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Evaluation of Quality of Instant Khaman Mix

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ABSTRACT: Due to its commercial importance and the fact that it is highly perishable, the tomato (*Solanum lycopersicum*) is one of the most researched vegetables in the field of scientific study. It is estimated that post-harvest losses range from 25 to 50 per cent in tropical countries from the time the tomato is harvested until it is consumed. It is necessary to turn it into goods that can be stored on shelves for use during the off-season in order to make up for the losses that occur after the harvest. Tomato can be dried on foam mat, which is a helpful procedure for preserving it in powder form. Fresh tomatoes are used to make a variety of products, such as puree, sauce, ketchup, pickles, etc., but due to their high moisture content, these products have a shorter shelf life. The main challenge in this industry is the high expense of the equipment required to produce better-quality products from fresh tomatoes. Because of this, the study's main contribution is to the creation of low-cost processing and packaging procedures that will enable the delivery of shelf-stable, high-quality, and convenient goods in today's competitive market. The primary objective of this research is to conduct an evaluation of the quality of the instant khaman mix. During the phases of the study, the tomato khaman powder quick mix was tested. The parameters, such as thickness, bulk density, moisture content, ascorbic acid, acidity, pH, total soluble solid and sensory of instant mix tomato khaman powder were carried out at concentrations of tomato powder ranging from 5 to 25 g, with gram flour concentrations ranging from 75 to 95 g, sodium bicarbonate concentrations ranging from 3 to 7 g and normal salt concentrations ranging from 3 to 7 g. As outputs, the parameters (thickness, bulk density, moisture content, ascorbic acid, acidity, pH, total soluble solid and sensory) were measured and analysed. In order to ascertain the conditions under which performance is maximised, a numerical multi-response method was used. This approach takes into account several responses simultaneously. Maximum attractiveness was reached at tomato powder concentration of 17.04 g, gram flour concentration of 87.90 g, sodium bicarbonate concentration of 5.46 g, and regular salt concentration of 2.83 g, which together make up the compromised ideal condition for instant mix tomato khaman powder.

Keywords: Tomato; Foaming Properties; Drying Characteristics; Instant Mix Tomato; Quality; Instant Khaman Powder Mix.

I. INTRODUCTION

Throughout the past few decades, there has been a significant increase in the number of industries that process tomatoes. These tomato processing sectors engage in a number of interconnected operations, such as the manufacturing of tomato salad, juice, puree, paste and powder [1, 2]. Fresh tomatoes can be used to make a variety of goods, such as puree, sauce, ketchup, pickles and others; however, because fresh tomatoes have a high amount of moisture, these products have a shorter shelf life. As a result of these items greater bulk volume in comparison to dehydrated products, additional challenges are presented during transportation and storage [3, 4, 5].

Tomato powder, gram flour, sodium bicarbonate and salt have been chosen as the components for the production of a value-added quick mix of tomato khaman powder. These components have been chosen based on traditional information and preliminary research and need to be optimised. Shelf life is the maximum amount of time that a food product may be kept in storage under certain environmental circumstances without suffering any discernible loss in quality or acceptability. This is measured in terms of the product's "shelf life". In light of the fact that there is a need for the development of an instant mix of tomato khaman powder, the study aims to evaluate the quality of Khaman instant mix's quality, the specifics of which are described in more detail in the following sections. This study's main advantage is the creation of low-cost processing and packaging procedures to provide shelf-

stable and convenience items, which are essential in today's cutthroat market.

