biology and life sciences forum

Proceeding Paper

Postharvest Quality and Storability of Organically Versus Conventionally Grown Tomatoes: A Comparative Approach †

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† Presented at the 1st International Electronic Conference on Horticulturae, online, 16-30 April 2022:

Abstract: In various parts of India, tomatoes are grown using eco-friendly indigenous organic manures prepared from cow products, for sustainable food production by small and marginal farmers. The main objective of the study was to compare the postharvest quality characteristics and storability between organically grown tomatoes using indigenous organic manures and those grown conventionally. The organic (OT) and conventional (CT) tomatoes procured from selected farms were observed for 28 days at ambient and refrigerated storage conditions. The postharvest quality characteristics and storability of tomatoes were assessed at the interval of 0, 7, 14, 21, 28 days and observed till senescence. Physiological loss of weight (PLW), total soluble solids (TSS), titratable acidity (TA), pH, colour, lycopene, ascorbic acid content, respiration rate and microbial stability were assessed to determine the postharvest quality and storability of OT and CT respectively. The study revealed that organic tomatoes stored at refrigerated condition had lower physiological loss of weight (2.78%), respiration rate (27.61 $\mu LCO_2 g^{-1} h^{-1}$) and loss in firmness (27.14%) compared to conventional tomatoes indicating the higher storability and delayed senescence. The titratable acidity showed a decreasing trend while pH increased significantly for both samples stored at ambient and refrigerated conditions. A slower rate of increment in redness and chroma values were observed for OT at refrigerated storage condition compared to ambient temperature. Ascorbic acid content was also found to be significantly higher in OT (23.53 mg/100g) compared to CT (13.85 mg/100g). Additionally, the result showed increased lycopene content in CT during storage compared to OT. Microbial study revealed that total aerobic mesophilic count and yeasts-molds was highest in CT on 28thday of storage. Therefore, the study revealed that OT at refrigerated storage condition had superior postharvest quality, storability and longevity compared to CT which may be due to sustained release of nutrients and useful elements from liquid organic manures and their uptake by plants.

Keywords: organic; conventional; tomato; storability; postharvest quality; lycopene; organic manures

Citation: Pradhan, A.; Srijaya, M. Postharvest Quality and Storability of Organically Verses Conventionally Grown Tomatoes: A Comparative Approach. **2022**, *1*, x. https://doi.org/10.3390/xxxxx

Academic Editor(s):

Received: date
Accepted: date
Published: 16 April 2022

1. Introduction

India experienced a '*Green revolution*' to greater abundance with increased use of synthetic agrochemicals and the adoption of high yielding varieties of genetically modified crops which led to the deterioration of soil quality, environment, and also human health [1]. In the current scenario, recognizing the impact of excessive use of chemical fertilizers, organic farming has gained a central focus amongst the consumers. There is a huge difference between organic farming and conventional farming practices which has an enormous impact on postharvest quality and physicochemical composition of produce [2]. Numerous studies have also highlighted that the difference detected between organic and conventional fresh produce are linked to differences in crop management practices [3]. The concept of organic agriculture is native to the Indian farming community and has its roots on intimate understanding of nature [4]. Several organic farming methods such as rishi krishi, panchgavya, natueco, zero budget organic farming, biodynamic agriculture, etc., are followed in different parts of the country, which are now gathered under one umbrella termed as 'Jaivik Krishi' [5,6]. In India, cows are an integral part of organic agriculture and cow dung is considered as an important and sole fertilizer by Indian farmers [7].

Additionally, indigenous organic manures prepared from cow products and on-farm wastes such as Beejamrutha, Jivamrutha, Panchyagavya are being widely used by small and marginal farmers due to its advantages on soil, crop health, and cost effectiveness than synthetic farm inputs. These eco-friendly fermented concoctions are rich in microflora, and plant growth promoters [7].

