International Journal of Multidisciplinary Research and Publications
ISSN (Online): 2581-6187

Impacts of Lemon Juice Extract and *Aframomum Danielli* on Physicochemical and Microbiological Properties of Stored Peeled Tomato (*Lycopersicon esculentum. L*)

Olagoke, H.B.[2]; Osunbade O.A.[1]*; Adewole S.A.[1]; Popoola, J.O.[1]; Iguh N.B.[3]; Oladimeji, T.E[1]

[1]Depatment of Food Science, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
[2]Department of Industrial Chemistry, Federal University, Oye-Ekiti, Ekiti State
[3]Department of Food Science and Technology, Michael Okpara University of Agriculture, Umudike, Nigeria
*Corresponding author: oaosunbade68@lautech.edu.ng,

***Abstract*—** *Tomato (Lycopersicon esculentum L) is an important fruit which plays an active role in human diets but deteriorate very fast due to its short shelf life. This necessitates the use of lemon juice extract and Aframomum danielli to preserve the food product. The study aimed at investigating the effects of lemon juice extract and Aframomum danielli on the storage of tomato. Fresh peeled tomato (cherry type variety) was packed in glass bottle. 5ml and 20ml of lemon juice extract and Aframomum danielli extracts were added to the samples respectively. At two weeks interval, the samples was evaluated for moisture content, ascorbic acids, p^H, titratable acidity, lycopene, coliform, yeast, molds and total viable count for a period of twelve weeks. The results showed an increased in titratable acidity as the period of storage proceed while pH decreased as the storage period increased. There was a significant difference in moisture content between tomato treated at 5ml and 20ml of both preservatives at $P<0.05$. Lycopene content, ascorbic acids decreased as the period of storage increased at each week. The results of microbiological properties showed that the samples treated with 20% lemon juice and Aframomum danielli had the lowest count while the samples treated with 5% lemon juice and Aframomum danielli had higher count. This finding revealed that microbial load of the stored peeled tomato treated with 20% of both lemon juice and Aframomum danielli were within safe limit (1.0×10^6), therefore the stored peeled tomato can be stored adequately with 20% lemon juice and Aframomum danilelli.*

***Keywords*—** *Aframomum danielli, lycopene, ascorbic acids, total carotenoid.*

I. INTRODUCTION

Tomato (Lycopersicon esculentum *L*.) is a popular fruit used in enormous quantities in the fresh state and notable among the list of vegetables used as canned product. It is widely recognized worldwide for its culinary purpose. The worldwide production of tomatoes totaled 170.8 million tons according to FAOSTAT (2017), with China leading the production chart which account for 31% of the total global production. India and the United States followed with the second and third highest production of tomatoes in the world. Tomato plays an important role in the diet and a valuable source of vitamin A and C. Tomato is a natural source of lycopene, a carotenoid that reduces the risk of cancer and coronary heart diseases. Nutritionally, tomatoes contain 95% water, 4% carbohydrates, and less than 1% of proteins and fats. The soluble carbohydrates in tomatoes are almost all reducing sugars. Glutamic acid is the main amino acid, rarely found in other fruits (Abou Dahab, 2006).

Fresh fruits and vegetables are inherently perishable and their quality start to decline immediately after harvesting. Postharvest quality loss usually results from produce transpiration, senescence, ripening-associated processes and wound-initiated reactions. In addition, microbial proliferation contributes markedly to postharvest quality loss (Mohammad, 2007). During the process of distribution and marketing, substantial losses are incurred which range from a slight loss of quality to total spoilage. The causes of losses are many: physical damage during handling and transport, physiological decay, water loss, or sometimes simply because there is a surplus in the market place and no buyer can be found. In order to solve these problems, it is important to preserve fruits and vegetable and make them available when they are out of season.

