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RESEARCH NOTE

Quality Attributes, Biochemical Profile and Calorific Status of Functional RTS Drink from a Blend of Mango and Tomato

Madhu Parmar[1], Sonia Johri[1]*, Hradesh Rajput[2] and J.L. Bhat[2]

[1]Department of Life Sciences, ITM University, Gwalior, Madhya Pradesh, India
[2]Department of Food Technology, ITM University, Gwalior, Madhya Pradesh, India

*Corresponding author: johrisonia@gmail.com

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ABSTRACT

Fruits are rich sources of nutrients, macro molecules, good source of energy and a reservoir of antioxidants. In the present study, an attempt has been made to prepare a RTS (Ready-to-serve) functional food. Sensory evaluation of various combinations, followed by screening of the best combination was performed. Proximate analysis such as pH, moisture content, ash content, total solid and Vitamin C content of the combination was estimated. Results of biochemical evaluation revealed that combination of mango: tomato in 50:50 followed by 60:40 proved to be the best combination. The phenolic and flavanoid content was the marker of the antioxidant status. The RTS proved to have a rich calorific value.

Keywords: Mango, RTS, tomato, fruits juice and phytochemicals

Fruits play a very important role in maintaining the nutritional status of the body. They are a reservoir of essential elements, such as water, vitamins (A, B_1, B_2, C, D and E), minerals (Ca, Mg, Zn, Fe, K etc.) and organic compounds which are very important for our body to make body function, (Okwu and Emenike, 2006; Dosumu *et al*. 2009). They are a good source of antioxidants which are the scavengers of free radicals. Because of rich perishability of fruits, they spoil quickly but can be preserved as beverages (Brett *et al*. 1996). Juices can be prepared by squeezing fresh fruits mechanically or by enzymatic extraction process. Fruit juices promote detoxification in the human body and contribute to good health (Minich and Bland, 2007). Natural sources of antioxidants from fruits are more advantageous to health than the synthetic counterparts or supplements (Liu, 2003). In the present era, consumer awareness towards the relationship between food and health has led to an explosion of interest in "healthy foods"; which could be partly attributed to the increasing cost of healthcare, the steady increase in life expectancy, and the desire of older people for an improved quality of life (Granato *et al.* 2010). Ready-to-serve (RTS) beverages are made out of fruits, such as pineapple, orange, lime, banana, litchi, passion fruit, and other local fruits which can be used for ready-to-serve (RTS) beverages preparations.

Mango has high nutritional value and is an important source of dietary antioxidants such as carotenoids, ascorbic acid and phenolic compounds (Manthey and Perkins, 2009). The phenolic compounds include flavonoids, phenolic acids, xanthones and

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gallotannins (Kim *et al*. 2010) (Manthey and Perkins, 2009). The ascorbic acid is an important micronutrient acting as an antoxidant in the human diet is also known as neuroprotective agent (Du *et al*. 2012).

Tomato is among the fruit of the numerous cultivated varieties of *Solanum lycopersicum.* It is a rich source of ascorbic acid (vitamin C). Tomatos are known as a good source of phenolic compounds, pigments, like carotenoids antioxidants, and other nutrients in the human diet (Taveira *et al.* 2012).

The present study aims to prepare a ready-to-serve formulation (RTS) of combination of mango and tomato in different proportions.

MATERIALS AND METHODS

Preparation of mango pulp and tomato juice

Mango and tomato were procured from a local market of Gwalior, M.P. India. Fresh fully ripe mangoes were used for extraction of pulp. After washing the fruits were peeled cut into small pieces and then ground using laboratory grinder and the pulp was collected and heated at 80 °C for 5 minutes and filled in sterilized bottles for further preparations. For preparation of tomato juice, fresh and ripe tomatoes were washed, dipped in hot water for removing the peels followed by juice extraction using laboratory juicer. For preservation, it was heated at 80 °C for 5 min and stored in sterilized bottles for further use.

