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Studies on healthy fruit based chhana whey beverage by using kiwi (*Actinidia deliciosa*) fruit extract

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Abstract

Kiwifruit whey beverage was prepared from different proportions of kiwi extract blended with whey. The product obtained was subjected for chemical analysis. On an average the moisture content of kiwi fruit whey beverage was found to be 90.31, 86.35, 84.49 and 83.14 per cent, fat 0.39, 0.44, 0.47 and 0.49 per cent, protein 0.47, 0.51, 0.56, and 0.58 per cent, ash 0.38, 0.47, 0.52 and 0.57 per cent, total solids 8.88, 13.38, 14.52, and 16.53 per cent and total sugar 7.77, 12.17, 13.23 and 15.22 per cent for treatment T₁, T₂, T₃ and T₄, respectively. It was observed that as the proportion of Kiwi fruit extract increased, there was increase in, protein, fat, total solids, total sugar and decrease in pH and moisture content of kiwifruit whey beverage.

Keywords: Whey, Chhana, kiwifruit, beverage

Introduction

Whey is the watery part of milk that remains after separation of curd/coagulated product that result from acid or proteolytic enzyme mediated coagulation of milk. Whey is an important by product obtained during the manufacture of cheese, chhana, and panner. Whey contains almost all constituent of milk except casein, fat and fat soluble vitamins. Generally whey contains approximately half of the total solid of the original milk. The total solid contain of whey ranges between 6.5-7.0 per cent in addition to water soluble vitamins, mineral and proteins. The whey being a good source of high quality protein, minerals and easily digestible carbohydrates.

In dairy industry it is usually dumped because it has no value, on other hand whey present interesting nutritional value. The whey which is used as waste effluent in the formulation of nutritious palatable and therapeutic beverages presence of Lactose, fat, protein, minerals and water soluble vitamins make the whey a highly nutritious product. Therefore, the utilization of whey in to fermented or non-fermented beverages is one of the most attractive avenues for the utilization of the whey.

Whey contains almost all the nutrients except casein and fat. The whey has greater nutritional and therapeutic values because it contains lactose, thiamine, riboflavin, vitamin B, vitamin C, calcium and phosphorus. Whey can also be used as electrolyte solution. The whey solid apart being nutritious also carry excellent functional properties such as solubility, gel formation, emulsification, water blending, whipping etc. beverages are consumed people of all age groups as they are nourishing, pleasant drinks that provides energy, water digest food, regulate body temperature, prevent dehydration and removes physiological tension.

A whey beverage means purified water in which sugar, flavouring, edible acids and colouring matter are present and sometimes carbonated with carbon dioxide gas. But recently the whey beverages are also prepared using various fruit pulp (juice) such as Mango whey beverage Dhawale *et al.* (2009), Guava whey beverage Divya *et al.* (2009)^[9], Sapota whey beverage Gaikwad *et al.* (2010)^[11], Pineapple whey beverage Bhavsagar *et al.* (2010)^[4], Pomegranate whey beverage Babar *et al.* (2008)^[3], etc. As like such beverages many attempts have been made by the research workers to utilize whey as base for fruit juice beverages.

Fruits play an important role in the balanced diet of human being by providing not only the energy rich food but also promise vital protective nutrients. Fruits enrich health by turning up energy and vigour. Kiwifruit is the native and national fruit of China. Kiwi fruit cultivation in India is negligible due to its exotic introduction though it is extended to mid hills of Himachal Pradesh, Jammu and Kashmir, Arunachal Pradesh, Sikkim, and Meghalaya with extensive

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research and developmental support. Most of the fruits are available in the market from October-December and kiwi also ripens during this time, so its price is always very high.

Kiwi contains vital substances that are required to maintain good health. The fruit is rich in vitamin C, E, sugars and several minerals such as phosphorus, potassium, magnesium, copper and calcium. It is low in calories and high in ascorbic acid content Singh (2008) [21]. The fruit is rich in antioxidants due to presence of phytonutrients such as, lutein, phenolics, flavonoids, carotenoids and chlorophyll (Cassano *et al.* 2006) [5]. Presence of these beneficial substances helps reducing the risk of cardiovascular disease (Chang *et al.* (2009) [6]. Kiwi fruit juice are used extensively as fruit ingredients in many food such as dairy products, jams, and jellies, syrups, confectionery, etc.