II. LITERATURE REVIEW

Owureku-Asare *et al.* (2018) [6] and Farooq *et al.* (2020) [7] stated that tomatoes (*Solanum lycopersicum*) are a popular cooking ingredient. Sun-dried tomatoes are cheaper and better. This study constructed and tested a tomato-drying natural mixed-mode sun dryer. 1% potassium metabisulfite, 1% ascorbic acid or untreated fresh tomatoes were used. Drying pre-treated tomatoes took three days on average. Pre-treated solar-dried tomatoes had 14–15% moisture, while sun-dried had 19–22%. Sun-dried samples exhibited higher ash, indicating contamination. Solar-dried tomato pre-treated using potassium metabisulfite has 740.8 mg/Kg. sulphur dioxide, significantly below the 2000 mg/Kg limit. Solar dryers outperformed sun-drying for pre-treated solar-dried tomatoes.

Yegrem and Ababele (2022) [8] examined how osmotic solutions, dehydration processes, as well as packaging materials, affect tomato powder quality. They include pretreatments and osmotic agent solutions (potassium metabisulphite, calcium chloride, sodium metabisulphite, ascorbic acid, citric acid, sodium chloride and sodium benzoate), thermal blanching (steam blanching and hot water), non-thermal processes (freezing, sulphuring, etc.) and drying methods (oven, sun and indirect solar). Tomato powders are dried for storage, transit and preservation. Drying involves chemical as well as physical changes, which the consumer may see. Freeze-dried and direct sun-dried samples had the most lycopene, vitamins A and C and nutritional value. For improved design and scale-up, non-thermal pre-treatment categories might be a superior replacement for thermal blanching to improve nutritional quality.

III. METHODOLOGY

The methodology used in this study includes the following variables:

Independent Variables:

(i) First factor: Concentration of tomato powder (5, 10, 15, 20 and 25 g)

(ii) Second factor: Concentration of gram flour (75, 80, 85, 90 and 95 g)

(iii) Third factor: Sodium bicarbonate (3, 4, 5, 6 and 7 g)

(iv) Fourth factor: Normal salt (Sodium chloride) (1, 2, 3, 4 and 5 g)

(v) Total number of experiments: 30

(vi) Experimental design: Central Composite Design

Dependent Variables:

(i) Physical parameters: Thickness, bulk density, moisture content

(ii) Chemical parameters: Ascorbic acid, acidity, pH, TSS

(iii) Sensory evaluation: Colour, aroma, taste, overall acceptability

Table 1 below shows the Treatment combinations for instant mix tomato khaman powder.

Table 1: Treatment combinations for instant mix tomato khaman powder.

Treatment no.	Tomato powder, g		Gram flour, g		Sodium bicarbonate, g		Salt, g	
	Coded	Uncoded	Coded	Uncoded	Coded	Uncoded	Coded	Uncoded
1	-1	10	-1	80	-1	4	-1	2
2	1	20	-1	80	-1	4	-1	2
3	-1	10	1	90	-1	4	-1	2
4	1	20	1	90	-1	4	-1	2
5	-1	10	-1	80	1	6	-1	2
6	1	20	-1	80	1	6	-1	2
7	-1	10	1	90	1	6	-1	2
8	1	20	1	90	1	6	-1	2
9	-1	10	-1	80	-1	4	1	4
10	1	20	-1	80	-1	4	1	4
11	-1	10	1	90	-1	4	1	4
12	1	20	1	90	-1	4	1	4
13	-1	10	-1	80	1	6	1	4
14	1	20	-1	80	1	6	1	4
15	-1	10	1	90	1	6	1	4
16	1	20	1	90	1	6	1	4
17	-2	5	0	85	0	5	0	3
18	2	25	0	85	0	5	0	3
19	0	15	-2	75	0	5	0	3
20	0	15	2	95	0	5	0	3
21	0	15	0	85	-2	3	0	3
22	0	15	0	85	2	7	0	3

23	0	15	0	85	0	5	-2	1
24	0	15	0	85	0	5	2	5
25	0	15	0	85	0	5	0	3
26	0	15	0	85	0	5	0	3
27	0	15	0	85	0	5	0	3
28	0	15	0	85	0	5	0	3
29	0	15	0	85	0	5	0	3
30	0	15	0	85	0	5	0	3

A. Procedure for Instant Tomato Khaman

Instant tomato khaman powder was made with tomato powder, gram flour, sodium bicarbonate and sodium chloride. Instant tomato khaman powder made the khaman using 125 ml of drinking water mixed with all four components. After 12–15 minutes, water and ingredients created a thick batter (khiru). An 18.5 cm steel dish included 1–2 g edible oil. The batter was spread over steel. An induction hot plate heated 600 ccs of water in a stainless steel jar for 1–2 minutes. A stainless steel knife cut the batter after 15 minutes. This flowchart shows how to make instant tomato khaman.

