

Development of Spirulina Fortified Pineapple RTS

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Abstract- The present investigation was undertaken to develop spirulina based pineapple RTS. Spirulina often known as super food is a natural algae (Cyanobacteria) that is incredibly high in protein and a good source of antioxidant, vitamin B and other nutrients. It is largely made up of protein and essential amino acids. The high concentration of protein and iron makes it ideal during pregnancy, after surgery, or anytime the immune system needs a boost. Spirulina powder was added in pineapple RTS in varied concentrations. Three samples were prepared using 0.01%, 0.1% and 1% of spirulina along with other ingredients to prepare product having adequate sensory attributes. RTS samples were evaluated for organoleptic properties. The best chosen product was assessed for its chemical composition. Pineapple RTS prepared with spirulina powder exhibited acceptable organoleptic properties. Fortification of spirulina to pineapple RTS increases its protein content markedly

Key words: - Spirulina, pineapple, RTS, fortification, organoleptic properties.

I. INTRODUCTION

Spirulina is the common name for human and animal feed supplements produced primarily from two species of cyanobacteria: *Arthrospira platensis* and *Arthrospira maxima*, (Sapp, 2005). Spirulina refers to the dried biomass of *arthrospira platensis*, an oxygenic photosynthesis bacterium found worldwide in fresh and marine water. It has a long history of use as food and it has been reported that it has been used during the Aztecs civilization until 16th century (Vonshak, 1997). Spirulina is blue green algae. It is simple, one celled form of algae that thrives in warm, alkaline fresh water bodies. The name spirulina is derived from a Latin word for "helix" or "spiral"; denoting the physical configuration of the organism when it forms swirling microscopic strands, (Komarek and Hauer, 2009). These are free floating filamentous cyanobacteria characterized by multi-cellular trichome in an open left hand helix. Spirulina occurs in tropical and sub tropical lakes with high pH and high concentration of carbonate and bicarbonate. Spirulina is rich in vitamin E as well as vitamin A and chlorophyll is also there which help overcome acne. The spirulina extract inhibits HIV-1 replication in human derived T-cell lines and in human peripheral blood mononuclear cells. Spirulina with its easily assimilated protein, vitamin E, folic acid, Vitamin B6 and B12 as well as iron and copper make it an ideal food source for patients suffering from anemia. The positive effect of spirulina on our health in regard to general well-being, cancer, hepatitis, anemia, slimming, diabetes and so on has been studied. Spirulina protects against radiation (Karkoset al., 2008). It is also beneficial in the fight against heavy metal poisoning, increasing problems of our times. Spirulina for weight loss program found that weight loss runs parallel with a decrease in the cholesterol levels. It is used as a dietary treatment for

treating pancreatitis with good success. There are benefits of spirulina for eye diseases too (Deng and Chow, 2010 and Khan et al., 2005).

Spirulina is a super food containing health giving phytonutrients. Beta carotene is an anti-cancer and anti-oxidant nutrient, boosts energy and cellular health. It has rare essential fatty acids and more than 60% protein (Park and Kim, 2003). Pineapple is the third most important tropical fruit in the world after banana and citrus. Mature fruit contains 14% of sugar, a protein digesting enzyme, bromelin, and good amount of citric acid, mallic acid, vitamin A and B (Joy, 2010). In view of this, present study on development of pineapple RTS fortified with spirulina was undertaken to study organoleptic and chemical properties of pineapple RTS.

II. EXPERIMENTAL METHODS

Material

Ingredients

The fully ripe pineapple fruits and spirulina powder were purchased from local market, Pune. Sugar and pineapple flavor were obtained from local market of Pune.

Chemicals

Chemicals required for processing and analysis were taken from J.P Gandhi chemicals, Pune.

Equipments

Equipments required for processing and analysis were taken from MITCFT, Loni-Kalbhor, Pune.

Methodology

The detailed process for preparation of Pineapple RTS fortified with spirulina is shown in Fig.1. RTS is prepared by using the method given by Shrivastava, 2006. In present investigation of development of pineapple RTS fortified with spirulina the pineapple fruits and spirulina powder were procured from local market. The pineapple fruits were

cleaned and crown of pineapple was removed and then peeling and slicing was done. Pineapple juice was extracted by using food processor and then it was strained to obtain a clear juice. Sugar syrup was prepared using sugar, sodium benzoate, citric acid and water and then it was strained. Sugar was added for sweetness till 10oB. Sodium benzoate and citric acid were added to it 120 ppm and 0.25g, respectively. 90 ml of strained syrup was added to 10 ml of pineapple juice to prepare 100 ml RTS. Spirulina was added in the juice in varied proportions. Three different samples were prepared with different levels of spirulina (0.01g, 0.1g and 1g). Sample without spirulina was taken as control. The RTS was filled in glass bottles and then crown corking was done. Later these bottles were pasteurized and stored.

