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Sensory Evaluation of Toma–Pep Ketch–up Prepared from Two Local Varieties of Fresh Tomato *(Lycopersicum esculentum Mill)*

Research Article

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Abstract

This study focused on the development and sensory evaluation of Toma–Pep Ketch–Up (TPK) prepared from two local species of fresh Tomato fruits (Ronita and UTC); all the samples, including the control sample (commercially available Tomato Ketch–up) (TK), were subjected to sensory evaluation to establish the organoleptic acceptability of the TPK. The results of Mean scores for the Sensory evaluation conducted for T–test for the two samples 215 and 217 were greater than the T–tabulated value ($P < 0.05$); and this implies that there was no significant difference between the two samples of the prepared TPK in terms of colour, sweetness, and taste; but there was a significant difference in terms of texture and overall acceptability of the two samples of TPK prepared from the Ronita and UTC species of fresh Tomato fruits ($P < 0.05$) This study suggests that the production of Toma–Pep Ketch–up was achieved using local varieties of Tomato Ronita and UTC using sweet pepper puree as an Adjunct, although results of the sensory indicated sample 215 (Ronita TPK) was better than samples 217 (UTC TPK) and 204 (TK).

Keywords: Ronita, UTC, Development, Sensory, Evaluation, Toma–Pep, Ketch–up

Introduction

The aim to develop Toma–Pep Ketch–up from two local varieties of Tomato fruits namely 'Ronita' and 'UTC' mixed with sweet pepper and other essential ingredients prompted this research. Tomato is botanically known as *Lycopersicon esculentum Mill*; it belongs to the family *Solanaceae*; it has been categorized as both fruit and vegetable, and it is regarded as a crop of great interest around the world today because it is widely consumed by many people [1]. Tomato Ketch–up is a product prepared from the concentrated paste of healthy and ripe Tomato pulp mixed with sweet pepper puree, Onion pulp, salt, sugar and vinegar by adopting a specific percentage for each ingredient used for formulation of the TPK [2].

Materials and Methods

The raw materials and ingredients used for developing Toma–Pep Ketch–up (TPK) include two varieties of fresh Tomato fruits namely 'Ronita' and 'UTC', fresh red sweet Pepper, fresh Onion, vinegar, sugar, salt, and potable water. The materials for this study were bought from the Tudun Wada market, Gusau; the Tomato products were developed and subjected to sensory analysis in the Food Processing workshop and Sensory Evaluation Unit of the Department of Food Science and Technology, Federal Polytechnic, Kaura–Namoda.

Experimental Design

Two varieties of fresh Tomato fruits, 'Ronita' and 'UTC', were used in the production of Tomato paste by Hot–Break Rupture Process; the preparation of samples of TPK was done under a hygienic condition using a modified method of [3–4]. And there was a comparison between both Toma–Pep Ketch–up developed; the control sample was used as the basis for comparison; and sensory evaluations were conducted on all the Tomato products including the Control sample (i.e. commercially available Tomato Ketch–up). And t–Test (two–tail), ANOVA, and Least Significant Difference (LSD) test for multiple comparisons among the three samples of Tomato products, Profiling and Ranking were used for statistical analysis of all the data ($P < 0.05$) to compare the relationship between the variables [3,6,7]. All data were recorded in duplicates and statistically analyzed results were presented in Tables.

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Table 1: Recipe formulation for the Production of TPK.

Ingredients	Amount (g/ml)	Amount (%)
Fresh Tomato Paste	1500g	86.21
Fresh Onion Paste	50g	2.87
Fresh Red pepper Paste	50g	2.87
Salt	5g	0.29
Sugar	100g	5.75
Natural Vinegar (White Type)	35ml	2.01

Recipe Formulations for the Production of Toma–Pep Ketch–up (TKP)

All the ingredients (Table 1) were measured with the aid of the electronic compact weighing balance (Model KD–BV, China).