Jivamrutha is prepared in two forms: wet fermented slurry known as dhrava jivamrutha, while the dried form is termed as ghana jivamrutha. During the preparation of dhrava jivamrutha, 200 L of water, 10 kg of fresh cow dung, 5–10 L of cow urine, 2 kg of jaggery, 1–2 kg of pulse flour and a handful of soil are mixed thoroughly and fermented for 48–72 hrs before application. The ghana jivamrutha uses 100 kg of cow dung, 5 L of cow urine, 2 kg of pulse flour and a handful of soil. The components are then mixed properly, formed into balls, shade dried for storage and ploughed into the soil before any crop plantation. Beejamrutha is used as seed/seedling treatment which provides protection to young roots from fungus and soil or seed-borne diseases [8].

A significant amount of research is being carried out that deals with the study of these indigenous organic manures on yield and economics of organic fruits and vegetables in comparison to non-organic inputs [9]. For example, application of beejamrutha, jivamrutha, and panchagavya showed higher plant growth and root length in tomatoes compared to individual manure application [10]. However, studies with respect to the influence of the indigenous organic manure on postharvest quality and safety of the produce and storability are negligible. Therefore, in the present study we sought to compare the postharvest quality characteristics and storability between organically grown tomatoes using indigenous organic manures with those grown conventionally to gain a holistic view on the effect of crop management practices on produce quality which is of paramount importance to health-conscious consumers.

2. Materials and Methods

2.1. Experimental Design

Tomato (*Lycopersicon esculentum*) *'448 variety'* plants were planted in June 2021 under both organic and conventional management systems. Farms were located at Anantapur district, Andhra Pradesh, India (14^0 33′ 13.9284″ N and 77^0 39′ 7.884″ E) approximately 500 m apart.

Organic tomatoes were grown using indigenous on-farm organic inputs. Ghana jivamrutha (400 kg/acre) was applied to the soil prior to bedding. Once the bedding was ready, the tomato seedling roots were dipped in beejamrutha and sowed in the soil. Dhrava jivamrutha was applied through drip irrigation in 5, 10, 15 L/100 L of water/acre at 15th, 30th and 45th day of transplantation respectively. In the case of conventional counterpart, 20 kg/acre of NPK fertilizer (13:00:45) was applied through drip irrigation once every 3 days. Boron (2 kg/acre) was applied to the soil before transplantation. Insecticide spraying was done twice after the fruiting started. Irrigation was provided to prevent the drought related stress.

After 60 days of transplantation, approximately 15–20 kg of fruits were harvested at breaker stage from both the farms and brought to the research laboratory, Department of Food and Nutritional Sciences, Sri Sathya Sai Institute of Higher Learning, Anantapur. Fruits were harvested at early morning hours and brought to the laboratory within an hour. Samples were washed with deionized water and allowed to air dry. After drying tomatoes were sorted, graded and fruits without blemishes, external injuries and uniform sizes were selected and stored under ambient (25 ± 2 °C) and refrigerated conditions (10 ± 2 °C). Organic (OT) and conventional tomatoes (CT) stored at ambient condition were marked as OTRo and CTRo while those at refrigerated condition were marked as OTRef and CTRef respectively. Further, postharvest quality and storability at 0, 7th, 14th, 21st, and 28th days was investigated for the stored samples. All the analyses were performed in triplicates.

2.2. Physical Parameters

Postharvest physical quality indicators selected were physiological loss of weight (PLW), firmness, instrumental color, and respiration rate (RR). Physiological loss of weight (PLW) was determined by weighing fruits at beginning and subsequent storage interval and expressed as a percentage of weight loss relative to the fresh weight of the fruits [11]. Fruit firmness was determined by a digital hand-held penetrometer using an 8 mm diameter probe (Turoni-53205, Italy). Three fruits were randomly selected from each category and measurements were taken in triplicates on the equatorial plane of the fruit and expressed in maximum force (N) to penetrate the fruit pulp [12]. Instrumental color was measured using Konica Minolta color reader CR-10 (Minolta Co. Ltd., Osaka, Japan) for the estimation of L* (lightness), a* (redness to greenness), b* (yellowness to blueness), c (chroma value), and h (hue angle) [13]. Respiration rates of tomatoes were determined in a closed system at the interval of 7 days during storage period. Tomatoes were placed in a rigid container of known volume and kept for incubation for 2 hours. Gas composition (O_2 and CO_2%) were measured using a CO_2/O_2 gas analyzer (PBI Dansensor, Checkmate II, Ringsted Denmark). The concentration of CO_2 evolved during the incubation period was used in the calculation of respiration rate [14].