The market demand for instant food and whey beverage is growing all over the world and consumers are seeing new tastes. The main marketing advantages of whey beverages are healthful combination of fruit based vitamin containing components and the dairy based calcium and whey protein. Hence, taking into account the market demands and consumer preference, conversion of whey into beverages is one of the most important avenues for utilization of whey in human food chain.

Keeping in view the nutritional, biological and functional qualities of whey, attempts have been made to utilize the whey for the preparation of palatable refreshing beverage with addition of Kiwi fruit extract

Experimental Methodology

Extraction of chhana whey

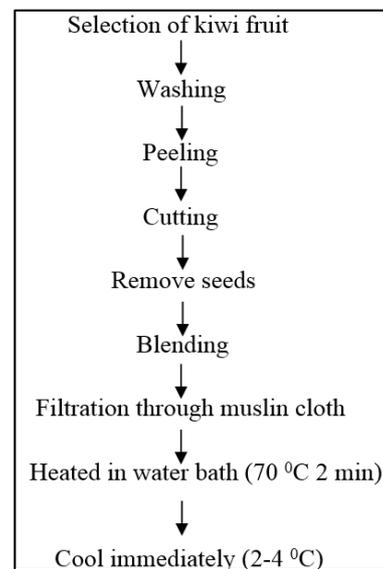
Chhana whey was prepared as per the method given by Shewfelt (1997) [19]. Good quality fresh cow milk was strained through muslin cloth. Then milk was transferred to stainless steel vessel and brought to boil by heating at temperature 80 °C. The vessel was removed from the fire and allows to cool at temperature 75 °C. The coagulant i.e. citric acid @ 0.5 per cent was added slowly and stirred so that it was mixed properly. The coagulated milk was poured over piece of clean muslin cloth stretched over another vessel to drain the whey. The clear drained whey was collected in vessel. The whey was again heated to a temperature of 100 °C for 5 minutes, so as to remove the traces of fat and curd particles. The clear yellowish green whey was then used for the preparation of Kiwi fruit (*Actinidia deliciosa*) extract whey beverage.

Selection of Kiwi Fruit (*Actinidia deliciosa*).

Kiwi fruit were collected from fruit market, Latur. During the course of present study while selecting the kiwi fruit, stage of ripening, size, colour and taste were considered so that there should not be any variation in the quality of juice to be extracted from the fruit.

Preparation of Kiwi Fruit (*Actinidia deliciosa*) extract

Prior to preparation of Kiwi Fruit (*Actinidia deliciosa*) extract, first kiwi fruits were washed with clean water. The skin was removed. The slices were cut with the help of knife and finally it was converted in homogeneous mass of juice by putting into mixer. Homogenous mass of juice drained with muslin cloth and collect juice in vessel.

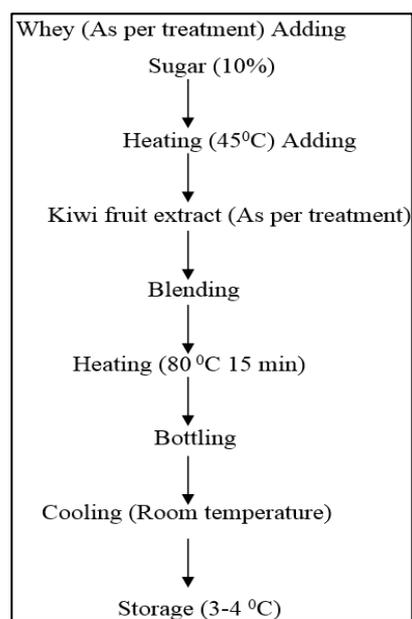


(Source: Shewfelt *et al.* 1997 [19]; 30 Dubost *et al.* 2003) [10]

Fig 1: Flow chart showing preparation of kiwi fruit extract

Preparation of Kiwi fruit (*Actinidia deliciosa*) extract whey beverage

Good quality cow milk was obtained and strained through muslin cloth. The standardized milk was transferred to stainless steel vessel and heated to boiling temperature with continuous stirring. Then milk was allow cooling up to 75 °C and added 0.5 per cent citric acid with constant stirring for equal distribution and stirred till coagulation took place. Then whey was strained through muslin cloth. The obtained whey was clear and greenish yellow in colour. The whey was heated to 100 °C and then cooled to room temperature. Sugar was added @ 10 per cent into the whey. Heat the mixture of whey and sugar for 45 °C. Then extract was added as per the treatments and mixed thoroughly by heating at 80 °C, 15 min. The product was filtered, bottled, cooled at room temperature and then stored in refrigerator at temperature 3-4 °C.



