | 80   | 70   | 60   | 50   |
| 2.     | Whey           | 10   | 20   | 30   | 40   |
| 3.     | Sugar syrup    | 10   | 10   | 10   | 10   |

Processing for Preservation
The beverages thus obtained were heated to 80°C for 2-3 seconds. They were cooled immediately and stored.

The beverages were analyzed for total solids, fat, protein, ascorbic acid, acidity, ash content.

Chemical Analysis
Chemical analysis was done for total solids (Sharma 1993), fat content was estimated by blorr method. Biuret method was used for protein estimation. Ascorbic acid by titrimetric method, titrable acidity and mineral ash content (NIN, 2003) were also done.

Statistical Analysis
The statistical methods used for the analysis of data regarding the present investigation were: Mean, Standard Deviation.

RESULTS AND DISCUSSION
This work was an attempt to develop fruit-based beverages which had been enhanced in nutritive value by the addition of whey. As an integral part of the process of product development, all these beverages were tested for nutrient analysis.

Nutrient Analysis
The four whey added fruit beverages made as a part of this study were analyzed fresh for total solids, fat, protein, ascorbic acid, acidity, and ash. The result has been discussed as:

Total Solids
The total solids scores of four beverages varying in the percentage of whey incorporated are being discussed here. The total solids scores of apple juice + whey have been presented in Table 1. With the increasing proportion of whey, a decrease in value was noticed. The highest value was 19.5 for 10% whey beverage and the lowest value was seen in 40% beverage which was 12.2. There was not much change in the values of 30% and 40% beverage and 10% or 20% beverage.

Fat
All the basic ingredients of these beverages are inherently low fat.

The fat content of apple juice + whey beverage is presented in Table 1. The fat content of apple juice rose with an increase in the concentration of whey. The highest fat content was 1.1 in 40% beverage, a slight difference was seen in 20% and 30% beverage. The lowest value was 0.5.

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|--------|----------------|-------------|
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Table 1: Nutrient analysis

| Nutrients | 10% | 20% | 30% | 40% |
|-----------|-----|-----|-----|-----|
| Total solids (%) | 19.54 | 18.48 | 13.09 | 12.29 |
| Fat (g %) | 0.50 | 0.80 | 0.90 | 1.10 |
| Protein (g %) | 0.72 | 0.79 | 1.80 | 1.98 |
| Ascorbic acid (mg) | 2.97 | 2.79 | 1.99 | 0.85 |
| Acidity (%) | 0.20 | 0.27 | 0.28 | 0.34 |
| Ash (g %) | 0.20 | 0.10 | 0.50 | 1.50 |
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Protein
Addition of milk-based products adds to protein content. The values have been presented in Table 1. Highest content was 1.98 for 40% whey beverage. With the increasing proportion of whey, an increased value was observed. A difference was observed in the protein content of all these beverages.

Addition of whey increments the protein content of juices which is evident from a linear rise in protein with an increase in the proportion of whey. Addition of whey at 30% and 40% level also contributes fatty to protein content.

Ascorbic Acid
The ascorbic acid value of four beverages varying in the percentage of whey incorporated is being discussed here.

With the increasing proportion of whey ascorbic acid content lowered (Table 1). The highest value was 2.9 mg% for 10% beverage. The difference was seen in the various percentage of beverages with the lowest value being 0.85 for 40% beverage.

Acidity
The value acidity of beverages varying in the percentage of whey is presented in Table 1.

On adding whey in juice acidity of beverage increased. There was a slight difference seen in 10% 20% and 30% beverage. The highest value was 0.34 for 40% beverage and the lowest value (0.20) was observed in 10% whey beverage that is shown in Table 1.

As the level of sugar addition increased there was a very slight change in the titratable acidity (Kar and Mishra 1998). In the present study also the similar results were seen.

Ash Content
The ash content scores of four beverages varying in the percentage of whey incorporated are being discussed here.

The highest value was seen in 40% beverage that is 1.5 and the lowest was 0.1 for 20% beverage and much difference was observed in 30% and 40% beverage.

The chemical analysis shows that the addition of whey brings about an increment in fat and protein but the overall content of these macronutrients in these beverages remain low. These beverages are a poor source of ascorbic acid but the ash content varies from poor to good.

Summing up the results, it could be inferred that the apple juice with whey has fair nutritional composition and good acceptability, therefore, this set of beverages are likely to be accepted by the consumers as a healthy drink.

Summary and Conclusion
Whey, dairy by-products, has high nutritive value. Whey protein could also be of value as supplements to vegetable proteins which are limiting in certain amino acids.

The present study was designed and conducted to develop beverages using fruit juices with whey, and to appraise their nutritional quality.

The preliminary phase of the study involved the selection of fruit like apple and preparation of fruit juices and incorporation of whey at different percentage level, viz., 10%, 20%, 30%, 40%

In the next step involved the estimation of nutrient content—total solids, fat (blorr method), protein (Biuret method), ascorbic acid (titrimetric method), acidity (titration) and ash content (NIN, 2003).

Mean and the standard deviation was calculated.

The results of the analysis of the beverages were as follows:

Nutrients Analysis
Total solids: Total solids content was highest in 10% product which was 19.54%. The lowest value was seen in 40% (12.29) beverage. The scores decrease with the increase in the concentration of whey.

Fat: All the beverages were low in fat. The content rose with an increment in the concentration of whey. The highest value was found in 1.10%. The lowest value was seen in 0.50 in 10% beverage.

The fat content was in the range of 0.50 to 1.10.

Protein: Protein increased with an increasing concentration of whey. Highest protein content was analyzed in 40% (1.98) beverage, where the range was 0.72–1.98%. The lowest value was 0.72% in 10% beverage.

Ascorbic acid: Ascorbic acid content was highest in 10% beverage. The lowest value was 0.85 in 40% beverage. The range was between 0.85–2.97%.

Acidity: Acidity content was varied between 0.20–0.34%. The highest value was 0.34 in 40% beverage and the lowest value was seen in 10% beverage.

Ash content: Ash content was highest in 40% beverage that is 1.50%. In beverages, the score range varied between 0.20 and 1.50%.

Thus the following conclusions could be drawn from the results of the study:

• Overall acceptability of apple+ whey, the beverage is very good. Its color, aroma, appearance is appropriate.
• Acceptability declined on storage.
• Addition of whey increased in estimated protein value.
• All the beverages were low in fat.
• The ascorbic acid level was low and the content decreased as the amount of whey increased.

It was interpreted that apple juice with whey was of good nutritional composition, which could be recommended to consumers as health and refreshing drink.

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