Many developed countries have put in place means of preserving foods till time of scarcity but in developing countries like Nigeria, preservation is still minimal due to inadequate storage facilities. Spoilage of fresh tomato is also caused by poor transportation, a menace in developing countries. Packaging tomatoes on each other prior to transportation increases the chances of spoilage as the tomatoes packed under break easily due to pressure. Being an annual crop, tomatoes has its off-season when there price become 2 to 3 times higher and not readily available. *A. danielli* has been found to have preservative properties in some food systems (Adegoke, 2007). Similarly, the preservative effect of lemon juice was established in the research conducted by Onyimba and Dishon (2019) on the shelf life enhancement of kunun zaki. This research intends to determine effects of different concentrations of lemon juice and *Aframomum danielli* on the stored peeled tomatoes and to

Olagoke, H.B.; Osunbade O.A.; Adewole S.A.; Popoola, J.O.; Iguh N.B.; and Oladimeji, T.E, "Impacts of Lemon Juice Extract and *Aframomum Danielli* on Physicochemical and Microbiological Properties of Stored Peeled Tomato (*Lycopersicon esculentum. L*)," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 3, Issue 12, pp. 30-34, 2021.

evaluate antioxidants, physiochemical and microbial properties of the peeled tomatoes during storage period.

II. MATERIALS AND METHODS

Materials

The raw materials used are tomatoes, lemon juice, *Aframomum danielli.* They were obtained from Sabo market Ogbomoso.

Methods

Preparation of lemon juice

Juice from fresh lemons at room temperature was squeezed in order to extract the juice. The extracted juice was sieved to remove pips. The lemon juice was stored in a refrigerator until when needed.

Preparation of Aqeous Extract of Aframomum danielli

Aframomum danielli seeds were sorted, washed and air-dried. They were winnowed and milled into powder by using hammer mill. The powder was sieved with a wire mesh to obtain a fine powder. 1g of *Aframomum danielli* powder was added to 100ml of distilled water and mixed thoroughly and this were centrifuged at 300 resolutions per minute. 20 minutes after which the supernatant was obtained as *Aframomum danielli* extracts (Ashaye, 2006).

Preparation of peeled tomatoes for storage

Freshly picked tomatoes were sorted to remove damage ones and rinsed in clean water. They were dipped gently into boiling water for thirty seconds. After thirty seconds they were taken out of cooking pot as quickly as possible with a sieve. They were plunged immediately into cold water for a few minutes. Immersion in cold water after boiling will helps to loosen the skin. The tomatoes were peeled with knife. The clean jar was filled with peeled tomatoes. The peeled tomatoes was packed in by tapping the bottom of the jar with one hand so tomatoes are shaken down and fit snugly against each other. Lemon juice extract and aqueous extract of *Aframomum danielli* was added for preservation at different concentrations (5ml and 20ml), hot pulp was added to fill up the jars leaving about 1cm of air underneath the lid. After that the jars were tightly closed and sterilized by boiling in water for 45minutes and peeled tomatoes were stored in a cool dry place.

Determination of physiochemical properties

Moisture content determination

5g of tomato sample was weighed into a previously weighed metal dish that had been heated for 15 minutes at 105^0C and cooled in desiccators. The metal dish and sample was transferred into the oven at 105^0C for $1^1/_2$ hours. It was cooled in the desiccators and weighed as soon as possible at room temperature. It was then re-heated at the same temperature for 30 minutes, reweighed after cooling. The process was repeated until a constant weight was maintained and the % moisture was calculated as;

$$\% \text{ moisture} = \frac{\text{weight of moisture evaporated}}{\text{Weight of sample}} \times 100$$

$$= \frac{\text{weight before drying-weight after drying}}{\text{Weight of sample}} \times 100 \quad \text{(AOAC, 2013)}$$

pH determination

20ml of distilled water was added to 10g of tomato sample and mixed very well. pH meter dielectrode was dipped in and pH value recorded when reading stabilizes (AOAC, 2013)

Ascorbic acid determination

20g sample was weighed and ground with a little glacial acetic acid in a mortar. The extract was transferred quantitatively with distilled water into a 50ml volumetric flask and made up to mark with more water and filtered rapidly. 10ml of the filtrate was taken into a conical flask with one drop dilute acetic acid. It was titrated against the redox dye 2, 6-dichlorophenol solution in the burette. The volume of the dye required to decolorize the 10ml of the sample was noted. Titration was repeated using a standard ascorbic acid solution (1 mg. pure vit/100ml) in a place of the tomato extract. The calculation of ascorbic acid per 100g of tomato was made thus;

$$\text{Mg Vit. C/100g} = \frac{w_1 + w_2 \times v_1}{w_1 \times w_3 \quad v_2} \times 100 \text{ (v x f)}$$