Thickness: A clean, transparent, 15 cm long ruler was used to measure the height of the batter and khaman. Batter was prepared in a flat-bottomed steel dish. A ruler was placed vertically into the centre and four corners of batter until it touched the bottom of the steel.

Mass: The batter and khaman were weighed in a steel dish on a computerised scale.

Water: Khaman was prepared with 125g of water after early testing.

Volume of khaman: The volume was measured using diameter (D) of khaman and the thickness (t), i.e., ($\pi D^2/4$) x t.

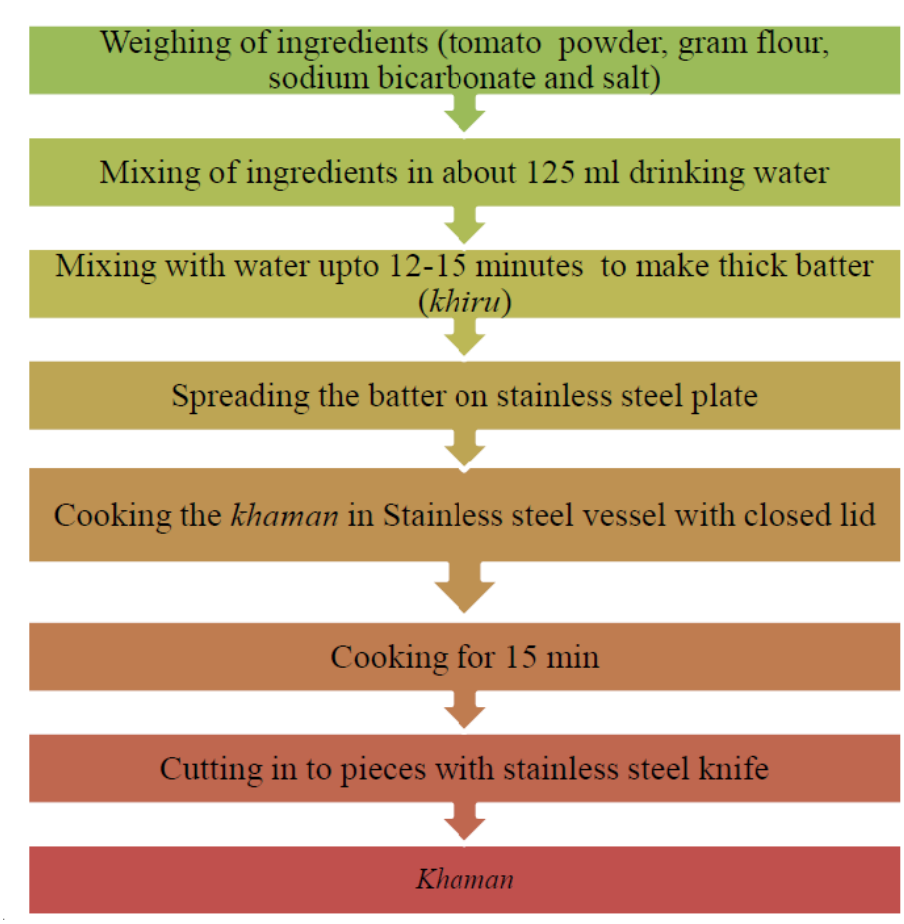

Fig. 1. Process flow chart of khaman.

