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Development of Ready-To-Serve Organic Tomato Powder Mocktail

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Abstract
Purpose: Tomato being a widely consumed fruit has the potential for meeting the increasing demand for quality fruit and vegetable juices in India and abroad. In this present scenario application of various vegetable juice powders is growing enormously. However use of organic tomatoes and its value added products are rarely seen.
Objective: Hence to increase the demand and explore the possibility of developing new products the present study was carried out, to develop a product with different fruit blends by using organic tomato powder as a base material.
Method: Tomato slices were dried at 50 ºC for 14-16 hours in a tray drier and later milled into powder with the help of pulverizer.
Results: Study showed better results for both powder and RTS juice of organic samples. Sensory evaluation showed good results with respect to all quality attributes like colour, aroma, consistency, flavor, taste, sweetness, mouthfeel and overall acceptability for all selected juice combinations however S4 (tomato powder + papaya fruit pulp) ranked first with an overall acceptability score of 8.0. Further, the highest scored sample (S4) was analyzed for bio-chemical properties, on confirming colour (L* 20.26, a* 14.57, b* 27.90), TSS (12.5°Brix), pH (4.5), aw (0.94), viscosity (5.43 cP), acidity (0.19%), vitamin C (10.00 mg/100 ml) and lycopene (0.50 mg/100 ml). Statistical analysis showed a significant differences among the samples at (P<0.05).
Conclusion: Tomato powder acts as a potential substitute in the prepared RTS juice which is a healthy drink to relish.

Keywords: Organic tomato powder, RTS beverage, organoleptic and biochemical properties

Introduction
Tomato (*Solanum lycopersicum* L.) is well known as a health promoter that contains a bowl of vitamins and disease fighting phyto-chemicals specially lycopene, along with dietary fiber, beta-carotene, iron, magnesium, niacin, potassium, phosphorus, riboflavin and thiamine respectively with minimum saturated fat, cholesterol and sodium (Charanjeet *et al*. 2004) [3]. It is a highly perishable fruit mainly due to its high water content and therefore prone to spoilage by microorganisms, whose activities bring about high levels of postharvest losses (Aworh *et al*. 1983) [2]. It is also susceptible to injury because of its shape and structure and its relative soft texture which is associated with high moisture content, which ultimately leads to deterioration in transit and storage which is more rapid under ambient conditions, finally leading to heavy losses (Idah *et al*. 2007) [4].
In spite of all these India is lacking in adequate processing and preservation mechanisms with respect to tomatoes which falls under perishable nature of fruits and vegetables, because of which farmers are compelled to sell their produce quickly in order to avoid high losses, by flooding the market with their produce at reduced prices (C, Ametepe, Vegetable Production and Export Association of Ghana, Accra, Ghana, personal communication). So there is a need to overcome all these problems by adopting techniques that preserve the produce through value addition.
Even though there are various methods of processing fruits and vegetables, drying or dehydration is the most economical one, since this is highly stable against deteriorative microbial, chemical and enzymatic reactions and requires inexpensive packaging and almost no energy during storage. Ready to serve and drink fruit juices with superior nutritional properties occupy a major part in overall value added products by providing benefits like

easily digestible, highly refreshing, thirst quenching, appetizing. These kind of juices can be obtained from a single fruit or else from different kinds of fruits and vegetables (Tombak, 2000) [8], which balances out certain nutrients which may not be present in a single fruit or vegetable respectively, by helping to improve the nutritive value of the product and also making it more cost competitive.

This endeavor helps not only to utilize the excess produce of tomatoes during the season, but also ensures the development of sustained tomato processing industry on cottage scale in the rural areas. When this dream comes true, the contribution of tomato to the food front will be immense. So to ensure year round availability of products of tomatoes, viable processing technology need to be developed and promoted which enables continuous supply and availability of its products and also reduces postharvest losses by transforming raw material into edible products, increasing food security, improving nutrition and health, generating increased income, etc. With this view the study was carried out especially with organic tomatoes through which consumers are benefited by getting tasty and nutritionally rich drink all around the year and also where both farmers and industries are mutually benefited.

Material and Methods

Sample collection

Ripe organic tomatoes (Variety: Sivam) were procured from Coimbatore and Thanjavur, Tamil Nadu, India. Every effort was made in maintaining the quality of samples throughout the supply chain (Plate 1).

Plate 1: Selected organic tomatoes

Preparation of organic tomato powder

Organic tomatoes were initially subjected to primary processing (cleaning, grading/sorting and washing) and sliced into 6-8 mm thickness and tray dried for 14-16 hours at 50 ºC, which was further processed into fine powder by using a blender. Finally tomato powder was subjected to sieving to achieve uniform particle size and packed for further use (Figure 1 and Plate 2).