Where w_1 = weight of sample (g)

w_2 = weight of extracting acid (g)

w_3 = weight of slurry taken for analysis (g)

v_1 = volume to which slurry sample is diluted (ml)

v_2 = volume of filtrate taken for filtration (ml)

v = volume of dye solution used for titration

f = ascorbic acid equivalent of dye (mg/ml) (AOAC, 2013)

Determination of Antioxidant properties

Total carotenoid determination

10g of homogenous sample was weighed. 50ml of cold acetone was added and homogenize for 1 minute. It was filtered through Whatman No 4.0 filter paper. Residue from homogenizer was washed with cold acetone until washing is colourless. The extract was poured into a separating funnel and 20ml petroleum ether was added slowly, flowing along the wall of the separating funnel to avoid formation of an emulsion. It was allowed to stand for a few minutes until the 2 phases separated. The lower aqueous acetone phase was discarded. The petroleum ether phase was washed with water for 4-5 times to remove all traces of acetone. The petroleum ether phase was passed through cotton wool and anhydrous sodium sulphate in a glass funnel. It was collected in 25ml volumetric flask and petroleum ether was added to make up to volume. Absorbance was then measured at 450nm and total carotenoid was calculated as;

$$\text{ug/g} = \frac{A \times \text{vol.} \times 10^4}{A^{1\%/cm} \times \text{weight of sample}}$$

Where A = Absorbance

$A^{1\%/cm} = 2592$

Vol. = 25ml (Sharoba, 2009)

Lycopene determination

Lycopene standard was prepared by weighing 1g of lycopene powder into 100ml of hexane-acetone mixture. This was allowed to stand for 1 hr before filtration. Then 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 and 0.9ml of the stock were measured into test tubes and these were made up to 10ml each with hexane-acetone mixture. About 10ml of acetonic hexane mixture was used as blank. This mixture was allowed to stand

Olagoke, H.B.; Osunbade O.A.; Adewole S.A.; Popoola, J.O.; Iguh N.B.; and Oladimeji, T.E, "Impacts of Lemon Juice Extract and *Aframomum Danielli* on Physicochemical and Microbiological Properties of Stored Peeled Tomato (*Lycopersicon esculentum. L*)," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 3, Issue 12, pp. 30-34, 2021.

for another 30 minutes before measuring there absorbance with UV-Spectrophotometer at 475 wavelengths and a standard curve were obtained. About 3g of tomato sample was grinded with pestle and mortal and 1g of each sample was added to 100 ml of hexane and acetone for 1hr with vigorous shaking. From the stock, 1ml of each sample were up to 10ml with hexane and acetone mixture and absorbance read on the spectrophotometer at 475 (Sharoba, 2009).

Titratable acidity determination

10g of sample was weighed and 200ml distilled water was added in a 250 conical flask. 4-5 drops of phenolphthalein was added and titrated against 0.1M NaOH. Titre value was recorded and the calculation was made thus;

TA= titre value x 0.09 (AOAC, 2013)

Determination of microbial loads

The total viable

The total viable was estimated using Serial dilution method. Nutrient agar was used for the estimation of total viable count. The inoculated plate was properly and gently mixed before incubation at 27^0C for 48 hours. Colonies was counted and the count was done in duplications using an electric counter (Oyebanji, 2011).

Yeast and Molds count

Fugal count was estimated according to Oyebanji, (2011). One ml of the mixture that was serially diluted for yeast count was aseptically inoculated and was poured into a sterilized plate containing Potato Dextrose Agar (PDA) by using a sterile pipette. The plates were properly and gently mixed before it was incubated at room temperature for 24hours. All counts were carried out in duplicates by using an electronic counter.

Coliform count

One ml of the mixture that was serially diluted for yeast count was aseptically inoculated and was poured into a sterilized plate containing Mac Conkey agar using a sterile pipette. The plate was properly and gently mixed before it was incubated at 44^0C for 24-48hours. All counts were carried out in duplications by using an electronic counter (Sharoba, 2009).