(Source: Shewfelt *et al.* 1997 [19]; Dubost *et al.* 2003) [10]

Fig 2: Flow chart for preparation of chhana whey beverage by using Kiwi (*Actinidia deliciosa*) fruit extract.

Treatment combinations

For the preparation of Kiwifruit (*Actinidia deliciosa*) whey beverage from chhana whey, the treatment combinations studied were as under.

T₁ - 100 parts whey

T₂ - 90 parts whey + 10 parts of Kiwi fruit extract

T₃ - 80 parts whey + 20 parts of Kiwi fruit extract

T₄ - 70 parts whey + 30 parts of Kiwi fruit extract

Physico-chemical analysis of Shrikhand**A) Determination of Acidity**

Determined as per the method cited in IS (SP: 118) Part-XI, 1981

B) Determination of pH

Digital pH meter (335) method.

C) Determination of fat

Determined as per the method cited in ISI (IS 1224) 1958

D) Determination of protein

Determined as per method described in A.O.A.C. (1965)^[1]

E) Determination of moisture

Determined as per the method cited in IS (SP: 118) Part-XI, 1981

F) Determination of total solids

Determined by the method described in IS 1479 (Part-II) 1961.

G) Determination of ash

The ash in beverages was determined by the I.S.I. (IS 1479, Part II) 1961.

H) Determination of total sugar

Determined by the volumetric (lane-Eynon) method as a described in IS: SP: 18 (Part XI) 1981.

Statistical analysis

The data were analyzed statistically by using Completely Randomized Design (CRD) as per Panse and Sukhatme (1985)^[16].

Result and Discussion**Titrateable acidity of kiwi fruit whey beverage**

The average acidity was 0.38, 0.42, 0.45 and 0.48 per cent for treatment T₁, T₂, T₃ and T₄ respectively. All the treatments were significantly differed from each other. It was further observed that as the quantity of kiwi fruit extract in the beverage increased the acidity of the finished product was also increased.

pH of kiwi fruit whey beverage

The average pH of kiwi fruit whey beverage was 4.97, 4.78, 4.68 and 4.37 for treatment T₁, T₂, T₃ and T₄, respectively. All the treatments were significantly differed from each other. It was also observed that as the quantity of kiwi fruit extract in the beverage increased, correspondingly the pH of the whey beverage was decreased. This might be due to high carbohydrate (10%) in kiwi fruit which contains sugar, which might be utilized by acid producing bacteria. similar results were obtained by Kaur *et al.* (2000)^[15], Sarvanakumar and Manimegalai (2002)^[17] and Shukla *et al.* (2004)^[20]

Mean chemical composition of kiwi fruit whey beverage

The data obtained on mean chemical composition of kiwi fruit whey beverage was analyzed and tabulated in table given below

Table 1: Mean chemical composition of kiwi fruit whey beverage

| Sr. No. | Constituents in per cent | Treatments | | | | SE ± | CD at 5 Per cent |
|---------|--------------------------|--------------------|--------------------|--------------------|--------------------|------|------------------|
| | | T ₁ | T ₂ | T ₃ | T ₄ | | |
| 1) | Moisture | 90.31 ^d | 86.35 ^c | 84.49 ^b | 83.14 ^a | 0.13 | 0.42 |
| 2) | Fat | 0.39 ^c | 0.44 ^b | 0.47 ^{ab} | 0.49 ^a | 0.10 | 0.33 |
| 3) | Protein | 0.47 ^b | 0.51 ^b | 0.56 ^a | 0.58 ^a | 0.01 | 0.04 |
| 4) | Ash | 0.38 ^d | 0.47 ^c | 0.52 ^b | 0.57 ^a | 0.01 | 0.04 |
| 5) | Total sugar | 7.77 ^d | 12.17 ^c | 13.23 ^b | 15.22 ^a | 0.02 | 0.06 |
| 6) | Total solid | 8.88 ^d | 13.38 ^c | 14.52 ^b | 16.53 ^a | 0.19 | 0.59 |