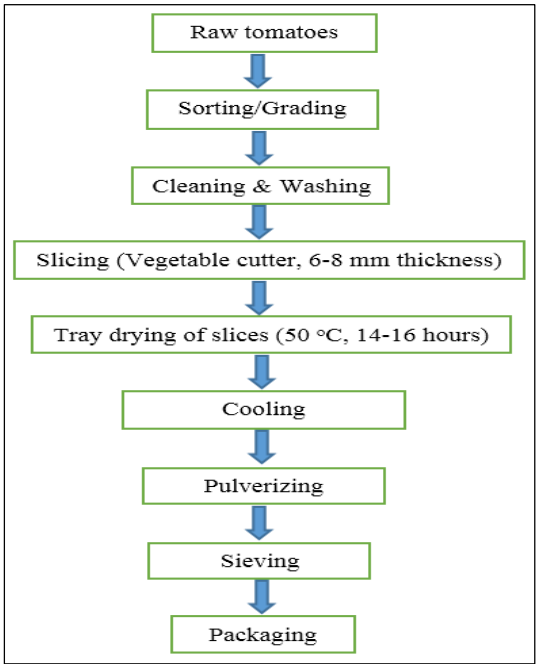

Fig 1: Flowchart for production and analysis of organic tomato powder

Plate 2: Dried tomato slices and powder

Physico-chemical analysis
Tomato powder was analyzed to determine colour, pH, TSS and water activity by using colorimeter, pH meter, refractometer and water activity analyzer respectively.

Proximate/Chemical analysis
Tomato powder was analyzed to determine moisture, protein, fat, fiber and ash by using standard official methods mentioned in Association of Official Analytical Chemist, 1990[1].

Preparation of RTS blended beverage
The process flowchart for the preparation of RTS juice is given in Figure 3 and the various combinations of tomato powder and fruit blend is presented in Table 1. Blending was carried out during the preparation of RTS beverage, where tomato powder was taken in powdered form as given in Figure 1 and different fruit pulp was taken in semi-solid form as presented in Table 1, Figure 2 and 3, Plate 3.

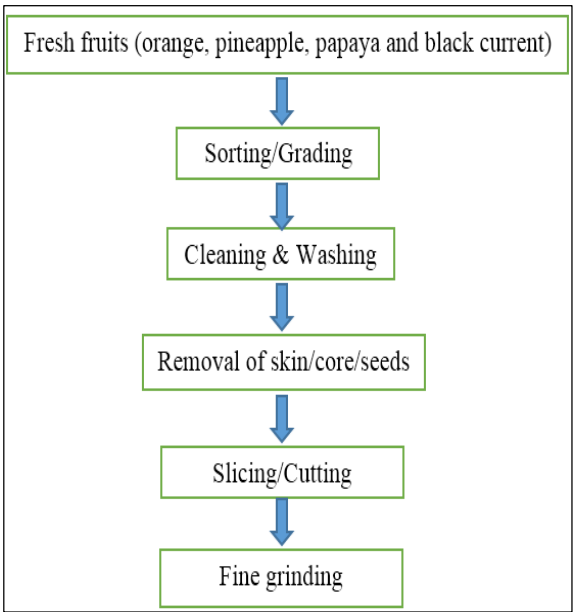

Fig 2: Flowchart for production of different fruit blends

Table 1: RTS juice combinations

S. No	Type of blend/Combination	Blending ratio(g)	Treatment/Sample code
1	Tomato powder (control)	1:0	S1 (control)
2	Tomato powder : Orange pulp	1:3	S2
3	Tomato powder : Pineapple pulp	1:3	S3
4	Tomato powder : Papaya pulp	1:3	S4
5	Tomato powder : Black currant crush	1:3	S5