2.3. Chemical Parameters

The chemical parameters studied were total soluble solids (TSS), titratable acidity (TA), pH, ascorbic acid and lycopene. Total soluble solids (TSS) of the fruit were determined by using a digital pocket refractometer (model PAL-3, ATAGO, Tokyo, Japan) and expressed as ° Brix [15]. Titratable acidity of the fruit was determined by taking 5 mL of filtered juice and homogenizing with 100 mL of distilled water. The aliquot was titrated with 0.1 N NaOH using phenolphthalein as an indicator and expressed as% citric acid equivalent [16]. Digital pH meter (model ELICO-120,) was used for determination of pH of the tomato juices. Ascorbic acid was estimated by homogenizing the 10 g of the sample in 3% freshly prepared metaphosphoric acid. The aliquot was mixed with 2,6-dichlorophenol indophenol after filtration, measured at 515 nm using UV-Vis spectrophotometer (Cary-60, Agilent Technology, USA) and expressed as mg of ascorbic acid/100 gm of the sample [17]. Lycopene content was assessed by spectrophotometric method using UV-Vis spectrophotometer (Cary-60, Agilent Technology, USA). Briefly, 0.3 g of tomato pulp was taken in triplicates and extracted with a solvent mixture of hexane: 0.5% of butylated hydroxy acetone: 95% ethanol (2:1:1) at dark condition using a magnetic stirrer. After 20 minutes the sample was mixed with 5 ml of water and a hexane layer was taken for analysis of lycopene at 503 nm [18].

2.4. Microbial Analysis

Total aerobic mesophilic bacterial count (AMC) and yeasts and molds count (YMC) was determined to assess the microbial stability [19]. 0.1 mL of appropriate dilution of aseptically homogenized samples was plated on plate count agar containing 1% triphenyl tetrazolium chloride using spread plate method and incubated at 35 ± 1 °C for 48 h. Yeasts and molds count was determined using potato dextrose agar using spread plate method and incubated at 25 ± 1 °C for 3 to 5 days. Colonies were counted using digital colony counter (Scan100 Interscience, St Nom, France) and reported as log CFU/g of sample [14].

2.5. Statistical Analysis

The data obtained from the experiments were analyzed statistically using SPSS software (IBM SPSS Statistics 21, New York, NY, USA) and MS-Excel-2019. The data obtained from chemical and physical parameters across the storage period were subjected to one-way analysis of variance (ANOVA) followed by posthoc Duncan's Multiple Range Test (DMRT) at $p \leq 0.05$ level to compare the means of different treatments.

3. Result and Discussion

3.1. Physical Parameters

Physiological loss of weight is a key factor for shelf life of fresh fruits and vegetables. The weight loss was found to be predominant on CTRo compared to OTRo on 28th day of ambient storage condition as depicted in Figure 1a. In the case of refrigerated storage conditions, CTRef showed a higher range of water loss at 28th day of storage. The physiological loss of weight was observed on both samples regardless of cultivation method and storage conditions. Similar results were obtained by Eboibi et al. [20] where loss of fruit mass was evident regardless of production method and calcium chloride treatment. The loss of weight affects the quality of fruits and vegetables which is mainly due to excessive loss of moisture through metabolic activity such as respiration and transpiration process [21].