1) Moisture content of kiwi fruit whey beverage (per cent)

It may be observed from the Table 10, that the average moisture content of the product was found to be 90.31, 86.35, 84.49 and 83.14 per cent for the treatments T₁, T₂, T₃ and T₄ respectively.

The treatment T₁ had significantly higher moisture content (90.31 per cent) as compared to the rest of the treatments. Due to decrease in proportion of whey and increase in kiwi fruit extract from treatment T₂ to T₄ moisture content of kiwi fruit whey beverage was decreases. The results were in agreement with Gond (2015)^[12] and Dhumale (2016)^[8].

2) Fat content of kiwi fruit whey beverage (per cent)

The Table indicates that the average fat content in kiwi fruit whey beverage was found to be 0.39, 0.44, 0.47 and 0.49 for treatment T₁, T₂, T₃ and T₄, respectively. Observations clearly indicates that, as the incorporation of kiwi fruit extract to whey beverage was increased, the fat content in the finished product also increased. The high fat content in T₂, T₃ and T₄ may be due to high fat content in base kiwi extract. The

results were in agreement with Shaikh *et al.* (2001)^[18] and Aher (2007)^[2].

3) Protein content of kiwi fruit whey beverage

The protein content was found in increasing order from T₁ to T₄ treatment. The highest protein content was recorded for treatment T₄ i.e. 0.58 per cent. The lowest protein content was recorded for treatment T₁ i.e. 0.38 per cent. This might be due to high protein content in kiwi fruit (0.8-1gram). As kiwi fruit extract in product increased, the protein content in finished product was also increased.

The juice extracted from kiwi fruit had on an average protein content of 0.8 to 1 per cent and its relative contribution was high in the final product. The values recorded for protein in the present research work were comparable with the values observed by Suresha and Jayaprakasha (2004)^[23]

4) Ash content of kiwi fruit whey beverage

Table indicates that the mean ash content in the finished products was found to be 0.38, 0.47, 0.52 and 0.57 per cent for treatment T₁, T₂, T₃ and T₄ respectively.

The values recorded were found to be in increasing order from 0.38 to 0.57 for treatment T₂ to T₄. This may be due to the incorporation of kiwi fruit extract in increasing level, which contains the appreciable quantity of mineral in it. Obtained results are in agreement with results of Suresha and Jayaprakasha (2004)^[23] and Babar *et al.* (2008)^[3].

5) Total solids content of kiwi fruit whey beverage

It clearly indicated from table that the average total solids content of the kiwi fruit whey beverage were found to be 8.88, 13.38, 14.52 and 16.53 for treatment T₁, T₂, T₃ and T₄, respectively.

It was observed from above findings that as the incorporation of kiwi fruit extract to whey beverage increased from treatments T₂ to T₄, the total solids content of the kiwi fruit whey beverage was also increased. Similar results were observed by Bhavsagar *et al.* (2010)^[4], Gaikwad (2010)^[11] and Singh and Singh (2012)^[22].

6) Total sugar content of kiwi fruit whey beverage

The mean total sugar content ranged between 7.77 to 15.22 per cent. Whereas, the least value of total sugar content was recorded for T₁ treatment, 7.77 per cent.

It may be seen that the total sugar content were found in increasing order from T₂ to T₄. It was due to the incorporation of kiwi fruit extract in increasing portion. Results obtained are in agreement with findings of Babar *et al.* (2008)^[3], Yadav *et al.* (2010)^[24] and Dhumale (2016)^[8].

Conclusion

From present investigation it can be concluded that the whey beverage prepared by using kiwi fruit extract can be very well utilized for preparation of nutritious, palatable and low cost refreshing beverage by blending 20 per cent kiwi fruit extract with 80 percent chhana whey on weight basis.

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