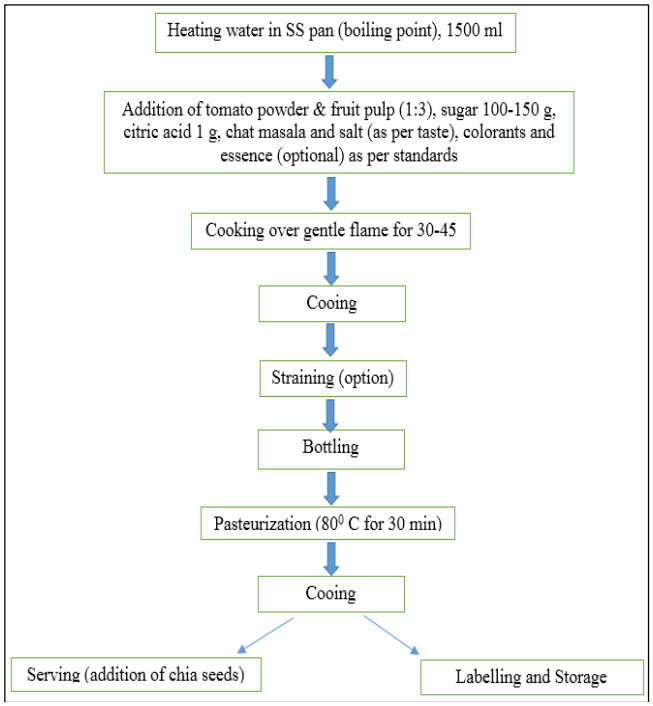

Fig 3: Process flowchart for preparation of RTS blended juice

*Quantity of taste makers (sugar, salt and chat masala) varies according to the sweetness/taste (ripening) of tomatoes and other fruits blends.

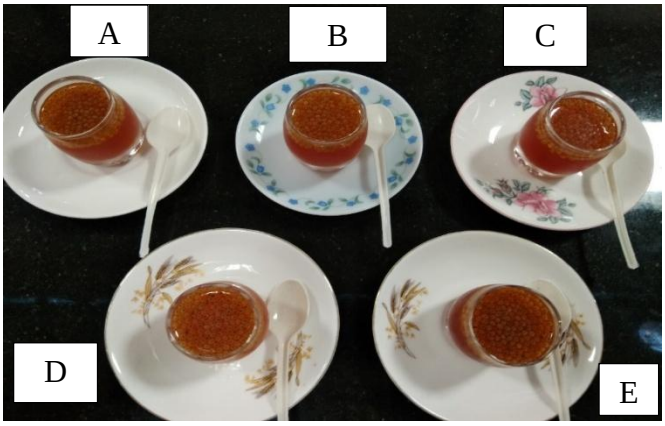

Plate 3: Developed RTS Beverage

Organoleptic evaluation
A quantitative descriptive analysis was developed to characterize the sensory quality of processed beverage from different combinations for parameters like colour, flavor, taste, mouth-feel and overall acceptability by using 9 point hedonic scale by a panel of judges to conduct further analysis for highest scored sample.

Physico-chemical analysis
The best ranked RTS beverage was further analyzed for properties like colour, TSS, pH, water activity, viscosity, colorimeter, pH meter, refractometer, water activity analyzer and Brookfield viscometer, whereas, titratable acidity, vitamin C and lycopene by standard procedures (Ranganna, 1986) [6].

Statistical analysis
The data of all analyzed sensory properties for RTS beverage was determined by using analysis of variance (ANOVA).

Results and Discussions

Drying

Tomato slices were dried by using tray dryer, where the slices were uniformly spread, generally in a thin layer, on trays in which the drying action takes place. Heating in a tray drier is due to air current sweeping across the trays, by conduction from heated trays or heated shelves on which the trays lie, or by radiation from heated surfaces. Most tray dryers are heated by air, which also removes the moist vapours.

Physico-chemical and proximate study of tomato powder

Quality attributes and composition of tomato powder are presented in Table 2. The study showed better results for all analyzed properties which is mainly due to decrease in moisture content. Similar observations were found by (Mozumder *et al*. 2012) [5], where moisture (5.9-6.9%), protein (12.6-13.9%), fat (2.2-3%), ash (10.21-10.72%) and pH (4.20-4.40) were recorded in tomato powder. Sarker *et al*. 2014 [7], findings were also comparable with the present work where moisture (8.1%), protein (14.3%), fat (2.1%), ash (9.22%) and pH (4.3) respectively.

Table 2: Physico-chemical composition of organic tomato powder

S. No	Component	Organic tomato powder
1	Moisture content (%)	3.0
2	Colour (L*a*b*)	39.94, 27.82, 37.93
3	pH	4.04
4	TSS (º Brix)	6.00
5	a_w	0.42
6	Protein (%)	18.16
7	Fat (%)	2.5
8	Ash (%)	9.5
9	Fiber (%)	1.00

Sensory evaluation of developed RTS juice

The sensory results of the developed product is presented in Table 3. The study showed that all RTS drink developed from different combinations were good and accepted with respect to all organoleptic properties by showing minor differences.