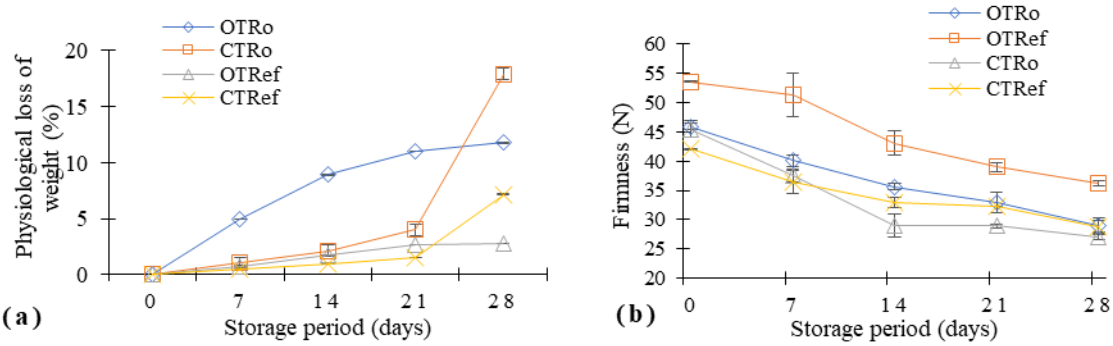

Figure 1. Changes in physical quality attributes of organic and conventional tomatoes: (**a**) Physiological loss of weight (%); (**b**) Firmness (N); OTRo—Organic tomatoes at ambient storage; OTRef—Organic tomatoes at refrigerated storage; CTRo—Conventional tomatoes at ambient storage; CTRef—Conventional tomatoes at refrigerated storage; data are mean ± SD (n = 3).

Firmness is also one of the important quality parameters for assessing the quality of the produce. The Figure 1b depicts the changes in firmness in OT and CT stored at ambient and refrigerated conditions. Organic tomatoes were observed to be firmer compared to conventional tomatoes. At 0 day the OTRef (53.55 N) showed the highest value of firmness compared to other samples; however, the decrement was seen gradually over the period of storage at both ambient and refrigerated conditions. Additionally, loss of firmness was observed more in case of Morra et al. [22] reported implementation of organic soil amendments such as buffalo slurry resulted in increased firmness of the tomato fruit.

The evolution of color parameters during the postharvest storage of OT and CT is represented in the Figure 2. The major changes were observed on L, a* and hue angle. The decrease in lightness was observed in greater intensity in CTRo where the lightness values decreased from 55.63 to 36.07. Apart from this, results revealed that the decrease in lightness was lesser in refrigerated samples compared to samples stored at ambient temperature. More importantly, the decrease in lightness was significantly ($p < 0.05$) lesser in tomatoes grown in indigenous organic manures compared to conventional. Similar results were observed by Bilalis et al. [23] who investigated higher lightness values of tomatoes treated with organic fertilizers. a* values showed an increasing trend in all the samples over the storage period of 28 days. The green color was more dominant in tomatoes at the time of harvest which turned into red color during the postharvest storage period. The increment in a* was higher in case of CTRo (40.60) followed by OTRo (23.63), CTRef (23.60) and OTRef (6.87).