Statistical analysis

Data was analyzed using analysis of variance (ANOVA) with the aid of SAS (statistical analysis system) software package and means that was significantly different was separated at 5% probability level.

III. Results and Discussion

Chemical and Antioxidant properties of stored peeled tomatoes

The results obtained from analysis of stored peeled tomatoes (Table 1, 2, 3 and 4) showed that the titratable acidity of stored peeled tomatoes treated with 5% lemon juice extract ranged from 0.88 to 1.53% while that of stored peeled tomatoes treated with 20% lemon juice extract ranged from 0.93 to 2.03%. The titratable acidity of the stored peeled tomatoes treated with 5% *Aframomum danielli* ranged from 0.52 to 1.24% and the samples treated with 20% *Aframomum danielli* ranged from 0.50 to 0.90%. The findings showed that the titratable acidity of stored peeled tomatoes increased as the period of storage increased in all the samples from week zero to week twelve. This may be due to the presence of acidophilus in the samples. Stored peeled tomatoes treated with 20ml lemon juice had the highest titratable acidity at week twelve (2.03%) while the highest titratable acidity was obtained from stored peeled tomatoes treated with 5ml *Aframomum danielli* extract at week 6 (1.24%).

p^H of the stored peeled tomatoes treated with 5% lemon juice extract ranged from 1.87 to 2.83 while that of the samples treated with 20% lemon juice extract ranged from 1.78 to 2.13. The p^H of the stored peeled tomatoes treated with 5ml *Aframomum danielli* ranged from 2.10 to 3.20 and the samples treated with 20% *Aframomum danielli* ranged2.20 to3.30. It was observed that there was decreased in p^H as the period of storage increased. This observation may be due greater rate of fermentation as result of favourable temperature for microbial activities (Ashaye *et al*, 2006). The findings showed that stored peeled tomatoes treated with 5% lemon juice extract at week zero had the highest pH value of 2.80 while decrease in pH value (2.10) of stored peeled tomatoes treated with 20% lemon juice extract was observed at same storage week. This can be attributed to the increased acidic content of the lemon juice extract at increased concentration of treatment. Almost similar results were observed for other storage weeks with same storage period at 5 and 20% concentrations of lemon juice extract treatment of stored peeled tomatoes. However, stored peeled tomatoes treated with 20% *Aframomum danielli* at week zero tends to be higher in pH value (3.30) compared to stored peeled tomatoes samples (pH 3.20) treated with 5% *Aframomum danielli*. This trend was also observed to be similar in same storage weeks at different concentrations of 5 and 20% *Afromomum danielli* treatment of stored peeled tomatoes. This could be attributed to the ability of the spice at increased concentrations to inhibit microbial activities that could lead to the formation of basic substances which would increase the acidity of the stored peeled tomatoes samples. Joseph and Norman (2006) reported that certain spices and chemicals destroy microorganisms.

The results of moisture content of stored peeled tomatoes treated with 5% lemon juice extract ranged from 92.87 to 93.71% while the stored peeled tomato samples treated with 20% lemon juice extract ranged from 91.0 to 91.80%. The results of moisture content of stored peeled tomatoes treated with 5% *Aframomum danielli* ranged from 93.8 to 94.5%while the samples treated with 20% *Aframomum danielli* ranged from 91.97 to 92.60%. Stored peeled tomatoes treated with 5% lemon juice extract had the highest moisture content at week two (93.70%), while tomatoes treated with 20% lemon juice had the lowest moisture content (91.0%) at week twelve. Stored peeled tomatoes treated with 5% *Aframomum danielli* had the highest moisture content at week two (94.50%), while tomatoes treated with 20ml *Aframomum danielli* had the lowest moisture content at week eight (91.97%). Fluctuation in moisture may be due to activity of micro-organisms and catabolic enzymes produced by them (Ashaye *et al.*, 2006).