RTS beverage prepared from S4 recorded highest scores of 8.5 in terms of *colour* followed by, S2, S3, S1 and S5. With respect to *aroma* S4 ranked first followed by S3, S2, S1 and S5. Sample S5 recorded highest score of 7.67 with respect to *consistency* followed by S4, S3, S2 and S1. In case of *taste*, S4 stood first with a score of 8.00 followed by S3, S2, S1 and S5. Mocktail developed from S4 recorded highest score of 8.5 in terms of *sweetness* followed by S1, S3, S2 and S5. In case of *flavor and mouth-feel* S4 stood first place followed by S3, S2, S5 and S1. The *overall acceptability* was highest for S4 (8.0) followed by S2, S3, S1 and S5 respectively.

Table 3: Sensory score table for developed RTS organic tomato powder mocktail

Sample Code	Sensory Properties							
	Colour	Aroma	Consistency	Taste	Sweetness	Flavour	Mouth-feel	Overall Acceptability
S1(control)	7.42	6.35	7.00	7.00	7.00	6.50	6.70	6.85
S2	7.70	7.10	7.07	7.05	6.85	6.90	6.95	7.25
S3	7.62	6.92	7.17	7.20	6.92	7.05	7.10	7.10
S4	8.50	7.50	7.50	8.00	8.50	7.50	7.50	8.00
S5	7.35	6.70	7.67	6.65	6.30	6.80	6.80	6.80
Mean	7.71	6.91	7.28	7.18	7.11	6.95	7.01	7.20
F value	*	*	*	*	*	*	*	*
SD	0.45	0.43	0.28	0.50	0.82	0.36	0.31	0.48
SEm±	0.20	0.19	0.12	0.22	0.36	0.16	0.14	0.21
CV (%)	0.05	0.06	0.03	0.06	0.11	0.05	0.04	0.06

*Significant

Statistically significant differences was found among samples (P<0.05). The human senses have always been used to assess food quality. For centuries they were the only instruments available. Today, foods from major suppliers usually offer comparable safety and nutritional value. Thus sensory characteristics are increasingly important for consumers as the differentiating factor between foods and brands. The developed RTS juice from different fruit blends was accepted on an whole but however when examined with precision S4 was liked very much that is a blend of tomato powder and papaya interesting combination of vitamin A and C, when compared to others which was in between liked very much and liked moderately with respect to all organoleptic properties. Henceforth, S4 was further analyzed for biochemical properties like colour, TSS, pH, water activity, viscosity, titratable acidity, vitamin C and lycopene.

Bio-chemical properties of prepared fresh juice from S4 blend

The results of the study is represented in Table 3. The colour is the first quality attribute that the consumer appreciates and has a remarkable influence on the acceptance. It is an indicator of the natural transformation of a fresh (ripeness) or of changes that occur during its storage or processing. The study revealed that the *colour* of fresh juice was very pleasant and the average values *viz*. L^*, a^* and b^* were 20.26, 14.57 and 27.90 respectively. The total soluble solids (TSS) of fresh mocktail juice was 12.5 °Brix. The average pH value was 4.57. Water activity which is a key parameter in the quality control of any moisture sensitive product or material like juice was found to be 0.9435, average viscosity was found to be 5.43 cp, titratable acidity of juice was 0.192, vitamin C content in the developed product was 10 mg/100 ml of juice, lycopene was present at the rate of 0.50 mg/100 ml of juice respectively.

Table 4: Bio-chemical properties of fresh RTS juice

S. No	Component	RTS beverage
1	Colour(L*a*b*)	20.26, 14.57, 27.90
2	TSS (º Brix)	12.5
3	pH	4.5
4	a_w	0.94
5	Acidity (%)	0.19
6	Vitamin C (mg/100 ml)	10.00
7	Lycopene (mg/100 ml)	0.50

Conclusion

It is always a known logic that food supply is achieved either by increase in production or else by reducing the loss. Dried tomato powder is more durable and also eliminates the need for any sort of additives, since it has a good potential as substitute of tomato paste and other tomato products. The results of the current research revealed that the tomato slices dried at 50 ºC for 14 to 16 hours retained all nutritional properties specially lycopene with zero or minimum losses and the developed product with different combinations was widely accepted because of its uniqueness. However sample 4 (S4) ranked first with highest score with respect to almost all quality attributes. The further biochemical analysis also gave good results with properties determined. Statistical study with all analyzed properties showed significant results (P<0.05 and $F \geq F_{crtical}$). Hence, it can be concluded that the developed product is a refreshing and healthy drink to cherish that is exactly prepared from organic tomato powder whose unseen idea ultimately to increase processing by value addition by reducing losses which finally leads to an economical benefit for farmer, industries and also to the country respectively.

Acknowledgement

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Conflict of Interest

There is no conflict of interest

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