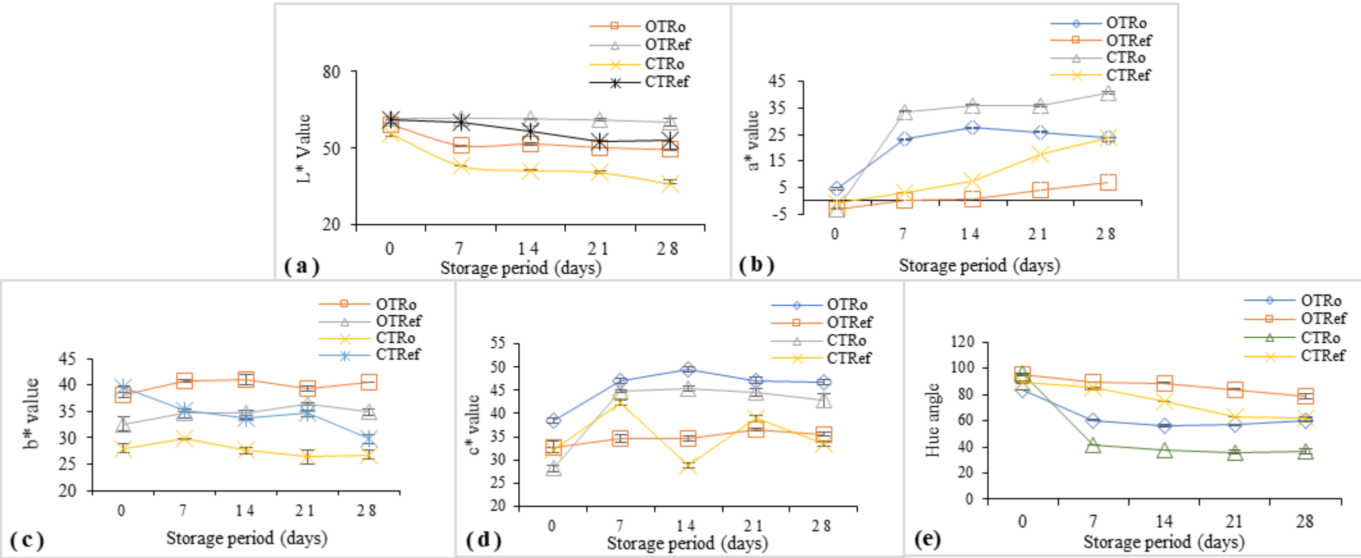

Figure 2. Changes in color attributes of organic and conventional tomatoes during storage: (**a**) L value (lightness); (**b**) a* value (+ redness; − greenness); (**c**) b* value (yellowness); (**d**) Chroma; (**e**) Hue angle; OTRo—Organic tomatoes at ambient storage; OTRef—Organic tomatoes at refrigerated storage; CTRo—Conventional tomatoes at ambient storage; CTRef—Conventional tomatoes at refrigerated storage; data are mean ± SD (n = 3).

Chroma values of both organic and conventional tomatoes increased during the period of storage (Figure 2). Hue angle of the organic and conventional tomatoes ranged from 83.20 to 96.10 at the time of harvest, which decreased consecutively during the storage period. The rate of decrease of hue angle in tomatoes was observed to be higher in case of conventional tomatoes. Organic tomatoes stored at refrigerated storage condition showed least decrease in hue angle value representing lower rate of postharvest ripening compared to conventional tomatoes at same storage condition. The controlled temperature storage in the refrigerator showed significant impact on the postharvest ripening of the organic and conventional tomatoes. The rate of postharvest ripening, indicative degradation of chlorophyll and synthesis of lycopene was higher in case of conventional tomatoes compared to organic tomatoes [23,24].

Respiration rate was observed to increase on the 7th day of storage which subsequently followed a decreasing trend in both OT and CT stored at ambient and refrigerated conditions during the storage. The respiration rate was significantly ($p < 0.05$) higher in conventional tomatoes compared to organic tomatoes as depicted in Figure 3

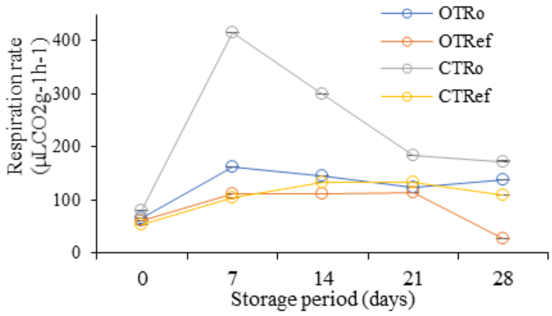

Figure 3. Changes in respiration rate of organic and conventional tomatoes during storage; OTRo—Organic tomatoes at ambient storage; OTRef—Organic tomatoes at refrigerated storage; CTRo—Conventional tomatoes at ambient storage; CTRef—Conventional tomatoes at refrigerated storage; data are mean ± SD (n = 3).

On the 7th day of storage, highest respiratory peak was observed in OTRo and CTRo, while in refrigerated samples, respiratory peak was observed on the 21st day of storage, owing to delayed senescence. Ayomide et al. [25]] reviewed that the increase in respiration rate occurs as tomato fruit ripens from mature green to red. Further, the depletion of organic food reserve during respiration hastens the process of senescence.