Preparation of Mango and Tomato RTS

Preparation of Mango and Tomato (ready-to-serve) RTS. After preparation of mango pulp and tomato juices RTS were prepared in different formulations. In all the different formulations sugar, citric acid, black paper and salt were added in same proportion but the amount of mango pulp and tomato juices were different (Table 1). The mixture was filtered through muslin cloth. The prepared product was filled in sterilized glass bottles, sealed and sterilized at 100 °C for 15 min, cooled and stored at room temperature for further study. The samples were screened on the basis of sensory evaluation and were further analyzed for their physicochemical and phyto-chemical properties.

Table 1: Different combination of RTS prepared by mango pulp and tomato juice

Sample No	Mango pulp: tomato juice
S1	100 : 00
S2.	90 : 10
S3.	80 : 20
S4.	70 : 30
S5.	60 : 40
S6.	50 : 50
S7.	40 : 60
S8.	30 : 70
S9.	20 : 80
S10.	10 : 90
S11.	0 : 100

Physico-chemical Analysis of raw juice and RTS

Raw fruits and their processed products were analysed for various physico-chemical characteristics. Oven drying method described by the Association of Official Analytical Chemists (AOAC, 1990; Nielsen, 1998) was used for determination of moisture content and total solid. The Kjeldah method was used to determine the protein content (Rangana, 2005). The acidity was determined by titration using standard sodium hydroxide solution and expressed as anhydrous citric acid while pH was measured by a pH meter.

Dinitrosalicylic acid (DNSA) method was used to measure the reducing sugars as per the method of Miller (1959). Calorie content was calculated according to Recommended Dietary Allowance (RDA) as described here.

Calculation: Calorie (kcal/100 g) = (Protein % × 4) + (Fat % × 9) + (Carbohydrate % × 4)

Vitamin C was determined by the titrimetric method using dichlorophenol indophenol dye (Ranganna 2005). Total phenolic content was determined by Colorimetric method of Folin-ciocalteau reagent (Singleton *et al*. 1999) using Gallic acid as a standard.

Total flavonoid contents were measured by the aluminum chloride colorimetric method.

Sensory evaluation of ready-to-serve (RTS)

Sensory evaluation was done by 9 point hedonic scale. Panelists were selected from the teachers, student and employee of the department and were briefed before evaluating sensory quality of the samples. The panelists evaluated the color, flavor, mouth feel, and overall acceptability. The scale was arranged such that: 9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly, 5 = neither like nor dislike, 4 = dislike slightly, 3 =dislike moderately, 2 = dislike very much, 1 = dislike extremely (Joshi, 2006).

Statistical Analysis

Results obtained from the physicochemical, phytochemical and sensory analysis were analysed and the means were presented Means+Standard deviation (S.D).

RESULTS AND DISCUSSION

Sensory evaluation of ready-to-serve (RTS)

The mean scores of sensory evaluation are presented on Table 2. In case of color preference among the samples, Sample S6 secured the highest score (7.3) and ranked as liked moderately while sample S7 score was 7.1. In case of flavor preference, sample S6 the most acceptable among two samples. Sample S6 secured the highest score 7.6 with moderately like ranking, followed by sample S7 (score = 7.4) From (Table 2), Overall acceptability of sample S6 (7.8) was more than S7 (6.4) thus, rendering it overall acceptability as highly acceptable. On the basis of sensory analysis it is conferred that mixed fruit juice (S6) containing 50% mango, 50% tomato juice secured the highest score followed by S7 in terms of color, flavor, sweetness and overall acceptability. This results are in confirmatory to those reported earlier (Sajeda Begum *et al.* 2018).

