

Research Article

Effect of Carbonation and Thermal Processing on Quality of Ashwagandha Health drink

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Abstract

The study was conducted to investigate the effect of thermal processing and carbonation on Ashwagandha Health drink. The health drinks were prepared using sugar syrup as well as aspartame. Three different concentrations of Ashwagandha powder (5g, 10g and 15 m) were used for preparation of the drinks. Results showed 10g concentration of ashwagandha was found to best for further analysis. The drinks were carbonated and thermally processed at 70⁰ C for 30 minutes. Quality and shelf life analysis of the health drinks was done. Results showed that the thermally processed health drink containing sugar syrup was found to have highest Energy content of 49 KCal while Carbonated health drink containing aspartame had the lowest Energy content of 10 KCal. In shelf life analysis, thermally processed health drinks showed lesser variation in pH and sugar contents as compared to the carbonated energy drinks.

Keywords: Ashwagandha, Carbonation, Thermal processing, Energy content.

1. Introduction

Health drinks are fortified beverages with added dietary supplements. The marketing of these drinks mainly relies on the claims that the natural ingredients in health drinks supply increased energy, increased alertness, and improved athletic performance. Energy drinks most often contain taurine, caffeine and glucose along with a variety of other substances like guarana and ginseng. Herbal extracts mostly the infusion type can be incorporated into soft drinks mineral water-based drinks and health drinks. Several herbal extracts on the basis of their mind-calming and soporific properties are being used. (Ansari *et al* 2012).

Withania Somnifera commonly known as Ashwagandha or winter cherry is a plant in the Solanaceae or nightshade family. Modern herbalists classify Ashwagandha as an adaptogen, a substance said to increase the body's ability to withstand stress of all types. Like other adaptogens, Ashwagandha is said to boost physical energy, exercise capacity, and overall health. Ashwagandha is used as a general tonic, to increase energy and improve health and longevity (Sandhu *et al* 2010). Ashwagandha is widely used in Ayurvedic medicine and is one of the ingredients in many formulations to increase energy, improve overall health and longevity, and prevent disease. The human doses of Ashwagandha are generally in the range of 4-6 g/day and expected to be safe

and non-toxic (Kushwaha *et al* 2012). There are numerous advantages to using botanical extracts in beverages, functional or otherwise (Joerg Gruenwald, 2009).

Carbonation occurs when carbon dioxide is dissolved in water or an aqueous solution. This process yields the "fizz" to carbonated water and sparkling mineral water. Carbonation creates bubbles and fizzing in a carbonated beverage due to the presence of the carbon dioxide gas.

In all its forms of application, thermal processing persists as the most widely used method of preserving and extending the useful shelf - life of foods. The time and temperature combination is based on the thermal death kinetics. The hermetic seal maintains an environment in the container that prevents the growth of other microorganisms of higher resistance and most importantly, prevents recontamination and pathogens from producing toxins during storage.

Pomegranate juice was used in the thermally processed energy drink. Pomegranate (*Punicagranatum L.*) belongs to the Punicaceae family. It is one of the important and commercial horticultural fruits which is generally very well adapted to the Mediterranean climate. The edible part of the fruit contains considerable amounts of acids, sugars, vitamins, polysaccharides, polyphenols and important minerals (Vahid *et al*, 2009). Based on the organoleptic properties of pomegranate fruit, cultivars are classified into three groups: sweet, sour-sweet and sour (Jelena *et al*, 2011). Pomegranate juice supplementation helps in the improved recovery of skeletal muscle strength after eccentric exercise in individuals who routinely performed resistance training and reduces weakness and soreness of the muscles (Trombold *et al*, 2011). The present study was

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conducted to prepare ashwagandha energy drink using sugar syrup and aspartame. The drinks were carbonated as well as thermally processed and the quality and shelf life analysis of the drinks was done.

2. Materials and methods

Ashwagandha powder was procured from the local market under the brand name *AsagandhChurna*. Pineapple and pomegranate flavours were used of the brand Spac and were purchased from the local market. Aspartame powder under the brand name sugarfree gold was used and was procured from the local market. Pomegranate juice was obtained from the local juice making store. It was then filtered through 0.8 µm filter to obtain a clear juice. Carbon Dioxide was obtained from 8g cylinders used for the Fizzini carbonation unit. Sugar was procured locally under the brand name Dalmia fine sugar. Citric acid was procured locally under the brand name Fischer Scientific. Sodium benzoate was procured locally under the brand name Fischer Scientific.