3.2. Postharvest Chemical Parameters

The changes in postharvest chemical quality parameters of OT and CT are presented in the Table 1. Total soluble solids content determines the sugar content of a produce in terms of °Brix. TSS ranged from 3.20 to 5.20 across the samples. It was observed that TSS was higher in conventional tomatoes at the time of harvest, which showed the increasing trend during storage period and consecutively declined on the 28th day. Similar trend was followed by organic tomatoes, however, the rate of increment in TSS was slower compared to conventional tomatoes. This indicates a slower rate of sugar accumulation in organic tomatoes. Current findings affirm the previous study of Navarro and Munne-bosh [26] and Kim et al. [27] that those fruits grown under low nitrogen content result in low soluble sugar content during maturity than that of higher nitrogen content. According to Shehata et al. [15] the increase in TSS during storage is indicative of solubilization of cell wall components or moisture loss through transpiration. However, the decrement in TSS at the end of the storage could be due to utilization of sugar in postharvest metabolic process.

Table 1. Changes in postharvest chemical quality parameters of organic and conventional tomatoes during storage.

Parameters	Sample	Storage period (days)				
		0 days	7 days	14 days	21st days	28th days
TSS (°Brix)	OTRo	3.67 ± 0.23 [a]	3.20 ± 0.00 [a]	3.90 ± 0.00 [a]	4.00 ± 0.00 [b]	3.50 ± 0.00 [a]
	CTRo	4.53 ± 0.06 [b]	4.20 ± 0.00 [c]	4.50 ± 0.00 [c]	3.70 ± 0.10 [a]	4.10 ± 0.10 [bc]
	OTRef	3.70 ± 0.00 [a]	4.10 ± 0.10 [b]	4.13 ± 0.06 [b]	3.90 ± 0.00 [ab]	4.13 ± 0.06 [c]
	CTRef	4.50 ± 0.00 [b]	4.70 ± 0.00 [d]	4.87 ± 0.06 [d]	5.20 ± 0.26 [c]	4.00 ± 0.00 [b]
Titratable acidity (% citric acid equivalent)	OTRo	0.38 ± 0.03 [a]	0.26 ± 0.03 [a]	0.32 ± 0.00 [a]	0.39 ± 0.01 [b]	0.24 ± 0.02 [ab]
	CTRo	0.46 ± 0.02 [b]	0.64 ± 0.00 [c]	0.51 ± 0.03 [c]	0.48 ± 0.03 [c]	0.30 ± 0.02 [c]
	OTRef	0.37 ± 0.02 [a]	0.30 ± 0.02 [b]	0.43 ± 0.02 [b]	0.35 ± 0.01 [a]	0.27 ± 0.05 [bc]
	CTRef	0.53 ± 0.02 [c]	0.96 ± 0.00 [d]	1.14 ± 0.02 [d]	0.70 ± 0.00 [d]	0.20 ± 0.02 [a]
pH	OTRo	4.44 ± 0.01 [b]	4.41 ± 0.01 [c]	4.52 ± 0.01 [d]	4.56 ± 0.01 [c]	4.54 ± 0.00 [b]
	CTRo	4.45 ± 0.01 [b]	4.49 ± 0.01 [d]	4.16 ± 0.06 [a]	4.37 ± 0.01 [a]	4.72 ± 0.01 [c]
	OTRef	4.38 ± 0.01 [a]	4.38 ± 0.00 [b]	4.30 ± 0.00 [b]	4.40 ± 0.01 [b]	4.49 ± 0.01 [a]
	CTRef	4.72 ± 0.01 [c]	4.19 ± 0.00 [a]	4.37 ± 0.02 [c]	4.75 ± 0.01 [d]	4.78 ± 0.02 [d]