Physico-chemical properties of raw juice and selected RTS

The proximate analysis of the mango pulp revealed that, the moisture content to be 83%, ash content 0.55%, respectively and tomato juice contain moisture content 87.33% and total ash 0.45 %, respectively. Table 3 showed that sample S6 or S7 contained 92.4% and 95.46% water. This moisture value is less compared to the reported range of the mixed tropical fruit juice (Siti *et al.* 2017). The higher the moisture content of products, the more it is susceptible to spoilage by microbial action (Robert *et al*. 2002).

Table 2: Sensory evaluation of the different combination of RTS

Sample	Colour	Mouth feel	Flavor	Overall Acceptability
S1	6.05±0.42	5.91±0.97	5.28±1.13	5.01±1.13
S2	6.71±0.45	6.46±0.65	6.26±0.66	6.63±0.31
S3	6.11±0.77	5.95±0.43	6.08±0.92	6.1±0.72
S4	6.88±0.22	6.90±0.38	7.08±0.56	6.11±0.51
S4	6.85±0.40	6.95±0.37	7.28±0.53	6.16±0.52
S6	7.33±0.69	8.05±0.60	7.6±0.72	7.88±0.40
S7	7.01±0.42	7.06±0.36	7.4±0.48	6.43±0.61
S8	5.83±0.69	6.50±0.34	6.91±0.42	6.05±0.50
S9	5.23±0.54	5.98±0.51	6.63±0.35	5.5±0.50
S10	5.31±0.52	5.65±0.65	6.23±0.45	4.86±0.44
S11	4.31±1.16	4.13±0.43	5.48±1.11	5.50±1.36

Results are mean ± SD.

Table 3: Physico-chemical characteristics of mango pulp and tomato juice

Parameter	Mango pulp	Tomato juice	S6	S7
Crude Moisture (%)	83 ± 3.60	87.33 ± 2.08	92.40 ± 1.64	95.46 ± 0.50
Crude Ash (%)	0.55 ± 0.07	0.45 ± 0.110	0.37 ± 0.006	0.320 ± 0.010
Titratable acidity (%)	0.3 ± 0.1	0.05 ± 0.01	0.27 ± 0.005	0.23 ± 0.01
Crude Total solid (%)	15.66 ± 1.52	12.66 ± 1.15	8.33 ± 1.53	4.78 ± 0.70
Crude Protein (%)	0.55 ± 0.9	0.116 ± 0.002	0.45 ± 0.01	0.31 ± 0.01
Crude Fat (%)	0.43 ± 0.05	—	0.30 ± 0.1	0.20 ± 0.1
Crude Carbohydrates (%)	14.21 ± 2.15	34.70 ± 8.62	13.55 ± 0.53	13.17 ± 0.85
pH	4.32 ± 0.39	4.13 ± 0.21	4.157 ± 0.232	4.280 ± 0.620
Calorie (kcal/100g)	63.3 ± 0.81	138.4 ± 0.91	59.03 ± 0.30	55.53 ± 1.30

Results are mean ± SD.

Ash content of combination S6 was 0.38 and of S7 was 0.32, respectively (Table 3). The results were more, similar to that reported by (Sajeda Begum *et al*. 2018) where 0.33% ash content was reported in orange juice. It was reported by (Harbers, 2002) that the ash contents of cherries, apple and tomatoes were 0.3, 0.5 and 0.6%, respectively. The total ash content in food can be referred to the residue of inorganic substances such as minerals in a food (Pomeranz and Meloan, 1994). The higher ash content indicates higher mineral content (Monti *et al*. 2008).

Generally, some nutrients such as protein, fat and fiber will be slightly lower in fruit juice compared to its fresh fruit because these nutrients were reduced during the processing of the fruit juice (Mercola 2014). Fortification and enrichment of any nutrient can be carried out, if needed. In our study protein content was found to be 0.55%, fat and carbohydrate content, ascorbic acid were 0.4%, 14.21%, 30.60 mg/100g respectively in mango pulp. The tomato sample was found to contain protein content 0.116%, carbohydrate 34.70%, ascorbic acid 23.6 mg /100g. pH 4.13. Further, these results are more and less similar to the values reported by earlier Bello *et al*. (2016). Moisture content and ash content of tomato juice were 87% and 0.45%, respectively. These results were in line with (Isabel Martınez-Valverde *et al.* 2002). Total solid content of tomato juice was 12.66%. Total solid and pH of the mango pulp were 15.60 %, 4.32, respectively. The pH of the pulp was lower to the values of reported earlier (Ruhul Amin *et al.* 2018).