A digital weighing balance Atcoset Model LR-120 A was used to take the accurate weight of the samples. A digital pH meter was used for measuring the pH of the materials whenever needed. The pH meter used was WTW inolab 720. The muffle furnace was used to determine the ash content of the drinks. The muffle furnace used during research was of Model HMF:4. A Density Meter was used to measure the °brix concentration of the carbonated energy drink. The Density meter used was Anton Paar DMA 4500 M. A Refractometer was used to measure the °brix content of the thermally processed energy drink consisting of juice solids. Refractometer used was Anton Paar Abbemat 350. A soxhlet apparatus was used to measure the fat content of the drinks. Micro – Kjeldahl apparatus was used for the estimation of protein content. Fizzini hand held carbonation unit of Model no. 85101 was used for carbonation. Thermo Scientific precision water bath of Model No. 285 was used for thermal processing.

2.1 Experimental Procedure

Different concentrations of Ashwagandha were used with different concentrations of sugar syrup and aspartame. Two different types of ashwagandha health drinks were prepared i.e. carbonated and thermally processed. In both types ashwagandha powder was added in concentrations of 5g, 10g and 15g. In the energy drinks, two types of sweetening agents was used i.e. sugar syrup and aspartame. With the increased concentration of ashwagandha, different concentrations of sugar syrup and aspartame was used. In the thermally processed health drinks pomegranate juice was used in 50ml volume.

2.2 Physico – Chemical Analysis

2.2.1 Determination of ash content

Ash is the residue remaining after all the combustible material has been burned off (oxidized completely). 100 ml sample was taken into crucible and ignited at low flame

till all the material was completely charred. Then it was kept in muffle furnace for 6 h at 600°C and further cooled in desiccators and weighed. This process was repeated till two consecutive weights were constant and percent ash was calculated.

$$\text{(\% Ash Content)} = \frac{W_1 - W_2 \times 100}{W_1}$$

Where, W_1 = Weight of dish sample before ignition
 W_2 = Weight of dish sample after ignition

2.2.2 Estimation of Fat

Soxhlet apparatus was used for the fat extraction from the health drink. All glassware were rinsed with petroleum spirit, drained and dried in an oven at 120°C for 30 min. 100 ml sample was taken and dried. It was then taken into the thimble. The thimble was inserted in a soxhlet liquid/solid extractor. About 75ml of petroleum spirit was poured into the flask. The extraction unit was assembled over either an electric heating mantle or a water bath. The solvent in the flask was heated until it boils. The heat source was adjusted so that solvent drips from the condenser into the sample chamber at the rate of about 4-6 drops per second. The extraction was continued for 8 hours. The extraction unit was removed from the heat source and detachment of the extractor and condenser was done. The flask on the heat was replaced and the solvent was evaporated. The flask was placed in an oven at 102°C and drying was done until a constant weight was reached. The flask was cooled in a desiccator and weight of the flask and contents were taken.

$$\text{Fat (g/100 ml)} = \frac{\text{Weight of ether extracted} \times 100}{\text{Weight of sample}}$$

2.2.3 Determination of Protein

The protein content of drinks was determined by Micro kjeldhal method using 25 – 50 ml sample by digesting with concentrated sulphuric acid at 100°C. Then it was distilled with 40 percent NaOH and liberated ammonia was trapped in 4 percent boric acid, using mixed indicator (methyl red :bromocresol green 1:5). Then it was titrated with 0.1 N Hydrochloric acid, the percent of nitrogen was estimated and protein percentage was calculated by multiplying percent nitrogen with factor 6.25.

% Nitrogen =

$$\frac{(\text{Titer reading} - \text{blank}) \times N \text{ of } H_2SO_4 \times 14 \times \text{volume made of digest} \times 100}{\text{Aliquot of wt. taken} \times \text{wt. of sample taken} \times 1000}$$

Protein = % nitrogen x 6.25

2.2.4 Determination of brix content

Density meter and Refractometer was used to measure the brix content of the drinks. The sugar syrup prepared was analysed by evaluating the brix content of the solution. One degree brix is 1 gram of sucrose in 100 grams of solution and represents the strength of the solution

as percentage by weight (% w/w). 10 ml of sample was feeded in to the inlet of the density meter ensuring that no bubbles were present. The reading was noted in ⁰brix.