Ascorbic acid (mg/100 g)	OTRo	23.53 ± 0.21 [d]	5.07 ± 0.10 [d]	13.29 ± 1.28 [ab]	13.15 ± 1.55 [b]	9.24 ± 0.30 [b]
	CTRo	13.86 ± 0.01 [c]	10.18 ± 0.20 [b]	15.20 ± 1.13 [b]	10.49 ± 0.70 [a]	8.10 ± 0.11 [a]
	OTRef	23.56 ± 0.20 [a]	16.18 ± 0.20 [c]	16.21 ± 1.19 [b]	17.79± 1.03 [c]	9.85 ± 0.02 c
	CTRef	13.78 ± 0.01 [b]	7.01 ± 0.03 [a]	11.78 ± 1.65 [a]	15.86 ± 0.70 [c]	8.15 ± 0.13 [a]
Lycopene (mg/kg of fresh tomatoes)	OTRo	8.43 ± 0.01 [d]	9.17 ± 0.17 [b]	20.73 ± 0.02 [d]	27.65 ± 0.31 [c]	44.84 ± 1.91 [c]
	CTRo	7.30 ± 0.01 [a]	40.13 ± 0.45 [d]	52.59 ± 0.09 [c]	93.76 ± 0.22 [d]	117.38 ± 1.56 [d]
	OTRef	8.01 ± 0.01 [c]	6.83 ± 0.03 [a]	15.94 ± 0.00 [b]	21.62 ± 0.54 [a]	26.82 ± 0.54 [a]
	CTRef	7.62 ± 0.02 [b]	11.93 ± 1.50 [c]	3.73 ± 0.02 [a]	22.86 ± 0.07 [b]	29.69 ± 0.52 [b]

OTRo—Organic tomatoes at ambient storage; OTRef—Oragnic tomatoes at refrigerated storage; CTRo—Conventional tomatoes at ambient storage; CTRef—Conventional tomatoes at refrigerated storage; different letters in a column denotes the significant difference at (p < 0.05) according to Duncan's Test; data presented are mean ± SD (n = 3).

Titratable Acidity (TA) was absorbed to be significantly higher in conventional tomatoes compared to organic tomatoes (Table 1). During storage, TA gradually increased and showed a step decline form the 21st day for all samples. On the 28th day of storage, decrease in acidity was observed for both samples regardless of storage condition. However, the decrement was significantly lesser in case of organic tomatoes compared to conventional counterparts. The results are in line with the previous data given by Shehata et al. [15]

pH ranged from 4.30 to 4.78 among the samples throughout the storage period. The detailed values are given in Table 1. The pH values were higher in case of conventional tomatoes. There was an increase in pH in all the samples during storage. The increment at maximum was observed in CTRef (4.78) followed by CTRo (4.72), OTRo (4.54), OTRef (4.49). Iqbal et al. [28] and Tilahun et al. [29] reported similar results and explained that changes in pH during storage is due to numerous pectin degrading enzymatic reactions which lead to altered physiological process ultimately spoiling the fresh produce.

Ascorbic acid content was significantly (p < 0.05) observed to be higher in organic tomatoes (23.53 mg/100gm) compared to conventionally grown tomatoes (13.86 mg/100gm) at the time of harvest (Table 1). Toor et al. [30] reported the similar results as in the current study wherein, the application of chicken manure and mulching influenced and improved the accumulation of ascorbic acids and phenolics in tomatoes. The increased antioxidant activity could be attributed to the self-defense mechanism triggered by slow nutrient uptake from organic inputs during growth and development phase [2]. In the current study, significant (p < 0.05) reduction in ascorbic acid content was observed in all the samples across the storage duration. Refrigerated storage helped in retaining the ascorbic acid in both organic and conventional samples [31].

Lycopene content of the freshly harvested organic tomato was 8.43 mg/kg at breaker stage, while 7.30 mg/kg was observed in conventional tomatoes (Table 1). The results revealed that refrigeration significantly decreased the rate of formation of lycopene, thereby reducing the postharvest ripening. It was also observed that lycopene content drastically increased in CTRo (117.38 mg/kg) on the 28th day of storage at ambient conditions, compared to OTRo (44.84 mg/kg). Additionally, the result also revealed that even at refrigerated conditions the rate of color development was significantly higher in case of conventional tomatoes. Fagundes et al. [32] reported similar results with respect to lycopene content in cherry tomatoes, wherein, lycopene content increased during the storage period. Further, low temperature storage at 5 °C inhibited the enhancement of lycopene [33].

3.3. Microbial Stability

The postharvest microbial quality of OT and CT during ambient and refrigerated storage is represented in Figure 4. Yeasts and molds growth was visible on the 14th day of storage for both OT and CT which consecutively increased during storage. Significantly lower (p < 0.05) increment in YMC was observed in OTRef (3.93 log CFU/g) compared to CTRef (4.42 log CFU/g).

