

“ORGANOLEPTIC EVALUATION FOR ACCESSING SENSORY ATTRIBUTES OF LYCOPENE CONTAINING TOMATO PUREES AND ITS OVERALL ACCEPTABILITY”

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SUMMERY:

A study on organoleptic evaluation for accessing sensory attributes of lycopene containing tomato purees & its overall acceptance was conducted at Food Science Analysis Laboratory, School of Home Science, B.B.A.U, Lucknow, Uttar Pradesh, India, during July 2020 to May 2021. Different treatments under the investigation were prepared using dried tomato (*Lycopersicum esculentum*), tomato pulp and water to find out most appropriate treatment having significantly higher sensory attributes and overall acceptability. Five different types of treatments/purees viz. Dried tomato powder without food additives (T₁), Mixture of tomato powder and water (ratio 1:10) without heating (T₂), Mixture of tomato powder and water (ratio 1:10) heating at 60-70 °C for 5 minutes (T₃), Fresh tomato pulp (T₄) & Tomato pulp cooked at 60-70 °C for 35 minutes (T₅) were used in the investigation. The effect of these treatments was distinguished as reflected on sensory characters like appearance, aroma, texture & overall acceptance. The highest overall acceptance of 8.20±0.7 on hedonic scale was obtained from tomato pulp cooked at 60-70 °C for 35 minutes (T₅) followed by dried tomato powder without food additives (T₁) ie. 7.90±1.0. These results appeared highly promising depending on the appearance, aroma & texture.

1. INTRODUCTION:

- 1.1 Tomato (*Lycopersicum esculentum*) is grown in India in abundance both in summer and winters. Tomato though botanically a fruit is generally considered as vegetable because of the way in which it is consumed.
- 1.2 Tomatoes are the most important vegetable crop with about 180.8 million tons of production, on global scale, [1].
- 1.3 Tomato is one of the most widely grown and consumed vegetable and it comes in various sizes, shapes and colors.
- 1.4 About 94 % moisture is found in ripe tomato, but, is an excellent source of minerals and vitamins.
- 1.5 Lycopene found in tomatoes act as an antioxidant and neutralizes free radicals which can damage cells in the body; inhibit the lungs, breast, and endometrial cells and also cuts down the risk of developing prostate cancer by 45% [2].
- 1.6 Tomatoes are highly perishable in the fresh state due to high moisture content leading to wastages and losses during harvesting and storage.
- 1.7 Loss in tomato production also occurs due to poor post harvest handling practices, hence, prevention of such losses and wastage is very important.
- 1.8 The demand of dehydrated tomato products in domestic and in international markets are increasing rapidly and its major portion is being used for preparing convenient foods [3].

- 1.9 Processing of tomato into tomato powder, sauce, etc can be done on large scale to prevent losses occurring during harvesting and post harvest handling. The need of the hour is that tomato produced in excess may be processed to preserve it for consumption during off season.
- 1.10 In a study on effect of drying methods and storage conditions on nutritional value and sensory properties of dehydrated tomato powder, it has been found that oven drying significantly increased the nutrient component of dehydrated tomato powder and decreased cfu/g of bacteria which could enhance the keeping quality of the products and consumer's higher acceptability [4]
- 1.11 Investigations on better technologies to reduce losses of fresh tomatoes and technologies for reducing cost of processing, packaging, handling, and transportation of the products must be done. While processing it also may be kept in mind that appearance, aroma and texture of the end product should be of such nature which may attract consumers.
- 1.12 Therefore, in view of the above, experiment was carried out at School of Home Science, Department of Food Science & Nutrition, B.B.A.U, LUCKNOW to find out most appropriate treatment/puree having significant sensory attributes (appearance, aroma, texture and overall acceptance).

2. MATERIAL & METHODS:

- 2.1 The investigation was carried out at Bakery & confectionary laboratory, School of Home Science, Department of Food Science & Nutrition, B.B.A.U, LUCKNOW, Uttar Pradesh, India, during July 2020 to May 2021 in randomized design with seven replications/panelist & five treatments viz.

Dried tomato powder without food additives (T_1), Mixture of tomato powder and water (ratio 1:10) without heating (T_2), Mixture of tomato powder and water (ratio 1:10) heating at 60-70 °C for 5 minutes (T_3), Fresh tomato pulp (T_4) & Tomato pulp cooked at 60-70 °C for 35 minutes (T_5).