Bulk density of khaman: The bulk density was estimated using the following formula:

$Bulk\ density = Weight/Volume,\ g/cm^3$…Eq. (1)

B. Sensory Characteristics of Instant Mix Tomato Khaman

Sensory analysis of instant mix tomato khaman. Ten semi-trained panellists rated the instant mix tomato khaman on a hedonic rating scale (1 = dislike extremely, 5 = neither like nor dislike and 9 = like extremely) based on colour, aroma, taste and overall

acceptability. Experiments were done under uniform lighting. Khaman's nature, components and health benefits were not disclosed. Sensory scores were printed. Samples above 5 were OK, whereas those below 5 were not. Sensory evaluation determines product quality and acceptance. In the state of Gujarat, Godhra College of Agricultural Engineering and Technology's Processing and Food Engineering Department conducted the sensory. Godhra's popular snack shop, New Thakkar Khaman House, reviewed the samples.

IV. RESULTS AND ANALYSIS

The model F value of 5.46 indicates significance ($P<0.001$). Model R^2 and adjusted R^2 are 0.8359 and 0.6828. The model can forecast the reaction inside the design space because its sufficient precision value is 7.418. Using the criteria, the following response model was chosen to represent overall acceptability variation for further investigation.

$$Overall\ acceptability = +8.17+0.12x_1+0.21x_2-0.042x_3+0.12\ x_4+0.063\ x_1x_2+0.063\ x_1x_3+0.19x_1x_4+0.063x_2x_3+0.19\ x_2x_4-0.062\ x_3x_4-0.32x_1^{\ 2}-0.20x_2^{\ 2}-0.32x_3^{\ 2}-0.20\ x_4^{\ 2} \quad \ldots.(2)$$

From Eq. (2), the following can be observed. x_1, x_2 and x_4 have positive coefficients. The coefficients of model terms x_1^2, x_2^2, x_3^2 and x_4^2 are negative. Research reveals that khaman's general acceptability may decline with excessive tomato powder, gram flour, sodium bicarbonate and salt.

Table 2: Analysis of variance for overall acceptability of khaman.

Source	Co efficient of model terms	Sum of squares	df	Mean Square	F Value	Prob>F
Constant	8.17					
x_1	0.12*	0.37	1	0.37	3.21	0.0932
x_2	0.21***	1.04	1	1.04	8.93	0.0092
x_3	-0.042 ns	0.042	1	0.042	0.36	0.5590
x_4	0.12*	0.37	1	0.37	3.21	0.0932
x_1x_2	0.063 ns	0.063	1	0.063	0.54	0.4755
x_1x_3	0.063 ns	0.063	1	0.063	0.54	0.4755
x_1x_4	0.19**	0.56	1	0.56	4.82	0.0443
x_2x_3	0.063 ns	0.063	1	0.063	0.54	0.4755
x_2x_4	0.19**	0.56	1	0.56	4.82	0.0443
x_3x_4	-0.062 ns	0.062	1	0.062	0.54	0.4755
x_1^2	-0.32***	2.86	1	2.86	24.52	0.0002
x_2^2	-0.20***	1.07	1	1.07	9.21	0.0084
x_3^2	-0.32***	2.86	1	2.86	24.52	0.0002
x_4^2	-0.20***	1.07	1	1.07	9.21	0.0084
Complete model						
Regression		8.92	14	0.64	5.46	0.0012
Lack of Fit		0.92	10	0.092	0.55	0.8031
Pure Error		0.83	5	0.17		
Residual		1.75	15	0.12		
Total		10.67	29			
R^2		0.8359	Adequate Precision			7.418
Adjusted R^2		0.6828				

The linear terms tomato powder (x1), salt (x4) and gramme flour (x2) have F values of 3.21 ($P<0.05$), 3.21 ($P<0.05$) and 8.93 ($P<0.001$). F values for the coefficient of model terms x_1^2, x_2^2, $x_3^{\ 2}$ and x_4^2 are 24.52 at P values of 0.0002 and 9.21 at P values of 0.0084, indicating that the terms are extremely significant.