Production of Samples of Toma–Pep Ketch–up (TPK)

Fresh Tomato fruits were sorted and graded to select the healthy, ripe and firm fruits from the whole; after sorting and grading the tomatoes and they were thoroughly washed, hot–water–blanched for 15 minutes and then de–skinned by peeling manually while still hot; while fresh red Pepper and Onions were steam–blanched for exactly 6 minutes; the blanched and peeled Tomato, Red pepper and Onions were allowed to cool and blended with the aid of an electric blender (Model BD0021DA–1031D, China). The pulp obtained was strained with the aid of a sieve of 0.5 µm diameter to obtain a fine pulp by removing seeds, skin and unblended pieces of the Tomato followed by holding for 3–5 minutes during which the enzymes are liberated to breakdown pectin. The pulp was concentrated by heating at 85°C for 90 minutes (Hot Break Process) in a stainless pot with continuous stirring to obtained concentrated pulp; after which sweet pepper paste, Onion paste, sugar, salt and natural white Vinegar were added to the concentrated Toma–Pep pulp and heating continued for 60 minutes at 85°C; the developed TPK was filled into a pre–sterilized bottle at 700C; the caps were closed and samples of the developed TPK were further pasteurized at 85°C for 5 minutes [8–10]. The mildly heated TPK samples were cooled and stored away for sensory evaluation [3,6,7].

Results and Discussions

Results of Sensory Evaluation Conducted on the Developed TPK

This part of the study presents and discusses the results obtained from the analyzed data generated from the sensory conducted on all the samples of Toma–Pep Ketch–up (TPK) developed from the species of fresh Tomato fruits 'Ronita' (coded sample 215) and 'UTC' (coded sample 217) and the Control (i.e. Commercially available Ketch–up) (coded sample 204)

Table 2 presents the results for ANOVA on the three samples of the TPK developed and commercially available Tomato Ketch–up used as the Control. SD = Significant Difference.

Key and word: LSD = Least Significant Difference

Table 3 presents the results for mean sensory values for all the three samples of Ketch–up. And the values with similar superscript imply that there is no significant difference between the samples in the row.

Table 4 presents the calculated and tabulated T values of two samples of Tomato Ketch–up prepared from 'Ronita' and 'UTC' varieties of fresh Tomato fruits.

Table 2: Summary of Results of Sensory Analysis (ANOVA) for the Samples of TPK and the Control.

Parameter	DF	D	S	N	T–calculated	T–tabulated	Remarks
Colour	19	4	1.15	20	15.56	2.093	SD
Taste (mouth feel)	19	7	1.03	20	27.56	2.093	SD
Sweetness	19	6	0.894	20	26.22	2.093	SD
Texture (smoothness)	19	4	1.137	20	20.01	2.093	SD
Overall acceptability	19	8	0.0894	20	40.02	2.093	SD

Table 3: Summary of Result of Mean Sensory Analysis for the Three Samples of Tomato Ketch–up.

Sample	Colour	Sweetness	Taste	Texture	Overall acceptability
215	7.7^{a}	7.65^{a}	7.7^{a}	7.25^{b}	7.8^{a}
217	7.5^{a}	7.35^{a}	7.35^{a}	7.05^{b}	7.4^{a}
204	6.3^{b}	7.90^{a}	6.9^{b}	7.65^{a}	7.05^{b}
LSD	0.971	0.877	0.62	0.035	0.6

Values in the same column with the same superscripts (a, b) are not significantly different at (P <0.05).

Table 4: Summary of T–test for the samples of TPK.

Sensory attribute	F–calculated	F–tabulated	Remarks
Colour	1.3372	2.85	NSD
Sweetness	1.3506	2.85	NSD
Taste (mouth feel)	1.0676	2.85	NSD
Texture (smoothness)	12.54	2.85	SD
Overall acceptability	3.476	2.85	SD

Keys and words: SD = Significant different and NSD = No significant difference

Table 5 presents the results for Profile mean value for all the three samples of Ketch–up that were sensorily analysed. And the values with similar superscript imply that there is no significant difference between the samples in the same row.

Table 5: Summary of Result of Profile Test Mean Values for Two Samples of TPK and the Control.