2.2. Technique used to prepare raw & cooked tomato puree:

7.00 Kg tomato was used to prepare tomato powder & pulp under the experimental work. Tomatoes of cultivar Pusa-ruby [5] were purchased from the local market of Lucknow at the rate of Rs.10/- per Kg., considering the basic quality attributes such as freshness, redness, shape and size. To prepare tomato pulp & powder, tomatoes were first thoroughly washed in water to remove all dirt or dust and foreign matter stuck on their surfaces & excess water on tomato surfaces were soaked with the help of soaking paper. After that all the tomatoes were divided into two parts, i.e. 1st part (5.00 kg) for making tomato powder & 2nd part (2.00 Kg) to make tomato pulp under this experiment.

2.3. Technique used to prepare pulp:

Fresh & fully red tomatoes were passed through the fine pulping machine to obtain pulp. Seed & skin was separated following protocols described by *Dauthy1995*. [6] The pulp extracted was used as basic material to prepare different treatments/purees. Recovery of pulp was 50% of fresh tomatoes on weight basis. Tomato pulp was concentrated in kettle to evaporate the extra moisture present in it, TSS content of the same was 22.5%, CODEX concentrates standards were followed [7]. After that pulp was filled into tin cans (temperature of filling 82°C to 88°C) and processed in boiling water for 20 minutes. Processed tin cans were cooled in cold water by dipping them and stored in cool & dry place.

2.4. Technique used to prepare tomato powder:

To make tomato powder, tomatoes were cut into slices of uniform thickness and removed the seeds from it to dry the same quickly & were placed on the tray of hot air oven in a single layer so that they can't stick with each other. Temperature of the dehydrator was kept at 50-60°C to dehydrate the tomato slices. Tomato slices took 27 hours to dry in the dehydrator. Then, the dehydrated slices were pulverized into powder, in a high powered blender. Tomato Powder was packed in laminated aluminum foils to prevent from moisture absorption [8] and stored in cool dry place.

2.5. Sampling Technique:

Sampling procedures defined to conduct an experimental work has been followed in the present investigation. Sampling was done by selecting random samples from each treatments/purees under this experiment. Step by step procedure was followed to find out sample from the whole material of the treatment/puree. As already cited above, that five treatments were prepared using pulp, powder & water as planned under this experiment to prove the hypothesis and find out the best treatment having significantly higher value of sensory attributes. To minimize the error/ bias in the experiment, seven panelists were employed to judge the sensory attributes (appearance, aroma, texture and overall acceptability) of each treatment/puree prepared under this experiment, on hedonic scale [9].

The data collected during the investigation were compiled in tabular form and analyzed on the statistical method to find out means, standard deviation among the treatments, as per *Gomez and Gomez* [10] and ANOVA table were prepared to check the significance of the same.

2.6. Estimation of organoleptic quality for accessing sensory attributes:

Organoleptic evaluation for accessing sensory attributes of samples taken from each treatment were conducted by a panel of 7 judges and recorded on 9 points Hedonic Rating Scale.

2.6.1. Sensory Evaluation of treatments:

Sensory evaluation was characterized in logical order to come out with the measures for investigation, especially to find out responses to those properties of the treatments, as they were seen by the sight of the judges such as colour & texture and felt by their taste buds & smell organs such as taste & aroma.

The sensory evaluation was done in the University campus by 7 trained panelists to know the sensory attributes of each treatment and the tool used for sensory evaluation was 9-point Hedonic Scale.

The well-known and utilized scale to test samples/products preference is known as 9-point hedonic scale. The scale ranges from one through nine with one being “dislike extremely”, five being “neither like nor dislike”, and nine being “like extremely”; 8 points on hedonic scale (like very much) was considered to be acceptable under this experiment. Judges were instructed to rate the sample of each treatment as they feel about the same and fill the score card.

3. RESULT & DISCUSSION:

3.1 Organoleptic evaluation for accessing sensory attributes in terms of appearance, aroma, texture & overall acceptance of the samples drawn from different treatments were studied during the investigation. The salient findings of the present study and brief discussions derived there are summarized hereunder:

3.1.1 Appearance of Different Treatments:

It is evident from the data presented in Table.1 that the highest mean score recorded on hedonic scale for appearance was 8.57 ± 0.53 and lowest 7.00 ± 1.41 in (T5) tomato pulp cooked at 60-70 °C for 35 minutes and (T2) mixture of tomato powder and water (ratio 1:10) without heating, respectively. However, it was found that data on appearance had no significance among different treatments.