2.2.5 Determination of Gas Volume

Gas volume was checked for the estimation of the carbon dioxide present in the health drink. Drink was taken and brought to 20⁰ C using refrigerator or water bath. Bottle was checked for proper crimping/capping. Vacuum gauge tester was used for clamping of bottle and tightened for proper sealing of bottle. Air release valve of the vacuum gauge tester was checked. Bottle was shaken for 1 minute in the auto shaker at 120 rpm. Pressure was observed in the gauge. The temperature was measured using the thermometer. Gas Volume was noted using the Pressure Vs Temperature GV Chart.

2.2.6 Determination of pH

pH meter was used for measuring the pH. Electrode was rinsed with distilled water. Electrode was immersed in drink sample and pH was noted.

3. Results and Discussion

3.1 Preparation of Ashwagandha Health Drinks

3.1.1 Preparation of Carbonated Ashwagandha Health

Drink using sugar syrup

Carbonated ashwagandha health drinks were prepared using three different concentrations of ashwagandha with sugar syrup. 5g, 10g and 15g concentrations of ashwagandha were used to prepare the drinks. The drinks prepared were evaluated with respect to the standard drink available in the market. Carbohydrate content was found to be highest in the standard drink with a concentration of 11g/100ml, while it was found to be lowest in the A₅ drink with a concentration of 9.58g/100ml.

- Ash content was found to be highest in A₁₅ at 1.10g/100ml drink while it was found to be absent in the standard drink.
- Energy content was found to be highest in the standard drink at 45Kcal/100ml of drink. While it was found to be lowest in A₅ drink with a value of 38Kcal/100ml of the drink.
- Fat and protein contents were found to be absent in the drinks.

In the above results, it was found that the carbonated energy drink having 15 g concentration of Ashwagandha showed best results in terms of carbohydrate and energy contents. However, sensory evaluation had the highest scores for A₁₀ drink having 10 g concentration of Ashwagandha while it was found to be lowest for A₅ sample. Hence, A₁₀ drink was selected for further analysis. The graphical representation is given below

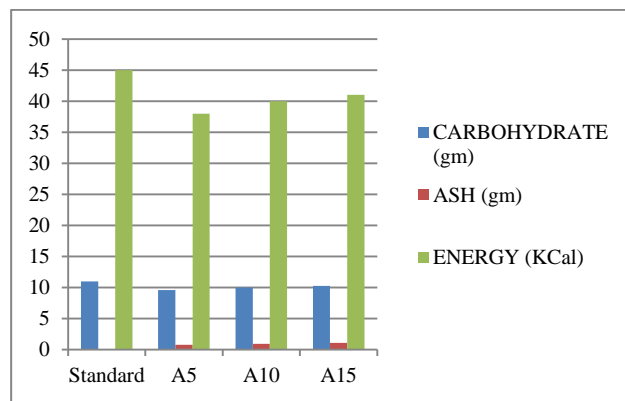


Fig 3.1: Nutritional analysis of Carbonated Ashwagandha Health Drink using sugar syrup

3.1.2 Preparation of Carbonated Ashwagandha Health Drink using Aspartame

Carbonated ashwagandha health drinks were prepared using three different concentrations of ashwagandha with aspartame. 5g, 10g and 15g concentrations of ashwagandha were used to prepare the drinks. The drinks prepared were evaluated with respect to the standard drink available in the market. Carbohydrate content was found to be highest in the standard drink with a concentration of 3g/100ml, while it was found to be lowest in the B₅ drink with a concentration of 2g/100ml.

- Ash content was found to be highest in B₁₅ at 0.96g/100ml drink while it was found to be absent in the standard drink.
- Energy content was found to be highest in the standard drink at 13Kcal/100ml of drink. While it was found to be lowest in B₅ drink with a value of 8Kcal/100ml of the drink.
- Fat and protein contents were found to be absent in the drinks.

In the above results, it was found that the carbonated health drink having 15 g concentration of Ashwagandha showed best results in terms of carbohydrate and energy contents. However, sensory evaluation had the highest scores for B₁₀ drink having 10 g concentration of Ashwagandha while it was found to be lowest for B₅ sample. Hence, B₁₀ drink was selected for further analysis.