Sample	Pineapple juice (ml)	Strained syrup (ml)	Spirulina powder (g)
Control	10	90	0
S ₁	10	90	0.01
S ₂	10	90	0.1
S ₃	10	90	1

Table 1: Sample preparation of pineapple RTS fortified with spirulina

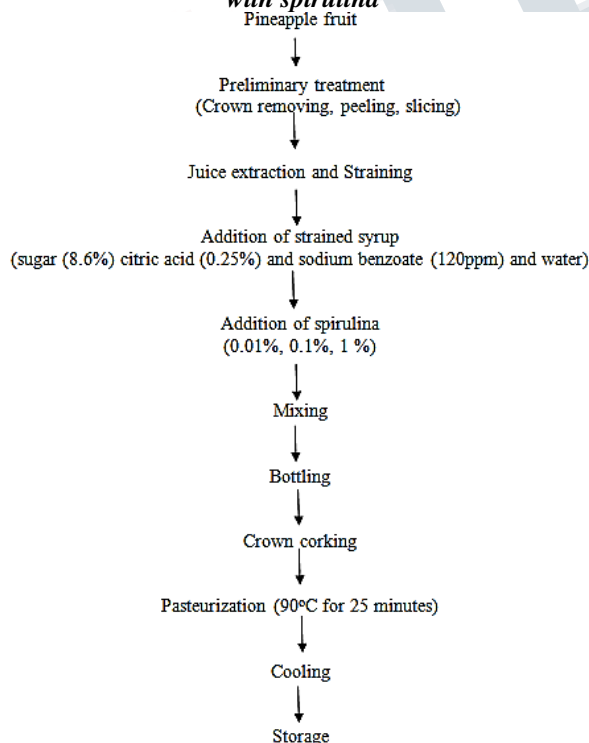


Fig. 1 Process flow chart for the preparation of pineapple RTS fortified with spirulina

Sensory evaluation

The sensory evaluation of different organoleptic properties viz., color and appearance, mouthfeel, taste, flavor, and overall acceptability were carried by a panel of judges of different groups and food habits on basis of 9 point hedonic scale (Anon, 1971). The average score was calculated for individual organoleptic properties. The overall acceptability score 7 to 9, 5 to 6 and below 5 were evaluated as more acceptable, acceptable and not acceptable products respectively.

Chemical analysis

Raw material and final products were analyzed for carbohydrate, protein, fats, acidity and TSS. Carbohydrate was determined by Anthrone method, protein by Kjeldhal method, fat by Gerber method, TSS by hand refractometer and acidity by titration (Ranganna, 1977).

Determination of carbohydrate

For determination of carbohydrate Anthrone method was used (Ranganna, 2005).

Determination of protein content

The protein content was estimated by using micro-kjeldahl method (Ranganna, 2005).

$$\text{Nitrogen (\%)} = \frac{(\text{Sample titre} - \text{Blank titre}) \times \text{Normality of HCL} \times 14 \times 100}{\text{Weight of sample} \times 1000}$$

$$\text{Protein content (\%)} = \text{Nitrogen (\%)} \times 6.25$$

TSS

The content of total soluble solids (TSS) in the juice was determined with the help of Erma hand refractometer.

Acidity

The acidity was determined by the titration (Raganna 1986)

Titration Acidity as citric acid (%) =

$$\text{Titration Acidity as citric acid (\%)} =$$

$$\frac{\text{Titre} \times \text{N of alkali} \times \text{Volume made up} \times \text{Equivalent weight} \times 100}{\text{Volume of sample taken} \times \text{Weight of sample taken} \times 1000}$$

Experimental findings and analysis

Organoleptic properties

Data on organoleptic properties of various products is tabulated in Table 2. Effect of spirulina concentration on organoleptic properties of different RTS samples is plotted and shown in Fig.2. The sensory score of RTS samples using spirulina was found in the range between 6.8 and 8.5. The overall acceptability of RTS samples prepared with spirulina powder (0.01%, 0.1% and 1%) was found 7.1, 7.8 and 8.2, respectively. The overall acceptability of RTS sample prepared with 1% incorporation of spirulina powder was found to be 8.2 which is close to the control sample (8.6).