A study conducted by Ladi Justina Opega, et al on oven dried tomato powder had found that the Appearance of 8.00 ± 0.20 was recorded in the oven dried tomato powder. In the present study also the appearance of the Tomato powder without food additives (T₁) was almost equal as it was recorded 7.29 ± 0.95 on headonic scale.

ANOVA Table:

Source of variance	S.S.	d.f	M.S.	Variance ratio F
i) Between samples	12.11(SSB)	6	2.02	$2.02 \div 1.17 = 1.73$
ii) Within samples	32.86 (SSW)	28	1.17	
Total	44.97	34		

Result: Calculated value of $F = 1.73$; variance one (v_1) =6; variance two (v_2) = 28 and $F_{.05}$ value as per table= 2.45.

As F value less than Table value of $F_{.05}$, hence, difference in appearance was non-significant among the treatments.

Table.1 Appearance of different treatments on hedonic scale:

Panelists	T ₁	T ₂	T ₃	T ₄	T ₅
1	8	6	9	9	9
2	8	9	9	8	9
3	7	6	6	9	8
4	8	9	9	7	9
5	6	6	8	9	8
6	6	7	9	7	8
7	8	6	7	8	9
Total	51	49	57	57	60
Mean	7.29	7.00	8.14	8.14	8.57
Standard deviation	0.95	1.41	1.22	0.90	0.53

3.1.2 Aroma of Different Treatments:

The data pertaining to aroma presented in Table 2 indicates that the highest mean score of aroma was 8.86 ± 0.38 and lowest 6.43 ± 0.53 in Fresh tomato pulp & dried tomato powder without food additives, respectively. However, data collected and analyzed during the investigation, clearly indicates that aroma had high significance among different treatments.

In a study conducted by Ladi Justina Opega, et al on oven dried tomato powder they had found that the Aroma of 8.2 ± 0.20 was recorded in the oven dried tomato powder. However, in the present study aroma of the Tomato powder without food additives (T₁) was recorded only 6.43 ± 0.53 on headonic scale, which was much lower in comparison to results found by the above referred researchers. But, aroma of T₄ & T₅ was better than T₁ and $\geq 8.2 \pm 0.20$ found by Ladi Justina Opega, et al in oven dried tomato powder.

ANOVA Table:

Source of variance	S.S.	d.f	M.S.	Variance ratio F
i) Between samples	26.28 (SSB)	6	4.38	$4.38 \div 0.58 = 7.55$
ii) Within samples	16.30 (SSW)	28	0.58	
Total	42.58	34		

Result: Calculated value of $F = 7.55$; variance one (v_1) = 6; variance two (v_2) = 28 and $F_{.05}$ value as per table = 2.45.

As F value more than Table value of $F_{.05}$, hence, difference in aroma was significant among the treatments.

Table.2 Aroma of different treatments on hedonic scale:

Panelists	T ₁	T ₂	T ₃	T ₄	T ₅
1	7	6	6	9	8
2	7	7	7	9	8
3	6	7	9	9	7
4	7	7	6	9	7
5	6	6	7	9	9
6	6	7	9	8	8
7	6	7	7	9	8
Total	45	47	51	62	55
Mean	6.43	6.71	7.29	8.86	8.20
Standard deviation	0.53	0.49	1.25	0.38	0.70

3.1.3 Texture of Different Treatments:

It is pertinent from the data presented in Table 3 that highest mean score on hedonic scale for texture was recorded 8.43 ± 0.79 and lowest 6.67 ± 0.79 under fresh tomato pulp (T₄) and mixture of tomato powder and water (ratio 1:10) without heating (T₂), respectively. However, data collected and analyzed during the investigation, clearly indicates that texture has high significance among different treatments.

In the present study Texture of the Tomato powder without food additives (T_1) was recorded 7.00 ± 1.00 on hedonic scale. Similarly, in a study conducted by Ladi Justina Opega, et al on oven dried tomato powder, they had also found that the texture of the tomato powder was 7.00 ± 0.04 .