Fig. 2 shows that tomato powder and salt concentration boosted khaman's sensory value and acceptance. Fig. 4 shows that increasing gram flour and salt concentration made khaman more acceptable. The parameters for the preparation of the instant mix tomato khaman are listed in the table below.

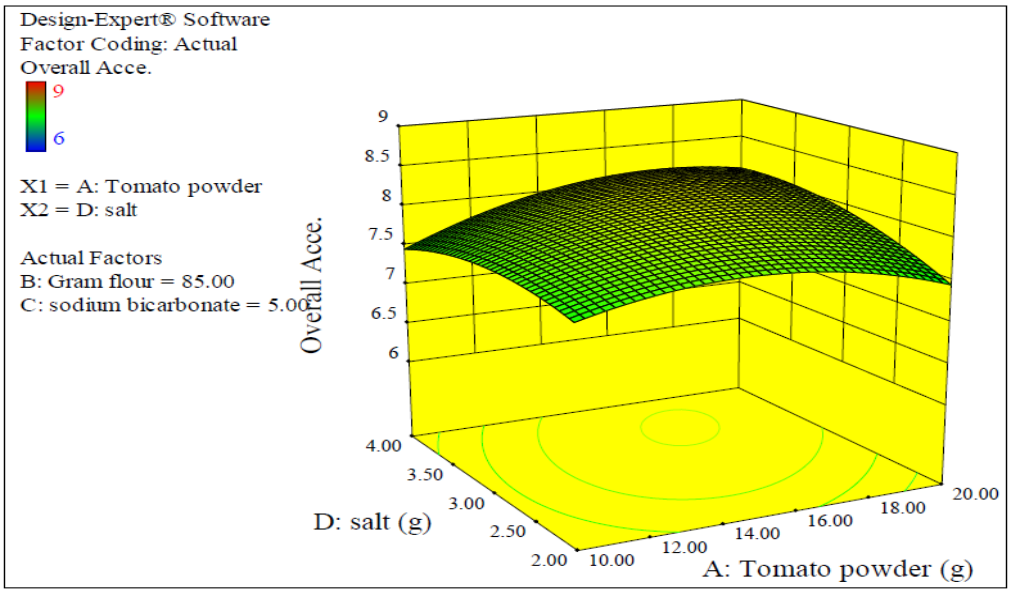

Fig. 2. Variation of overall acceptability with respect to tomato powder and salt.

