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Full Length Research Paper

Physicochemical and sensory evaluation of soy/carrot drinks flavoured with beetroot

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ABSTRACT

Soy/Carrot/Beetroot drinks were prepared with various ratios of the different vegetables. The Physicochemical properties, sensory evaluation of the drinks were evaluated. Physicochemical parameters of the drinks showed the drinks were almost at neutral pH as the values ranged from 5.95 in sample F to 6.42 in sample E. Values for sugar (Brix%) ranged from 8.00 - 9.00, total solid (%) ranged from 8.07 in sample F to 10.70 in sample E. Values for viscosity ranged from 0.331 pa.s in sample C to 0.415 pa.s in sample E. Proximate composition of the drinks showed values for moisture content ranging from 89.31% in sample E to 92.10% in sample C. Results for total ash fall between 0.39% in sample D to 0.53% in sample E. Sample E and F with the highest amount of soymilk and carrot drink, respectively gave the highest value for ash. Results for protein content ranged from 0.03% (sample F) to 0.53% in sample E, showing an increase with the increase in the soy content of the drinks. Values for carbohydrate ranged from 2.48% in sample A to 4.96% in sample E. The fat content of the drinks were generally low but showed an increase with increase in the soy content of the drinks. Sensory results showed the drinks were acceptable to the panelist as indicated by the average score of 5.9. Sample E (with 90% soymilk and 10% Beetroot juice was the most preferred for overall acceptability.

Keyword: Soymilk, carrot juice, beetroot, vegetable drink, fruit drinks.

INTRODUCTION

All over the world, health concerns have led to the popularization of natural drinks as a healthy alternative to other beverages.Fruit drinks and juices are nutritious, have a great taste and health benefits (Suad and Eman, 2008). Non alcoholic beverages, especially fruit drinks play a vital role in the diets of people in both developed and developing countries. They are regarded as after meal drinks or refreshing drinks during the dry season in rural and urban centres (Babajide et al, 2013). Fruits and drinks are consumed for their characteristic aroma and also considered a source of soluble and insoluble fibres, vitamins and minerals (Righetto et al., 1999).

A number of fruits, vegetables and in some cases soybean have become useful raw materials in the production of natural drinks. Production and preservation ofcashew-apple juice for use at off-season as an alternative to foreign juice and natural drink with high vitamin C content (Emelike and Ebere, 2015). Soymilk, an aqueous, white and creamy extract produced from soybeans which resembles cow milk both in appearance and consistency is a highly nutritious food drink which contains protein, fat, carbohydrate, vitamins and minerals. (Maduekwe et al., 2013).

Carrots according to Bazilla et al., (2012) is a rich source of β- Carotene and vitamins like thiamine, riboflavin, vitamin B-complex and minerals.Carrot drinks have been used as a healthy drink in homes in Nigeria. The consumption of carrots and its related products has increased steadily due to the recognition of its antioxidant and anti-cancer activities of β- Carotene in carrot which is also a precursor of vitamin A (Mridula, 2011). The vitamins in carrot juice helps to promote growth for visual light and colour, preventing dryness of skin and eyes (Ochulor et al., 2013).

Beetroots are rich sources of potent antioxidants and nutrients. It is an excellent source of foliate, manganese and iron (Wiki, 2013) and can complement soymilk and carrot juice in these areas. Beetroot has already been established as a flavouring agent or a special flavour that is generally liked by people who have known its benefits and functions (Mbaeyi-Nwaoha and Nwachukwu, 2012). Stephen (2014) also reported that Beetroot is used commercially as a food dye in ice cream, sweets, yoghurt and other confectionaries. Beetroot is a rich source of dietary inorganic nitrate and a number of studies have investigated its potential for reducing blood pressure in humans (Webb et al, 2008; Bailey et al., 2009;Vanhatalo et al., 2010). Coles and clifton (2012) reported that after consumption to beetroot juice on a low nitrate diet may lower blood pressure and therefore reduce the risk of cardiovascular event.

In Nigeria today, there is a preponderance of milk drinks with a strong fruit content, that is often beyond the reach of the less endowed in the society. Encouraging the home stead production of milk drinks while harnessing the nutritional and flavour properties of soybean, carrot and beetroot will no doubt enhance the nutrient intake of the less privileged, as these raw materials are available. Also the combination of these vegetables will make a highly nutritious and health supporting drink for human consumption. Based on the nutrient dense properties of these vegetables, the study is aimed at developing health drink from soymilk and carrot flavoured with beetroot juice. To evaluate the Physicochemical and sensory properties of the developed drinks in order to ascertain its acceptability.

MATERIALS AND METHODS

MATERIALS

Soybean (gycine max), carrot (Daucuscarota), Beetroot (Beta vulgaris) and sugar were purchased from Mile three market in Port Harcourt, Rivers State, Nigeria. The vegetables were sorted and cleaned so as to remove dirts and spoilt ones, thoroughly washed before processing.

METHODS

Sample Preparation

The soybeans were sorted to obtain clean white seeds, soaked in a volume of water four times its weight at 26oC and 75oC for 16h. The beans were manually dehulled, washed and allowed to drain. The carrot and beetroot were washed and the skin scraped off, washed again and sliced.