The results of lycopene of the stored peeled tomatoes treated with 5% lemon juice extract ranged from 1.10 to 1.87mg/100g while the samples treated with 20% lemon juice extract ranged from 1.03 to 1.47mg/100g. The results of stored

Olagoke, H.B.; Osunbade O.A.; Adewole S.A.; Popoola, J.O.; Iguh N.B.; and Oladimeji, T.E, "Impacts of Lemon Juice Extract and *Aframomum Danielli* on Physicochemical and Microbiological Properties of Stored Peeled Tomato (*Lycopersicon esculentum. L*)," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 3, Issue 12, pp. 30-34, 2021.

peeled tomatoes treated with 5% *Aframomum danielli* ranged from 1.10 to 1.57mg/100g while the samples treated with 20% *Aframomum danielli* ranged from 1.07 to 1.50mg/100g. Tomatoes are good source of lycopene, a carotenoid responsible for the bright red colour of tomatoes (Roldan-Gutierrez and Luque de Castro, 2007). It was observed that the lycopene contents decreased as the storage period proceeded at different concentration of both preservatives. This may be due to the colour intensity of the sample. Tomatoes treated with 5% lemon juice extract had the highest lycopene content (1.87mg/100g) than the samples treated with 5% *Aframomum danielli* at week zero (1.57mg/100g) while at 20ml lemon juice and *Aframomum danielli*, there was no significant differences at $P<0.05$ in the value of lycopene obtained (1.47mg/100g).

The results of ascorbic acids of the stored peeled tomatoes treated with 5% lemon juice extract ranged from 28.87 to 37.8 mg/100g while the samples treated with 20% lemon juice extract ranged from 31.87 to 41.83mg/100g. The results of stored peeled tomatoes treated with 5% *Aframomum danielli* ranged from 11.90 to 19.17mg/100g while the samples treated with 20% *Aframomum danielli* ranged from 10.47 to 18.33mg/100g. Findings showed that there was a decrease in ascorbic acid content after treated with both lemon juice and *Aframomum danielli* at different concentration as the period of storage increased. Tomatoes treated with 5ml and 20ml lemon juice had the highest ascorbic acid content (37.8mg/100g; 41.8m/100g) when compared with the value obtained from samples treated with 5ml and 20ml *Aframomum danielli* (19.17mg/100g; 18.33mg/100g).

Microbial load of the stored peeled tomatoes

The results of microbial load of stored peeled tomatoes showed that the total viable count of the samples treated with 5% lemon juice extract ranged from 2.0×10^3 to 8.90×10^5cfu/ml while the samples treated with 20% lemon juice extract ranged from 1.1×10^3 to 7.84×10^4cfu/ml. The results of the stored peeled tomatoes treated with 5% *Aframomum danielli* ranged from 1.5×10^4 to 8.60×10^6cfu/ml while the samples treated with 20% *Aframomum danielli* ranged from 1.40 to 6.70×10^6 cfu/ml. The findings showed an increased in microbial growth as the storage period increased and this is in-line with the finding of Adegoke *et al.*, (2007). Tomato treated with 5ml of both preservatives had highest count, while the tomatoes treated with 20% of both preservatives had lowest count. According to FAO Report (2012) reported, the microbial load is within the safe limit value (1.0×10^6).

The coliform count of the stored peeled tomatoes treated 5% lemon juice extract ranged from ranged from 0.9×10^2 to 2.10×10^4cfu/ml while the samples treated with 20% lemon juice extract ranged from 0.9×10^2 to 8.90×10^3cfu/ml. The results of the stored peeled tomatoes treated with 5% *Aframomum danielli* ranged from 6.5×10^2 to 6.50×10^4cfu/ml while the samples treated with 20% *Aframomum danielli* ranged from 1.60×10^3 to 4.50×10^4 cfu/ml. The findings showed that the peeled tomato treated with 5% lemon juice extract had the highest coliform count while the sample treated with 20% lemon juice extract had lowest coliform count. Similarly, the samples treated with 5ml *Aframomum danielli* had highest coliform count, while the tomatoes treated with 20% *Aframomum danielli* had lowest coliform count.