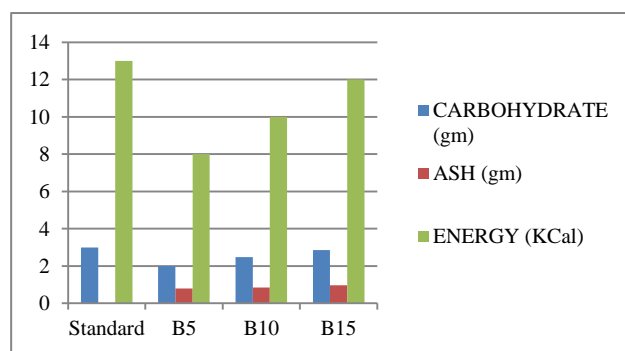


Fig 3.2: Nutritional analysis of Carbonated Ashwagandha Health Drink using aspartame

3.1.3 Preparation of Thermally Processed Ashwagandha Health Drink using sugar syrup

Thermally processed ashwagandha health drinks were prepared using three different concentrations of ashwagandha with sugar syrup. 5g, 10g and 15g concentrations of ashwagandha were used to prepare the drinks. The drinks prepared were evaluated with respect to the standard drink available in the market. Carbohydrate content was found to be highest in the standard drink with a concentration of 13g/100ml, while it was found to be lowest in the C₅ drink with a concentration of 11.91g/100ml.

- Ash content was found to be highest in C₁₅ at 1.10g/100ml drink while it was found to be absent in the standard drink.
- Energy content was found to be highest in the standard drink at 54Kcal/100ml of drink. While it was found to be lowest in C₅ drink with a value of 48Kcal/100ml of the drink.
- Fat and protein contents were found to be absent in the drinks.

In the above results, it was found that the thermally processed health drink having 15 g concentration of Ashwagandha showed best results in terms of carbohydrate and energy contents. However, sensory evaluation had the highest scores for C₁₀ drink having 10 g concentration of Ashwagandha while it was found to be lowest for C₅ sample. Hence, C₁₀ drink was selected for further analysis. The graphical representation is given below

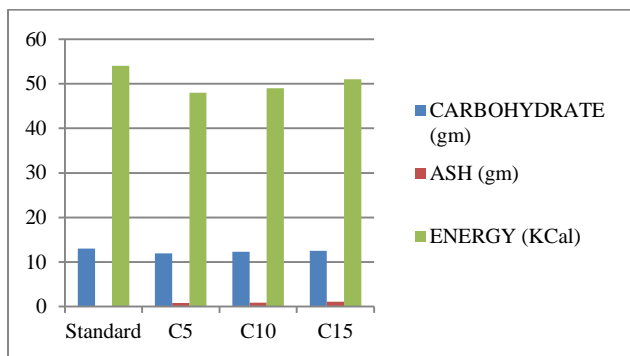


Fig 3.3: Nutritional analysis of Thermally Processed Ashwagandha Health Drink using sugar syrup

3.1.4 Preparation of Thermally Processed Ashwagandha Health Drink using Aspartame

Thermally processed ashwagandha health drinks were prepared using three different concentrations of ashwagandha with aspartame. 5g, 10g and 15g concentrations of ashwagandha were used to prepare the drinks. The drinks prepared were evaluated with respect to the standard drink available in the market. Carbohydrate content was found to be highest in the standard drink with a concentration of 8g/100ml, while it was found to be lowest in the D₅ drink with a concentration of 7.51g/100ml.

- Ash content was found to be highest in D₁₅ at 0.96g/100ml drink while it was found to be absent in the standard drink.
- Energy content was found to be highest in the standard drink at 33Kcal/100ml of drink. While it was found to be lowest in D₅ drink with a value of 30Kcal/100ml of the drink.
- Fat and protein contents were found to be absent in the drinks.