Preparation of soy/carrot/Beetroot Drink (SCBD)

A modified Carrao (1999) method was used. 380g of the dehulled soy bean was weighed and blended using a Philips HR2000 blender for 5 min. The milk was extracted by sieving the paste with a muslin cloth and water was added in the milk to water ratio of 1:10. The milk was heated at 95°C for 15min and cooled.

A 204g of beetroot or carrot was weighed with a digital electronic balance. They were cut into slices of about 2 – 3mm thick and subjected to extraction using a juice extractor (Iloytron 23438. UK). The pulp obtained was sieved with muslin cloth using a pulp to water ratio of 1:4 to obtain beet juice or carrot juice. The soymilk carrot drinks flavoured with beetroot juice were prepared according to the formulation shown in Table 1. The mixture was homogenized using a high speed homogenizer and transferred into bottles previously washed with hot water, stoppered and pasteurized at 75oC for 15min using a water bath (Techno test, Italy) and thereafter allowed to cool to room temperature.

Physicochemical Properties

Viscosity: The viscosity of the drinks was determined with the aid of a Rotary digital viscometer (NDJ.8S, China) using spindle number 2 at l2rpm. 250m1 of the drink was transferred into a 250m1 beaker. The content of the beaker was introduced directly unto the rotating spindle and the value of the viscosity displayed on the LCD screen in pa.S was recorded.

pH: The pH of the drinks was determined using a pH meter (TS 625, USA). Twenty (20ml) of the drink was transferred into a beaker and the pH was determined after the meter was calibrated using standard buffer of pH 4.0 and 7.0, sufficient time was allowed for stabilization before readings were taken.

Sugar: The hand held sugar refractometer was used. The prism of the refractometer was cleaned and a drop of the drink was placed on the prism and closed. The sugar content percentage (soluble sugar) was read from the scale of the refractometer when held close to the eye.

Proximate composition: The moisture content, total solid, ash and crude protein were determined by the method of AOAC (2012). Fat was determined by Rose-Gottlieb method (Pearson, 1981) while manual cleggAnthrone method (Osborne and Voogt, 1978) was used in the determination of total available carbohydrate.

Sensory evaluation: The sensory analysis was carried out using a twenty member panelist consisting of staff and students of Food Science and Technology Department, Rivers State University of Science and Technology, Port Harcourt, Rivers State Nigeria. The organoleptic qualities evaluated were: Taste, Colour Mouth feel, Flavour and Overall acceptability. The prepared drinks were served with clean glasses to

Table 1: Formulation of Soy-Carrot-Beetroot Drink

Sample	Soymilk(m1)	Carrot Juice(ml)	Beetroot Juice(m1)
A	800	100	100
B	700	200	100
C	600	300	100
D	500	400	100
E	900	0	100
F	0	900	100

Key:A = Soy/Carrot/Beetroot (ratio 80:10:10), B = (ratio 70:20:10), C = (ratio 60:40:10), D = (ratio 50:40:10), E = (ratio 90:0:10), F = (ratio 0:90:10)

Table 2. Physical Properties

Sample	pH	(Soluble) Solids Sugar (%)	Total Solid (%)	Viscosity (Pa.S)
A	6.11[a]	9.00[a]	9.34[a]	0.391[a]
B	6.33[a]	8.14[a]	8.50[a]	0.395[b]
C	6.36[a]	9.00[a]	9.24[a]	0.331[b]
D	6.34[a]	9.00[a]	9.91[a]	0.361[b]
E	6.42[a]	9.00[a]	9.40[a]	0.415[b]
F	5.92[a]	8.00[a]	8.17[a]	0.372[b]

Results shows means ± SD of duplicate readings. Values with different superscript in the same column are significantly different ($p \leq 0.05$)
Key:A = Soy/Carrot/Beetroot (ratio 80:10:10), B = (ratio 70:20:10), C = (ratio 60:40:10), D = (ratio 50:40:10), E = (ratio 90:0:10), F = (ratio 0:90:10)

Table 3. Proximate Composition and Energy

Sample	Moisture Content (%)	Ash (%)	Fat (%)	Crude Protein (%)	Total Carbohydrate (%) A.	Energy (Kcal/100ml)
A	90.66±0.72	0.40±0.03	1.38±0.14	0.27±0.09	2.48±0.16	21.35
B	91.87±0.23	0.42±0.07	1.18±0.03	0.29±0.90	3.14±0.24	24.16
C	92.10±0.03	0.43±0.12	1.16±0.01	0.23±0.04	3.06±0.13	23.60
D	91.93±0.06	0.39±0.01	1.09±0.11	0.21±0.09	3.58±0.04	24.97
E	89.31±0.72	0.53±0.19	1.56±0.01	0.53±0.07	3.49±0.06	30.12
F	91.53±0.00	0.46±0.06	0.89±0.04	0.03±0.01	4.91±0.09	27.77

Key:A = Soy/Carrot/Beetroot (ratio 80:10:10), B = (ratio 70:20:10), C = (ratio 60:40:10), D = (ratio 50:40:10), E = (ratio 90:0:10), F = (ratio 0:90:10)

individual panelist. The order of presentation of samples to the panel was randomized, portable water was provided to rinse the mouth between evaluations. Each sensory attribute was on a 9 – point Hedonic Scale with 1 = disliked extremely while 9 = liked extremely as reputed by Iwe (2010)

Statistical analysis: The method of Wahua (1999) was used to analysis the data using analysis of variance (ANOVA). The sensory evaluation were subjected to one-way analysis of variances, all means were separated using Duncan Multiple Range test and least significant difference at 5% probability level ($p>0.05$) using SPSS version 20.0 software 2011.