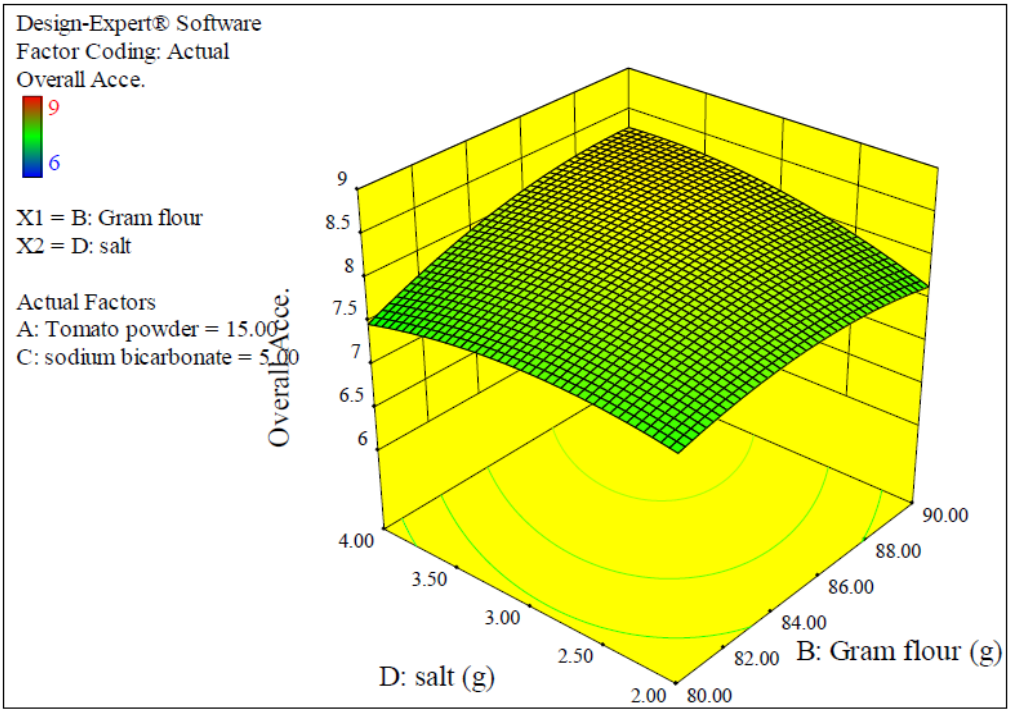

Fig. 3. Variation of overall acceptability with respect to gram flour and salt.

Table 3: Preparation parameters of instant mix tomato khaman.

Sr. No.	Product parameters	Observations
1	Weight of raw material	113.23 g
2	Diameter of steel dish	18.5 cm
3	Diameter of *khaman*	17.0 cm
4	Weight of steel dish	110.0 g
5	Water required	125 ml
6	Cooking time	15 min
7	Thickness of *khaman*	1.96 cm
8	Weight of *khaman* with steel dish	325 g
9	Weight of only *khaman*	215 g
10	Volume of *khaman*	444.65 cm^3
11	Bulk density of *khaman*	0.48 g/cm^3

Instant mix tomato khaman powder's compromised optimal condition: At maximum attractiveness, tomato powder 17.04 g, gram flour 87.90 g, sodium bicarbonate 5.46 g and normal salt 2.83 g. The parameters of instant mix tomato khaman powder such as thickness, bulk density, moisture content, ascorbic acid, acidity, pH, total soluble solid were 2.11 cm, 0.46 g/cc, 53.58 % (wb), 17.95 mg/100 g, 0.49 %, 7.69 and 5.53°Brix. At maximum attractiveness, instant mix tomato khaman powder had a 7.67 aroma, 8.20 taste and 8.12 total acceptance. Similar results showed for drying dragon fruit thin layers, foamed custard apple pulp, and thin layers of other fruits [9].

V. CONCLUSION

During the experimentation, the instant mix of tomato khaman powder was assessed. The parameters of the instant mix tomato khaman powder (thickness, bulk density, moisture content, ascorbic acid, acidity, pH, total soluble solid and sensory) were tested at concentrations of tomato powder (5, 10, 15, 20 and 25 g) with concentrations of gram flour (75, 80, 85, 90 and 95 g), sodium bicarbonate (3, 4, 5, 6 and 7 g) and regular salt (normal salt) (1, 2, 3, 4 and 5 g). The reactions were measured for the parameters (thickness, bulk density, moisture content, ascorbic acid, acidity, pH, total soluble solid and sensory). A numerical multi-response technique was used to determine the ideal circumstances. The thickness, bulk density, moisture content, ascorbic acid, acidity, pH and total soluble solids of instant mix tomato khaman were 2.11 cm, 0.46 g/cc, 53.58% (wb), 17.95 mg/100g, 0.49%, 7.69 and 5.53°Brix, respectively. The quick mix tomato khaman powder received scores of 7.67, 8.20 and 8.12 in terms of aroma, flavour and overall acceptance respectively. The compromised optimal condition for instant mix tomato khaman powder was attained at maximum desirability at tomato powder concentration of 17.04 g, gram flour concentration of 87.90 g, sodium bicarbonate concentration of 5.46 g and normal salt concentration of 2.83 g.

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