In the above results, it was found that the thermally processed health drink having 15 g concentration of Ashwagandha showed best results in terms of carbohydrate and energy contents. However, sensory evaluation had the highest scores for D₁₀ drink having 10 g concentration of Ashwagandha while it was found to be lowest for D₅ sample. Hence, D₁₀ drink was selected for further analysis. The graphical representation is given below

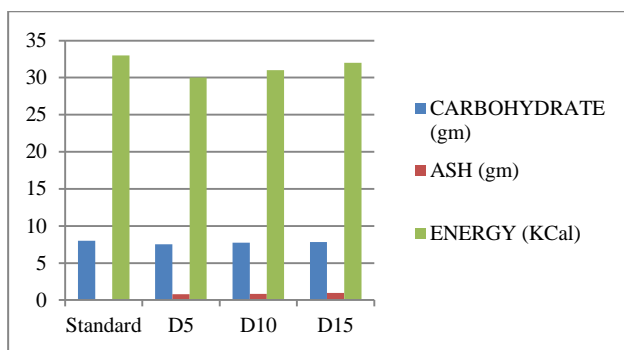


Fig 3.4: Nutritional analysis of Thermally Processed Ashwagandha Health Drink using aspartame

3.2 Study of quality attributes of the Carbonated and thermally processed Health Ashwagandha drinks using sugar syrup and aspartame.

3.2.1 Energy content analysis of the Healthdrinks

Health drinks selected on the basis of nutritional analysis were analysed on the basis of energy contents. It can be seen that thermally processed health drink C₁₀ was found to have highest energy content of 49 Kcal while Carbonated health drink B₁₀ was found to have lowest energy content of 10 Kcal. The graphical representation is given below.

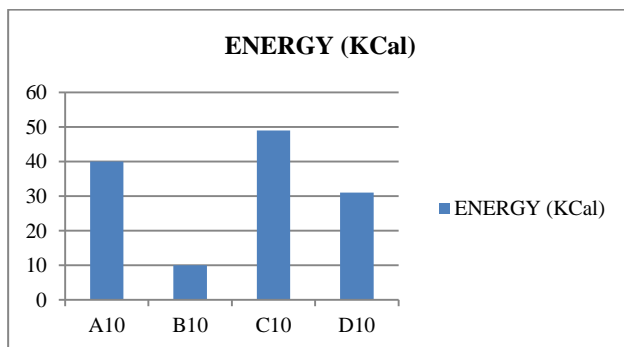


Fig 3.5: Energy content analysis of the Healthdrinks

3.2.2 Sensory Evaluation of Health Drinks

The Carbonated and Thermally processed health drinks were compared on the basis of sensory score. Carbonated energy drink containing sugar syrup (A₁₀) was found to have the highest score for taste (7.6) while carbonated health drink containing aspartame (B₁₀) was found to have the lowest score for taste (7.1).

- Thermally processed health drink containing sugar syrup (C₁₀) was found to have the highest scores for flavour (7.5) while Carbonated health drink containing aspartame and Thermally processed health drink containing aspartame (B₁₀, D₁₀) were found to have the lowest score for flavour (7.2).
- Thermally processed health drink containing sugar syrup (C₁₀) was found to have the highest score for appearance (7.6) while Carbonated health drink containing sugar syrup (A₁₀) was found to have the lowest score for appearance (7.2).

Overall acceptability was found to be highest in Thermally processed health drink containing sugar syrup (C₁₀) having a score of (7.5) while Carbonated health drink containing aspartame (B₁₀) was found to have the lowest score (7.2). Sensory scores were compared as given in the graphical representation below.

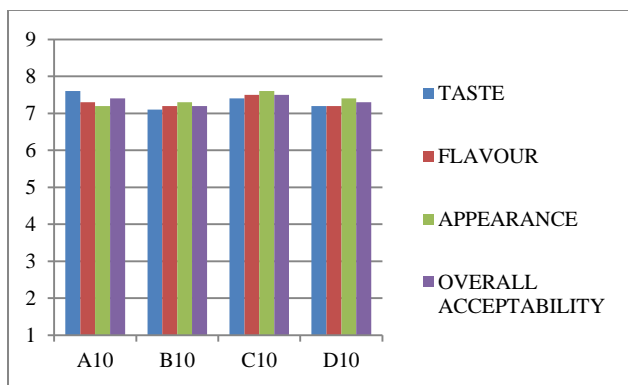


Fig 3.6: Sensory Evaluation of Health Drinks

3.3 Study of shelf life of the Carbonated and Thermally processed Ashwagandha Health drinks using sugar syrup and aspartame

3.3.1 Shelf life analysis of the Carbonated Health drinks containing sugar and aspartame

Shelf life analysis of the carbonated health drinks was done by evaluating gas volume, pH, brix, total plate count and yeast & mould count. Carbonated health drink samples were evaluated regularly at 7 day intervals for 49 days. Variation was found in gas volume, pH and brix contents while total plate count and yeast & mould count was found to be negligible.