Tomato juice was also analyzed for its physico-chemical parameters. Protein for combination S6 was 0.45% while that of S7 was 0.31% (Table 3). The highest protein was observed in sample S6 (0.45%). Siti *et al*. (2017) reported a simiar protein content in Mixed Tropical Fruit Juice. Fat content in combination S6 was 0.3 % while fat content in combination S7 was 0.2 g (Table 3). This also indicated that the combination of these fruit juices had very low fat content. The value of carbohydrate observed in combination S6 was 13.55% and S7 was13.17 % (Table 3). The juice was also low in calories, suitable to be included in diet. This was in line with reported value by (Morton, 1987) for Mango pulp to range between 16.2-17.8%, respectively. (Ahmed and Ahmed, 2014) have reported that matured fruits were usually sweeter due to higher sugar content.

The carbohydrate content of any food product determines its energy **(**Nicolas *et al*. 2002). The pH value of the juice represents the degree of acidity and alkalinity of a substance. This indicated that the juice was in acidic condition and suitable to be served as ready to drink (RTD) beverages here.

Phytochemical properties of raw juice and selected RTS

Flavonoid and phenolic content of the mango pulp were 9.0 mg/100g and 116 mg/100g, respectively.

Phenolic content of tomato juice was 29.66 mg/100. The results more or less similar to those reported value earlier (Gurpreet Kaur *et al*. 2016). In our study, the Vitamin C content was 30.60 mg/100g in mango pulp. (Table 4). Vitamin C for combination (S6) was 15.33 mg/100g and combination (S7) was 13.25 mg/100g (Table 4). Higher Vitamin C content has been reported as 35.18 mg/100g earlier (Gurpreet Kaur *et al*. 2016).

The value of phenolic content in combination S6 was 82.63 mg / 100g and combination S7 was 66 .78mg / 100g (Table 4). The result was more or less similar to that reported earlier (Gurpreet Kaur *et al*. 2016) where 84 to 98 mg /100g phenolic compound in mix fruits and vegetable juice were estimated, respectively.

Table 4: Phytochemical properties of selected ready-to-serve (RTS)

Parameter	Mango pulp	Tomato juice	S6	S7
Ascorbic acid (mg/100)	15.33 ± 1.15	13.25 ± 1.09	30.60 ± 1.15	23.6 ± 0.57
Flavonoid (mg /100g)	5.77 ± 0.40	4.76 ± 2.08	9.0 ± 0.20	1.2 ± 0.20
Phenolic (mg of /100g)	82.63 ± 0.33	66.78 ± 4.88	116 ± 2.08	29.66 ± 3.05

Results are mean + SD.

Generally it is known that phenolic content are highly correlated with antioxidant activity and bioavailability of polyphenols (Manach *et al*. 2005). Phenolic compounds play vital role in the quality of processed food products like flavor and taste, they have specific and important health-promoting properties (Sharma *et al*. 2012). Flavonoid observed in combination S6 was 5.77 mg / 100g and combination S7 was 4.76mg / 100g, respectively (Table 4). Leposava *et al*. (2018) reported about flavonoid content in commercial apple juice was found to range from 5.53 to 5.55 mg/l QE. Flavonoids are natu1ral antidiabetic agents, which interfere with the production of free radicals and reduces oxidative stress.

The preparation of RTS drinks has been optimized here. Due to its nutritional values which can act as efficient energy booster and a potent antioxidant.

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