Parameter	215	217	204
Colour	8.30^{a}	8.17^{a}	7.30^{b}
Sweetness	7.5^{b}	8.25^{a}	8.5^{a}
Taste (mouth feel)	7.75^{b}	8.25^{a}	7.50^{b}
Texture (smoothness)	6.75^{b}	6.75^{b}	7.75^{a}
Overall acceptability	7.17^{b}	7.17^{b}	7.92^{a}

Values in the same column with the same superscripts (a, b) are not significantly different at (P <0.05)

Table 6 presents the results of the Mean values for the Ranking test (P <0.05) conducted on both samples of TPK developed from 'Ronita' (Sample 215) and 'UTC' (Sample 217) varieties of fresh Tomato fruits.

Table 6: Summary of Results of Mean value for Ranking Test for the Developed TPK.

Parameter	215	217	Rank Total
Colour	8.45	7.6	313
Sweetness	7.7	7.95	313

Discussions of T–test, ANOVA, and Turkey Tests Conducted on the Prepared Samples of TPK and the Control (i.e. Commercial available Tomato Ketch–up)

Table 2 shows the results of ANOVA test conducted on the three samples of developed Toma–Pep Ketch–up and the commercial Tomato Ketch–up used as the Control; the samples were found to be significantly different ($P< 0.05$) in all their sensory attributes; hence, Turkey Test and Least of Significant Difference (LSD) were conducted further to determine the level of significant difference between the samples of Toma–Pep Ketch–up and the Control; and it was established that sample 215 (Toma–Pep Ketch–up prepared from Ronita) was significantly different from sample 217 (Toma–Pep Ketch–up prepared from the UTC) and 204 (Control) ($P< 0.05$). Table 3 presents the summary of result of Mean Sensory Analysis for the three samples of Tomato Ketch–up including the Control; and these were indicated by the use of letters ('a' and 'b') as superscripts on the various Means of the samples as shown in Table 3; and values in the same column with the same superscripts are not significantly different at ($P <0.05$). Table 4 presents the results of summary of T–test for all the F–calculated values for all the sensory parameters tested and analyzed; and the T–calculated is greater than the T–tabulated implying that there was a significant difference in all the sensory parameters generated and analyzed statistically ($P< 0.05$) [3,6,11]. The F–calculated values were 1.3372, 1.3506, 1.0676, 12.54, and 3.476 for colour, sweetness, taste, texture and overall acceptability respectively; while the F–tabulated for all the sensory parameter was 2.85 at ($P< 0.05$); hence the F–calculated for colour, sweetness, and taste are less than the F–tabulated at ($P< 0.05$); thus it can be deduced that there was no significant difference between the two samples of the prepared TPK in terms of colour, sweetness, and taste; while F–calculated for texture and overall acceptability are higher than F–tabulated at ($P< 0.05$) and this implies that there is a significant difference between the texture and overall acceptability of the two samples of TPK prepared from the Ronita and UTC species of fresh Tomato fruits ($P <0.05$).

Discussions on Profiling Test Conducted on the Prepared TPK

In this study, Table 5 presents the Profile Test Mean value of all the parameters of each sample and how they vary in terms of colour, sweetness, taste, texture and overall acceptability ($P <0.05$). In terms of colour sample 215 (Toma–Pep Ketch–up prepared from Ronita) is more acceptable than 217 (Toma–Pep Ketch–up prepared from UTC) and 204 (Control) but there is no significant difference between 215 (Toma–Pep Ketch–up prepared from Ronita) and 217 (Toma–Pep Ketch–up prepared from UTC) ($P <0.05$); but for sweetness, there was a significant difference between the three samples of Tomato Ketch–up as sample 204 is more acceptable than sample 215 (Toma–Pep Ketch–up prepared from Ronita) and 217 (Toma–Pep Ketch–up prepared from UTC) but no significant difference between 204 (Control) and 217 (Toma–Pep Ketch–up prepared from UTC) ($P <0.05$); this could be attributed to the additional starch–based thickening agent added in the preparation of the commercial available Tomato Ketch–up, and owing to the conversion of complex sugars (i.e. polysaccharides) to simple sugars under storage condition under the influence of acid and/or enzymes. However, for taste, sample 217 (Toma–Pep Ketch–up prepared from UTC) is significantly different from 215 (Toma–Pep Ketch–up prepared from the Ronita) and 204 (Control) ($P <0.05$); for texture, sample 204 (Control) is significantly different from sample 215 (Toma–Pep Ketch–up prepared from the Ronita) and 217 (Toma–Pep Ketch–up prepared from UTC) ($P <0.05$) and this could as well be as a result of thickener that was added into the commercial available Tomato Ketch–up which might have improved its texture. For overall acceptability, sample 204 is significantly different from sample 215 (Toma–Pep Ketch–up prepared from the Ronita) and 217 (Toma–Pep Ketch–up prepared from UTC) but sample 215 (Toma–Pep Ketch–up prepared from the Ronita) and 217 (Toma–Pep Ketch–up prepared from UTC) are not significantly different from each other ($P <0.05$). In summary, Table 5 shows the results of Profile Test Mean values for all samples of TPK including the Control and values in the same column with the same superscripts are not significantly different while those with different superscripts are significant different at ($P <0.05$).