3.3.1.1 Evaluation of gas volume of the Carbonated Health drinks containing sugar and aspartame

In the Carbonated Health drink containing sugar syrup gas volume was found to be highest at 0 day with a concentration of 3.62 vol. while it was found to be lowest at 49 days at 49 days with a concentration of 3.54 vol.

The gas volume of Carbonated Health drink containing aspartame was found to be highest at 0 day with a value of 3.71 vol. while it was found to be lowest at 49 days with a value of 3.65 vol.

Rodriguez et al (2013) studied the variation in carbonation values in coconut water over a period of 54 days and found that carbonation value varied significantly over the period of time. The graphical representation of the results is shown below.

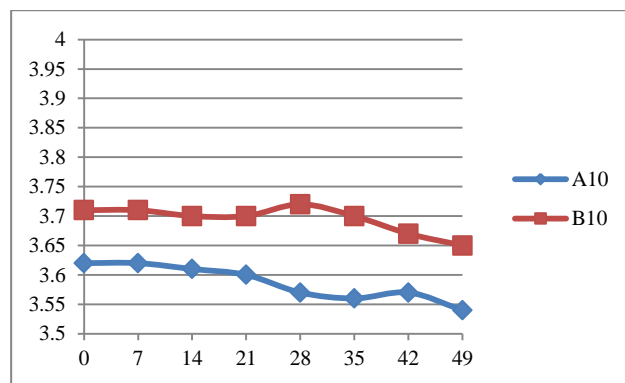


Fig 3.7: Evaluation of gas volume of the Carbonated Health drinks containing sugar and aspartame

3.3.1.2 Evaluation of pH of the Carbonated Health drinks containing sugar and aspartame

pH of the Carbonated Health drinks was evaluated during a time period of 49 days. The results are shown in Fig 3.8.

- In the Carbonated Health drink containing sugar syrup, the pH was found to be highest at 0 and 7 days with a value of 4.5 while it was found to be lowest at 49 days with a value of 4.
- In the Carbonated Health drink containing aspartame, the pH was found to be highest at 0 day with a value of 4.9 while it was found to be lowest at 49 days with a value of 4.5.

Rodriguez et al (2013) studied the variation in pH over a period of 54 days and found that pH varied significantly over the period of time with increase as well as decrease in the pH.

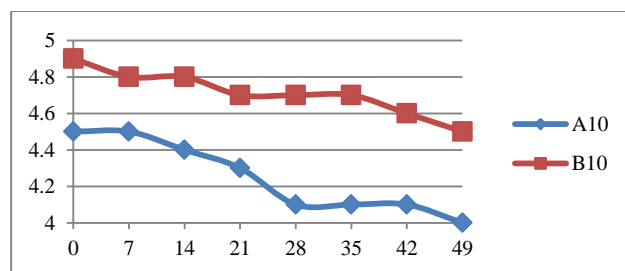


Fig 3.8: Evaluation of pH of the Carbonated Health drinks containing sugar and aspartame

3.3.1.1 Evaluation of Brix of the thermally processed Health drinks containing sugar and aspartame. The results obtained are shown in Fig 3.9.

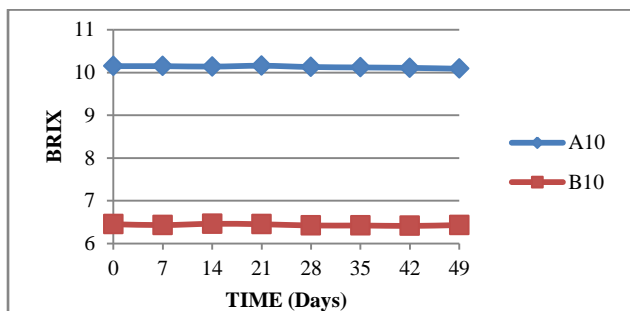


Fig 3.9: Evaluation of Sugar content of the Carbonated Health drinks containing sugar and aspartame

In the Carbonated Health drink containing sugar syrup the brix content was found to be highest at 0 day with a concentration of 10.15 °brix while it was found to be lowest at 49 days with a value of 10.09 °brix.

In the Carbonated Health drink containing aspartame the brix content was found to be highest at 0 day with a concentration of 6.45 °brix while it was found to be lowest at 42 days with a value of 6.41 °brix.