ANOVA Table:

Source of variance	S.S.	d.f	M.S.	Variance ratio F
i) Between samples	15.88 (SSB)	6	2.65	$2.65 \div 0.87 = 3.05$
ii) Within samples	24.29 (SSW)	28	0.87	
Total	40.17	34		

Result: Calculated value of $F = 3.05$; variance one (v_1) = 6; variance two (v_2) = 28 and $F_{.05}$ value as per table = 2.45.

As F value more than Table value of $F_{.05}$, hence, difference in texture was significant among the treatments.

Table.3 Texture of different treatments on hedonic scale:

Panelists'	T_1	T_2	T_3	T_4	T_5
1	6	7	7	9	8
2	6	6	8	8	6
3	8	8	6	9	8
4	6	6	7	9	8
5	8	6	8	8	7
6	8	6	7	9	9
7	7	7	6	7	9
Total	49	46	49	59	55
Mean	7.00	6.57	7.00	8.43	7.86
Standard deviation	1	0.79	0.82	0.79	1.07

3.1.4 Overall Acceptance of Different Treatments

It is conspicuous from the data presented in Table 4 that the highest mean score recorded on hedonic scale for overall acceptance among all treatments was 8.14 ± 0.69 and lowest 6.43 under T_5 (Tomato pulp cooked at 60-70 °C for 35 minutes) and T_3 (Mixture of tomato powder and water (ratio 1:10) heating at 60-70 °C for 5 minutes) respectively.

It was found that the appearance of different purees and powder prepared under the investigation varied due to mixing with water in different ratios and their concentrations in the treatments. For example mixture of tomato powder and water (ratio 1:10) heating at 60-70 °C for 5 minutes (T_3) had not attractive appearance, hence, its overall acceptance was very low, whereas tomato pulp cooked at 60-70 °C for 35 minutes (T_5) was very attractive in appearance, which resulted in very good acceptance of the same. Further, the Tomato pulp cooked at 60-70 °C for 35 minutes i.e. T_5 and dry tomato powder without food additives i.e. T_1 had overall acceptance almost equal to each other.

However, data on overall acceptance presented in Tables 4 clearly indicates very high significance among different treatments, as, mean score recorded on hedonic scale in descending order was 8.14 ± 0.69 , 8.00 ± 1.00 , 8.00 ± 1.00 , 6.60 ± 0.79 , 6.43 ± 0.53 in treatments T_5 , T_1 , T_4 , T_2 , T_3 , respectively.

In the study conducted by Ladi Justina Opega, et al on oven dried & sun dried tomato powder had found that the overall acceptance of 8.01 ± 0.20 was recorded in the oven dried tomato powder. In the present study also the overall acceptance of the Tomato powder without food additives (T_1) was almost equal as it was recorded 8.00 ± 1.00 on headonic scale.

ANOVA Table:

Source of variance	S.S.	d.f	M.S.	Variance ratio F
i) Between samples	20.27 (SSB)	6	3.38	$3.38 \div 0.72 = 4.69$
ii) Within samples	20.3 (SSW)	28	0.72	
Total	40.57	34		

Result: Calculated value of $F = 4.69$; variance one (v_1) = 6; variance two (v_2) = 28 and $F_{.05}$ value as per table = 2.45.

As F value more than Table value of $F_{.05}$, hence, difference in overall acceptance was significant among the treatments.

Table.4 Overall Acceptances of different treatments on hedonic scale:

Panelists'	T ₁	T ₂	T ₃	T ₄	T ₅
1	7	6	6	9	8
2	7	7	6	9	9
3	9	7	7	9	9
4	9	8	6	8	8
5	8	6	6	7	8
6	9	6	7	7	8
7	7	6	7	7	7
Total	56	46	45	56	57
Mean	8.00	6.60	6.43	8.00	8.14
Standard deviation	1.00	0.79	0.53	1.00	0.69

4. CONCLUSION

4.1: In conclusion, the tomato pulp cooked at 60-70 °C for 35 minutes & dried tomato powder without food additives can be adopted for Processing, packing & storage for supply during off season. But, looking on the keeping quality and lowest moisture content, dried tomato powder without food additives can be considered & recommended as the best option for processing, packaging & storage, to meet the off season demands.

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6. Author's contribution:

All authors designed the study & wrote the protocols. Author performed the statistical analysis, managed the analysis of the study, literature searches and wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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