Similarly, AMC was significantly higher in conventional tomatoes at initial phase of storage and showed an increasing trend during the storage. On 28th day of ambient storage condition, AMC was significantly ($p < 0.05$) higher for CTRo (5.78 log CFU/g) compared to OTRo (5.74 log CFU/g). The growth of YMC and AMC in both organic and conventional tomatoes was observed to be inhibited by low temperature storage condition. Similar results were reported by Merlini et al. [19] wherein, organically grown leafy vegetables had lower microbial counts compared to the ones grown conventionally [34]. As the fruit ripens and enters into senescence, susceptibility towards microbial attack also increases, which ultimately leads to microbial spoilage. In the current study, CT was observed to have higher ripening rate and early senescence, which can be corelated to the increased microbial load.

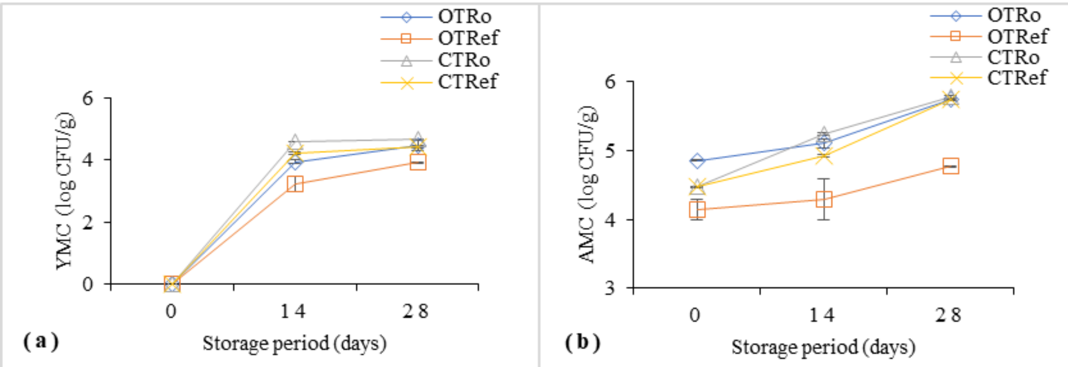

Figure 4. Microbial stability of organic and conventional tomatoes: (**a**) Yeast and molds count (YMC), (**b**) Aerobic mesophilic count (AMC); OTRo—Organic tomatoes at ambient storage; OTRef—Organic tomatoes at refrigerated storage; CTRo—Conventional tomatoes at ambient storage; CTRef—Conventional tomatoes at refrigerated storage; data are mean ± SD (n = 3).

4. Conclusion

In the current study, a comparative approach was implemented to assess the post-harvest quality parameters of tomatoes grown with indigenous organic manures and those grown using synthetic fertilizers. Organic tomatoes were found to have higher firmness, ascorbic acid and lycopene content at the time of harvest. Interestingly, conventional tomatoes exhibited an increased rate of lycopene synthesis during storage at ambient condition. It was observed that the refrigerated storage condition slowed down the metabolic changes that leads to senescence and low shelf stability. Tomatoes grown with indigenous liquid organic manures and stored at refrigerated condition showed lesser PLW, loss of firmness and respiration rate and lower microbial load compared to conventional counterparts. Additionally, the rate of ripening was slower in organic tomatoes compared to conventional tomatoes contributing to its longevity. Further, in-depth investigation will be carried out to understand the impact of indigenous liquid organic manures on the phytochemical and antioxidant profile of tomatoes.

Author Contributions: Conceptualization, M.S; methodology, M.S.; software, A.P.; validation, M.S; formal analysis, A.P.; investigation, A.P.; writing—original draft preparation, A.P.; writing—review and editing, M.S.; visualization, A.P.; supervision, M.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: The authors acknowledge the Founder Chancellor and the institute management of Sri Sathya Sai Institute of Higher Learning (SSSIHL), Andhra Pradesh, India, for providing the research facility in the Department of Food and Nutritional Sciences, and Central Research Laboratory (CRL), Anantapur.

Conflicts of Interest: The authors declare no conflicts of interest.

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