RESULTS AND DISCUSSION

Physico-chemical Properties

The results of the physio-chemical properties of the drinks are shown in Table 2. The value for pH ranged from 5.92 in sample F to 6.42 in sample E. The values for pH shows the drinks were almost at a neutral pH.These values were however less acidic when compared with 4.36 - 4.41 reported by Babajide et al., (2013) for spiced cucumber and pineapple drinks. This difference may be due to the pH of pineapple. Values for soluble sugar ranged from 8.00 - 9.00%. Sample F without soymilk

Table 4. Mean Sensory Scores of Soy/Carrot/Beetroot Drinks

Sample	Colour	Taste	Flavour	Mouthfeel	Overall acceptability
A	7.65[a]	6.35[a]	6.35[a]	6.65[b]	6.95[b]
B	7.45[a]	5.95[d]	6.05[b]	6.55[b]	6.85[b]
C	7.00[b]	6.50[c]	6.05[b]	6.05[b]	6.55[c]
D	7.15[b]	6.65[c]	6.70[a]	6.40[b]	6.90[b]
E	7.60[a]	7.75[a]	7.05[a]	7.25[a]	7.80[a]
F	7.65[a]	7.05[b]	6.80[a]	6.75[b]	7.10[b]

Results shows means ± SD of duplicate readings. Values with different superscript in the same column are significantly different ($p \leq 0.05$)
Key:A =Soy/Carrot/Beetroot (ratio 80:10:10), B = (ratio 70:20:10), C = (ratio 60:40:10), D = (ratio 50:40:10), E = (ratio 90:0:10), F = (ratio 0:90:10).

gave the least value. The generally low sugar content will make the drinks suitable as a low calorie drink. Results for total solids showed sample E with the highest amount of soymilk gave the highest value, followed by sample D, it was also observed that the differences between sample E and A, E and C were not significant. The results for total solids thus showed an increase with increase in soymilk content of the drinks. The result for total solids in sample E also correlates with the value for viscosity as it also recorded the highest value of 0.415 pa.S.

Proximate composition

The result for proximate composition is presented in Table 3. Values for moisture content ranged from 89.31% in sample E to 92.10% in sample C. These values agreed with the report of Hiroya et al., (1992) who reported 80% moisture content for skimmed sweet yoghurt and a range of 60 - 90.8% reported by Mbaeyi-Nwaoho and Nwachukwu (2012) for yoghurt flavoured with beetroot.Drinking juice is one of the ways of taking water which is vital for the transportation of food and waste, digestion and the regulation of body temperature. Results for ash ranged from 0.39% in sample D to0.53% in sample E. Values for ash was highest in sample E (0.53%), followed by sample F (0.46%), sample E which contains 90% soymilk and sample F with 90% carrot drink both gave the highest values of ash (0.53% and 0.46%),respectively. Suad and Emen (2008) reported that fruit drinks are important sources of minerals. Result of crude protein showed a decrease in pruting and in protein content with increase in the amount of carrot juice in the drinks. Sample F without soymilk gave the least value for crude protein (0.03%). The carbohydrate content of the drinks showed an increase with increase in the carrot component from sample A to D, the highest value for carbohydrate was in sample F with the 90% carrot content. The fat content result increased with increase in the soymilk content of the drinks. The fat content of the drinks were generally low. Fruit juices and drinks are not good sources of fat. Values for energy ranged from 21.35 Kcal/100ml in sample A to 30.12 kcal/100ml for sample E. Sample with the highest amount of soymilk in the drinks gave the highest value and this was followed with sample E with the highest amount of carrot content in this drinks. Values for A, B, C, and D were close.

Sensory evaluation

Results for sensory evaluation are as shown in Table 4. The result showed sample A, B, E and F were the most preferred for colour and values were significantly different from C and D. Sample F had the least preference for colour. Sample E with the highest amount of soymilk was the most rated for taste by the panelist followed by sample F with the highest amount of carrot. Sample B had the least preference for taste. Sample D and E were the most preferred for flavor while sample E had the highest preference for mouth feel and overall acceptability. The sensory results showed the products were acceptable to the panelists as seen in the average score of above 5.9.

CONCLUSION

A refreshing fruit drink was produced from soymilk and carrot juice flavoured with 10% beetroot juice. Sample E with 90% soymilk and no carrot was preferred for flavour, colour, mouthfeel, taste and overall acceptability. However, production of carrot juice flavoured with beetroot juice should be further investigated and the storage stability of the drinks determined.

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