The results of yeast and molds count of the stored peeled tomatoes treated with 5% lemon juice extract ranged from 4.8×10^2 to 9.50×10^5cfu/ml while the samples treated with 20% lemon juice extract ranged from 1.8×10^2 to 9.70×10^4cfu/ml. The results of the stored peeled tomatoes treated with 5% *Aframomum danielli* ranged from 2.8×10^2 to 1.0×10^6cfu/ml while the samples treated with 20% *Aframomum danielli* ranged from 1.1×10^3 to 8.80×10^5cfu/ml. The findings showed that the peeled tomato treated with 5% of both preservatives had the highest yeast count while the sample treated with 20% of both preservatives had lowest yeast count.

IV. Conclusion and Recommendation

Conclusion

It was deduced from the findings that both lemon juice extract and *Aframomum* danielli (5% and 20%) used for tomatoes pre-treatment preserved better. It could be concluded that the samples treated with 20% of both preservatives had lower microbial count when compared with the results obtained from the tomatoes treated with 5% of lemon juice extract and *Aframomum danielli*. The finding was able to establish that the peeled treated tomatoes with 20% lemon juice extract and 20% *Aframomum danielli* falls within the safe limit of 1.0×10^6 cfu/ml.

Recommendation

Tomato samples treated with 5% of lemon juice extract and 20% *Aframomum danielli* were more effective in preserving chemical parameters of tomatoes. Meanwhile, 20ml of both preservatives are recommended for preserving tomatoes against higher microbial loads.

References

[1] Abou Dahab, T. A. M. and Abd El-Aziz, N. G. (2006): Physiological Effect of Diphenylamin and Tryptophan on the Growth and Chemical Constituents of Philodendron erubescens Plants. *World J. Agric. Sci.*, 2 (1): 75-81.

[2] AOAC (2013). Official Methods of Analysis. Association of Official Analytical Chemists, Washington D.C., U.S.A

[3] Ashaye, O. A., Taiwo, O. O., and Adegoke, G. O (2006). Effect of Local preservative (*Aframomum danielli*) on the Chemical and Sensory Properties of Stored Warakanshi. *African Journal of Agricultural Research* Vol. **1 (1)**, pp. 010-016. Available online at http://www.academicjournals.org/AJAR

[4] Adegoke, G.O., Odeyemi, A.O., Hussein,O and Ikheorah, J. (2007). Control of ochratoxin A in kunu zaki (a non-alcoholic beverage) using DaniellinTM. *African Journal of Agriculture Research*, 2, 128-131.

[5] FAO, (2018). Post-harvest management of tomato for quality and safety assurance Guidance for horticultural supply chain stakeholders. Food and Agriculture Organization of the United Nation Production Year Book, FAO, Rome, 2-6.

[6] FAO Report (2012). Third mission report to project LTO under TCP/RAS/3310 – Capacity development to reduce post-harvest losses in horticultural chains in GMS countries, FAO RAP, Thailand. 23-26.

[7] FAOSTAT, (2017). http://faostat.fao.org.

[8] Joseph, H.H and Norman, N.P (2006). Food Science. CBS Publishers and Distributors. Daryaganj, New Delhi.

[9] Mohammad S.R (2007). Handbook of food preservation (2nd Edn). CRC Press Taylor & Francis Group, Boca Raton. Pp 316

[10] Oyebanji, A.O., Ibrahim, M.H., Okanlawon, S.O., Okunade, S.O and Awagu, E.F (2011). Moisture content, mouldiness, insect infestation, and acceptability of market samples of dried tatase pepper and tomato in Kano, *Nigeria Journal of Stored Products and Postharvest Research*, 2 (10):200-207.
[11] Onyimba I.A and Dishon C.H (2019). Effectiveness of lemon juice and honey in shelf life enhancement of kunun zaki. *World Journal of Advanced Research and Reviews*, 1(1), 01-08.
[12] Roldan-Gutierrez, J. M and Luque de Castro, M. D (2007). Lycopene: The Need for Better Methods for Characterization and Determination. *Trends in Analytical Chemistry*, 26 (2): 163-170.
[13] Sharoba, A.M (2009). Producing and evaluation of red pepper pastes as new food product. *Annals of Agricultural Science Moshbohor*, 47(2):151-165.