Table 2: Average organoleptic properties of RTS fortified with spirulina

Sample No.	Colour and appearance	Taste	Flavour	Mouthfeel	Overall acceptability
S ₀	8	8.6	8.2	8.9	8.6
S ₁	7.1	6.9	7.2	6.8	7.1
S ₂	7.4	8.3	8.3	8.2	7.8
S ₃	8.5	8.2	8.3	8.1	8.2

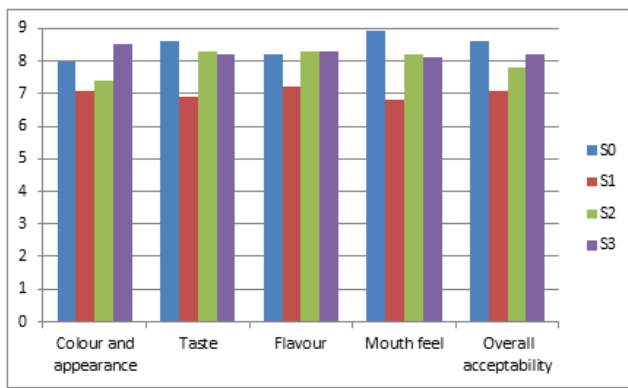


Fig. 2 Effect of spirulina concentration on organoleptic properties of different RTS samples

Chemical properties of raw material

Chemical composition of fresh pineapple fruit was determined and tabulated in Table 3. Data indicates that the carbohydrate content of pineapple fruit was 12.82%, Protein content was 0.54%. TSS and acidity of pineapple fruit was found 15.0% and 0.49%, respectively. Chemical composition of spirulina powder was determined and tabulated in Table 4. Spirulina powder was green in color. Protein content was found about 64.7%. Carbohydrate was found about 11.3%. Fat was found 4.8%.

Table 3: Chemical properties of pineapple fruit

Properties	Pineapple(g/100ml)
Colour	Yellow
Carbohydrate	12.82
Protein	0.54
Fat	0.12
TSS	15.0
Acidity	0.49

Table 4: Chemical properties of spirulina powder

Properties	Spirulina (g/100g)
Colour	Green
Protein	64.7%
Carbohydrate	11.3%
Fat	4.8%

Chemical composition of pineapple RTS fortified with spirulina

Chemical composition of pineapple RTS fortified with spirulina was determined and tabulated in Table 5. Protein content in pineapple RTS fortified with spirulina was found in the range from 0.1% to 1.2% whereas in control sample it was 0.08 %. There is marked effect of concentration of spirulina on protein content of RTS. It was seen that there is no marked effect of spirulina concentration on carbohydrate content. Carbohydrate content in spirulina fortified RTS samples was found in the range from 13.9% to 14.6% whereas in control sample it was 13.7%. Total soluble solids in spirulina supplemented pineapple RTS were found in the range from 11 to 12% whereas in control sample it was 10%. Acidity of spirulina fortified RTS was found in the range between 0.30 to 0.33% whereas in control sample it was 0.34%.

Table 5: Chemical properties of Pineapple RTS fortified with spirulina

Properties	S ₀ control	S ₁ (0.01%)	S ₂ (0.1%)	S ₃ (1%)
Carbohydrate (%)	13.7	13.9	14.2	14.6
Protein (%)	0.08	0.1	0.15	1.2
TSS (%)	10	11	12	12
Acidity (%)	0.34	0.33	0.31	0.30

III. CONCLUSION

Indian population is predominantly vegetarian. Spirulina can easily meet the requirement of vegetarian diet. Spirulina is rich in protein it has 65-70% protein in it. Spirulina in its natural balance is a nutritious health food. Spirulina is very close to being the ideal food for human beings. Containing an almost perfect balance of protein, including the eight essential amino acids, it is easily digested, quickly assimilated and satisfies hunger quickly. From this study it can be concluded that addition of spirulina powder in pineapple RTS improves the nutritional value in terms of protein content. Pineapple RTS with 1% of spirulina powder

was found more acceptable as compared to 0.01 and 0.1% of spirulina.

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