Discussion on Ranking Tests Conducted on the Prepared TPK

Also, in this study, Table 6 shows the result for the mean value for the Ranking test; and the sensory parameters including colour and sweetness for both samples 215 (Toma–Pep Ketch–up prepared from Ronita) and 217 (Toma–Pep Ketch–up prepared from UTC) respectively showed that there is significant difference in the colour between 215 (Toma–Pep Ketch–up prepared from Ronita) and 217 (Toma–Pep Ketch–up prepared from UTC) as sample 215 (Toma–Pep Ketch–up prepared from Ronita) is more acceptable than 217 (Toma–Pep Ketch–up prepared from UTC) ($P <0.05$). As for the sweetness, there is no significant difference between samples 215 (Toma–Pep Ketch–up prepared from Ronita) and 217 (Toma–Pep Ketch–up prepared from UTC) ($P <0.05$). In all the sensory parameters evaluated and statistically analyzed sample 215 (Toma–Pep Ketch–up prepared from Ronita) gained more acceptance than samples 217 (Toma–Pep Ketch–up prepared from UTC) and 204 (Control), respectively ($P <0.05$). This is because there is a significant difference in terms of colour between 215 (Toma–Pep Ketch–up prepared from Ronita) and 217 (Toma–Pep Ketch–up prepared from UTC), with a mean ratio of 8.45 and 7.60 for samples 215 and 217; but samples 215 and 217 are similar in sweetness, with a mean ratio of 7.70 and 7.95, even though sample 215 (Toma–Pep Ketch–up prepared from Ronita) is slightly judged to be sweeter than sample 217 (Toma–Pep Ketch–up prepared from UTC) ($P <0.05$) this could be attributed to the fact that perhaps 'Ronita' variety of fresh Tomato has a higher content of Polysaccharides which has been hydrolyzed and turned into simple sugars during thermal (hot–break) processing and as well as the presence of other simple sugars in free form than the 'UTC' variety of fresh Tomato. Nonetheless, there is a viscous (texture) and sensory difference between the Tomato products that are processed by either the hot break or cold break processes, which has been attributed to the inactivation of Pectin *Methylesterase* and *Endopolygalacturonase* involved in the breakdown of Pectin at a temperature that is elevated [8,10].

Conclusion

In summary, the TPK developed from the Ronita Tomato variety was rated best and most acceptable by the sensory panelists as it differs in all sensory parameters from samples 217 (UTC TPK) and 204 (Control TK). Hence, this study reveals that the TPK was successfully developed from the fresh Ronita variety of Tomato mixed with prepared sweet pepper paste and other ingredients. The developed TPK can be used by the catering and hospitality industries in the preparation and serving of several food menus and dishes such as Pizza, boiled and fried Irish potato, Sweet potato and yam.

Acknowledgement/Special Notification

We sincerely appreciate the Management of ALDUSAR Food and Beverages Limited, Katsina, Nigeria for allowing us to use their well–equipped laboratory to conduct Microbiological and Physico–chemical analyses during this study. Also, this developed Toma–Pep Ketch–up is on the process of patenting; hence no person or group of persons or any Tomato products production companies is/are allowed to use the Recipes formulation reported in this study. However, interested person(s) can consult the corresponding author for business details.

Conflict of Interest

Authors declare there is no conflict of interest.

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