Table 1: Antioxidant, Physiochemical, and Microbiological Property of Stored Peeled Tomatoes treated with 5% Aframomum. danielli

No of TYC week (cfu/ml)	TA (%)	P^H	MC (%)		Lyco (mg/100g)	AA (mg/100g)	TVC (cfu/ml)	Coli (cfu/ml)
0	0.52±0.00	3.20±0.00	94.33±0.21	1.57±0.03	19.17±0.29	$2.6x10^4$±0.29	$6.5x10^2$±0.00	$2.8x10^2$±0.00
2	0.51±0.01	3.07±0.12	94.5±0.10	1.53±0.05	19.0±0.09	$1.5x10^4$±0.00	$4.0x10^3$±0.00	$1.2x10^3$±0.00
4	0.59±0.01	2.87±0.06	94.17±0.21	1.47±0.03	18.27±0.06	$8.6x10^4$±0.00	$6.5x10^3$±0.00	$4.5x10^3$±0.00
6	1.24±0.01	2.73±0.06	94.0±0.06	1.40±0.00	18.26±0.06	$2.0x10^5$±0.00	$7.8x10^3$±0.00	$1.1x10^4$±0.00
8	0.75±0.01	2.56±0.06	93.87±0.12	1.30±0.06	15.67±0.06	$7.5x10^5$±0.00	$1.1x10^4$±0.00	$7.0x10^4$±0.00
10	0.90±0.01	2.17±0.58	93.93±0.15	1.27±0.06	13.10±0.21	$3.3x10^6$±0.00	$3.7x10^4$±0.00	$2.5x10^5$±0.00
12	0.97±0.01	2.10±0.58	93.80±0.00	1.10±0.00	11.90±0.10	$8.6x10^6$±0.00	$6.5x10^4$±0.00	$1.0x10^6$±0.00

Mean of triplicate determination, significant at level (P<0.05).
Key: TA-Titratable acidity, MC-Moisture content, Lyco-Lycopene, AA-Ascorbic acid, TVC-Total viable count, Coli-Coliform count, TYC-Total yeast count.

Table 2: Antioxidant, Physiochemical, and Microbiological Property of Stored Peeled Tomatoes treated with 20% *Aframomum. danielli*

No of TYC week (cfu/ml)	TA (%)	P^H	MC (%)		Lyco (mg/100g)	AA (mg/100g)	TVC (cfu/ml)	Coli (cfu/ml)
0	0.50±0.00	3.30±0.00	92.50±0.10	1.47±0.06	18.33±0.29	$1.4x10^4$±0.00	$3.6x10^3$±0.00	$1.1x10^3$±0.00
2	0.50±0.01	3.17±0.06	92.6±0.16	1.50±0.00	17.33±0.29	$1.6x10^3$±0.00	$1.6x10^3$±0.00	$8.7x10^2$±0.00
4	0.54±0.01	3.00±0.00	92.23±0.10	1.43±0.06	17.13±0.26	$7.6x10^4$±0.00	$5.8x10^3$±0.00	$2.8x10^3$±0.00
6	0.57±0.01	2.87±0.00	92.1±0.10	1.40±0.00	17.13±0.06	$9.0x10^5$±0.00	$6.6x10^3$±0.00	$9.8x10^4$±0.00
8	0.63±0.01	2.67±0.06	91.97±0.06	1.33±0.06	13.57±0.06	$9.6x10^5$±0.00	$8.7x10^3$±0.00	$1.1x10^5$±0.00
10	0.81±0.01	2.33±0.06	92.13±0.16	1.27±0.06	12.10±0.10	$3.8x10^6$±0.00	$1.1x10^4$±0.00	$2.2x10^5$±0.00
12	0.90±0.01	2.20±0.00	92.00±0.00	1.07±0.06	10.47±0.06	$6.7x10^6$±0.00	$4.5x10^4$±0.00	$8.8x10^5$±0.00

Mean of triplicate determination, significant at level (P<0.05).
Key: TA-Titratable acidity, MC-Moisture content, Lyco-Lycopene, AA-Ascorbic acid, TVC-Total viable count, Coli-Coliform count, TYC-Total yeast count.