3.3.2 Shelf life analysis of the thermally processed Health drinks containing sugar and aspartame

Shelf life analysis of the thermally processed Health drinks was done by evaluating pH, brix, total plate count and yeast & mould count.

Thermally processed Health drink samples were evaluated regularly at 7 day intervals for 49 days. Variation was found in pH and brix contents while total plate count and yeast & mould count was found to be negligible.

3.3.2.1 Evaluation of pH of the Thermally processed Health drinks containing sugar and aspartame

Thermally processed Health drink containing sugar syrup was found to have highest pH at 0 day with a value of 3.4 while the lowest pH was at 49 days with a value of 3.

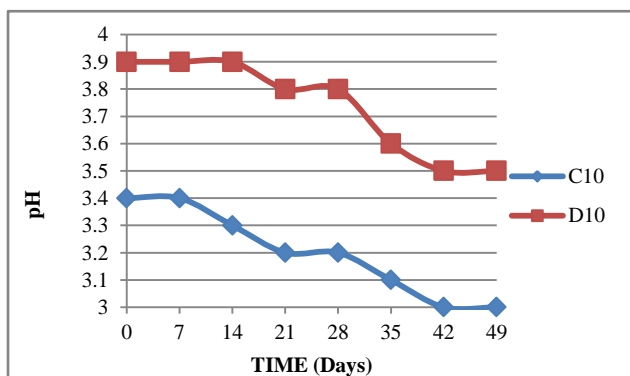


Fig 3.10: Evaluation of pH of the Thermally processed Health drinks containing sugar and aspartame

Thermally processed Health drink containing aspartame was found to have highest pH at 0 day with a value of 3.9 while the lowest pH was at 49 days with a value of 3.3.

3.3.2.1 Evaluation of Brix of the thermally processed Health drinks containing sugar and aspartame

Brix of the Thermally Processed Health drinks was evaluated during a time period of 49 days. The results obtained are shown in Fig 3.11.

Thermally processed Health drink containing sugar syrup was found to have highest brix at 28 days with a concentration of 11.57 °brix while the lowest brix was recorded at 49 days with a value of 11.51 °brix.

Thermally processed Health drink containing aspartame was found to have highest brix at 21 days with a concentration of 7.87 °brix while the lowest brix was recorded at 49 days with a concentration of 7.82 °brix.

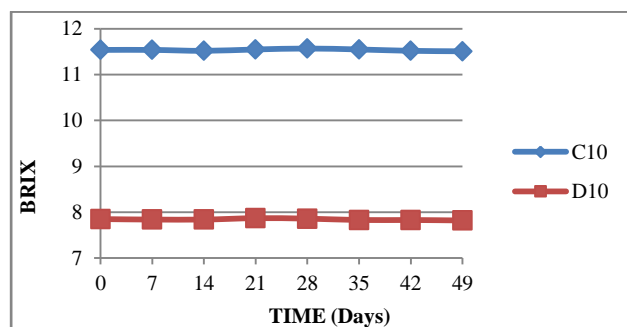


Fig 3.11: Evaluation of °Brix of the thermally processed Health drinks containing sugar and aspartame

Conclusion

The study was conducted on “Effect of Carbonation and thermal processing on quality of Ashwagandha Health drink”.

In the Carbonated Health drinks three different drinks were prepared with 5g, 10g and 15g concentration of Ashwagandha. Nutritional and sensory analysis of the drinks was done and was compared with standard drink. The Carbonated Health drink containing 10g of Ashwagandha was selected for Quality and shelf life analysis.

In the Thermally Processed Health drinks, three different drinks were prepared with 5g, 10g and 15g concentration of Ashwagandha. Nutritional and sensory analysis of the drinks was done and was compared with standard drink. The Carbonated Health drink containing 10g of Ashwagandha was selected for Quality and shelf life analysis.

Thermally Processed Health drink containing sugar syrup with 10g concentration of Ashwagandha was found to have highest Energy content of 49 KCal while Carbonated Health drink containing aspartame had the lowest Energy content of 10 KCal.

Energy drinks prepared were evaluated for shelf life study over a period of 49 days and were evaluated regularly at 7 day intervals. Thermally Processed Health drinks showed lesser variations in pH and °brix content as compared to the Carbonated Health drinks.

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