Table 3: Antioxidant, Physiochemical, and Microbiological Property of Stored Peeled Tomatoes treated with 5% Lemon juice extract

No of TYC week (cfu/ml)	TA (%)	P^H	MC (%)		Lyco (mg/100g)	AA (mg/100g)	TVC (cfu/ml)	Coli (cfu/ml)
0	0.84±0.00	2.80±0.00	93.5±0.21	1.87±0.05	37.8±0.57	$2.8x10^3$±0.00	$1.5x10^2$±0.00	$8.5x10^2$±0.00
2	0.88±0.01	2.83±0.01	93.7±0.10	1.83±0.05	37.7±0.29	$2.0x10^3$±0.00	$0.9x10^2$±0.00	$4.8x10^2$±0.00
4	0.95±0.00	2.63±0.06	93.17±0.06	1.73±0.05	35.83±0.57	$7.2x10^3$±0.00	$2.1x10^3$±0.00	$2.4x10^3$±0.00
6	1.10±0.00	2.47±0.06	93.0±0.06	1.57±0.06	34.13±0.06	$1.1x10^4$±0.00	$4.4x10^3$±0.00	$7.5x10^3$±0.00
8	1.23±0.06	1.87±0.58	92.87±0.06	1.33±0.06	31.43±0.12	$6.6x10^4$±0.00	$7.2x10^3$±0.00	$2.8x10^4$±0.00
10	1.33±0.06	2.13±0.06	92.96±0.12	1.10±0.06	30.03±0.21	$2.1x10^5$±0.00	$9.6x10^3$±0.00	$9.5x10^5$±0.00
12	1.53±0.06	2.10±0.00	92.87±0.06	1.10±0.00	28.87±0.12	$8.9x10^5$±0.00	$2.1x10^4$±0.00	$6.5x10^5$±0.00

Mean of triplicate determination, significant at level (P<0.05).
Key: TA-Titratable acidity, MC-Moisture content, Lyco-Lycopene, AA-Ascorbic acid, TVC-Total viable count, Coli-Coliform count, TYC-Total yeast count.

Table 4: Antioxidant, Physiochemical, and Microbiological Property of Stored Peeled Tomatoes treated with 20% Lemon juice extract

No of TYC week (cfu/ml)	TA (%)	P^H	MC (%)		Lyco (mg/100g)	AA (mg/100g)	TVC (cfu/ml)	Coli (cfu/ml)
0	0.93±0.00	2.10±0.00	91.67±0.06	1.47±0.06	41.83±0.76	$1.9x10^3$±0.00	$0.9x10^2$±0.00	$3.2x10^2$±0.00
2	0.96±0.01	2.13±0.00	91.8±0.07	1.43±0.06	41.67±0.55	$1.1x10^3$±0.00	$0.6x10^3$±0.00	$1.8x10^2$±0.00
4	1.50±0.05	2.03±0.06	91.37±0.06	1.47±0.06	40.00±0.76	$5.0x10^3$±0.00	$1.5x10^3$±0.00	$1.0x10^3$±0.00
6	1.77±0.06	1.93±0.06	91.17±0.06	1.36±0.06	38.53±0.40	$7.7x10^3$±0.00	$3.2x10^3$±0.00	$5.8x10^3$±0.00
8	1.83±0.06	1.90±0.00	91.0±0.00	1.27±0.06	36.87±0.21	$8.4x10^3$±0.00	$4.5x10^3$±0.00	$8.5x10^3$±0.00
10	1.97±0.12	1.87±0.06	91.1±0.10	1.17±0.06	35.37±0.11	$1.8x10^4$±0.00	$6.6x10^3$±0.00	$4.5x10^4$±0.00
12	2.03±0.06	1.78±0.00	91.0±0.00	1.03±0.06	31.87±0.15	$7.8x10^4$±0.00	$8.9x10^3$±0.00	$9.7x10^4$±0.00

Mean of triplicate determination, significant at level (P<0.05).
Key: TA-Titratable acidity, MC-Moisture content, Lyco-Lycopene, AA-Ascorbic acid, TVC-Total viable count, Coli-Coliform count, TYC-Total yeast count.