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Research article

COMPARATIVE STUDIES ON PHYSICOCHEMICAL AND NUTRITIONAL VALUES OF ORGANICALLY AND CONVENTIONALLY GROWN LUFFA ACUTANGULA L. ROXB STORED IN DIFFERENT HOUSEHOLD PACKAGING AND STORAGE TEMPERATURES

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Abstract

The organically grown fresh produce has 20% lesser yield and of premium range (10–40% more) than conventionally grown foods. *Luffa acutangula* L. Roxb (*Luffa*) is a widely consumed vegetable and commonly found in Indian dietaries. The present study, using the principles of modified atmosphere packaging, the changes in physicochemical and nutritional values of organic and conventional *Luffa* during storage in different packaging at ambient and low temperatures for 2 storage durations were experimented. There were significant differences in moisture, dry weight, total dietary fibre and protein content of both organic and conventional *Luffa* in all packaging. The study showed that during storage in PP container, LDPE zipper bags and cling film wrap at ambient(25◦C) and low (4◦) temperatures can produce a modified atmosphere which can extend the shelf life of *Luffa*.

1.Introduction

The popularity of organic foods is increasing globally as organic foods are perceived to have more nutritional values, have little or no additional contaminants and promotes sustainable agriculture (Das et al.2020; Greene et al. 2009).

Organically grown fresh produce has become quite demanding to the producers and consumers owing to their nutritional benefits as compared to conventionally grown crops (Funk and Kennedy, 2016; Durham and Mizik 2021).

The organically grown foods have 20% lower yield with 10–40% higher premium range as compared to conventionally grown foods (Durham and Mizik 2021; Winter and Davis 2006; Gutierrez et al. 1999). Therefore, it is of utmost importance to store at the domestic level this lower yielded and premium range organically grown fresh produce.

Luffa acutangula L. Roxb (*Luffa*) belongs to genus *Luffa* of Cucurbitaceae family and is commonly known ridge gourd and consumed as a popular other vegetable among Asian, African, and Arabic countries. Ridge gourd is considered as a very common vegetable in Indian dietaries (Jyothi et al., 2010). Ridge gourd is a commonly known medicinal plant as a potent blood purifier, has laxative actions, a hepatoprotective, anti-diabetic, body weight lowering, immunity booster, has antimicrobial activities and anti-inflammatory effect, and promote gut and skin health (Barik et al., 2018). Moreover, organically grown ridge gourd composed of greater amount of minerals, has more total sugars and reducing sugars, and more ascorbic acid than conventional ridge gourd(Barik et al., 2018).

Modified atmosphere packaging (MAP) of food commodity refers to the technique of sealing actively respiring produce (i.e., the fresh produce like fruits and vegetables) in polymeric films so that the O_2 and CO_2 levels are modified within the package headspace (Mangaraj et al. 2009). MAP of vegetable in combination with cold storage is considered as the best process to extend the shelf-life period (Kargwal et al. 2020; Sandhya 2010) and maintain sensory and microbiological quality of fresh-cut produce (Fang & Wakisaka 2021; Kader et al.1989; Philips1996).

The MAP has found to be effective for long-term storage of fruits like apple, orange, kiwi, pears, potato, and cabbage and for storage of strawberries, cherries, bananas, guava, tomato etc. for short term storage (Kargwal et al., 2020).

Polypropylene (PP) and Low-density polyethylene (LDPE) films are polymeric films generally used for MAP (Alimardani et al.2015). According to a study by Wang and Qi (1997) on other gourd family vegetable-Cucumis when stored within perforated or sealed 31.75-μm low-density polyethylene (LDPE) packets had showed less severe chilling injury than unpackaged fruit stored at 5 °C with 90–95% relative humidity (RH).

Therefore, in the present study, we have been conducted to find out the effect of domestic packaging (PP container, LDPE zipper bags, and cling film)and storage temperature controls(25^0C and 4^0C) on the changes in physicochemical and nutritional values between organic and conventional *Luffa* stored in at different temperatures.

2.Methods and Materials

2.1.Sample collection and sample preparation

The ridge gourd (*Luffa acutangula* L. Roxb) of Swarna Manjari cultivar were collected from certified organic farms and conventional farms carefully from two localities (Baruipur and Mathurapur of south 24 Parganas, West Bengal, India), and their average results were interpreted.

The organic *Luffa* was cultivated during the January to April (summer) or June to July (rainy) months in sandy loam concentrated in organic matter. Different organic fertilizers, such as vermicompost (1000 kg per acre), Ghana Jeevamrutham, and bone meal (50–75 kg per acre) rich in phosphorous, calcium and nitrogen compost are commonly added before cultivation to supply the nutrients, essential for plant growth, such as nitrogen, phosphorus, and potassium. In addition, provision for good drainage and pH range 6.5–7.5 at warm temperature (above 16°C) were also maintained. Organic plant fertilizer containing seaweed extract, humic acid, and fulvic acid was applied for growth promoter.

For plant protection, neem cakes (150–200 kg/ acre), Trichoderma viride biofungicide (1.5% w.p.), neem oil (1–2 ml/litre sprinkled 1–2 times per week), Bacillus thuringiensis (Bt) power or liquid inoculums (spray), Curcumin (spray) and pheromone trap (one trap per 25 square feet area) were used.

During intercrop time and for crop rotation, cultivation of dhaincha (*Sesbania spp*) was also advocated for enhancing the soil fertility.

The *Luffa* was conventionally grown using conventional cultivation techniques including inorganic manure, such as ammonium nitrate, calcium phosphate, muriate of potash added during soil preparation with N:P: K−10:26:26 and urea was at the middle of cultivation for growth of plant. For plant protection, various pesticides and conventional fungicide were applied.

Three types of domestic packaging made of polymeric film/bag/box such as polypropylene or PP (of 0.23 mm thickness) container, low-density polyethylene or LDPE (of 2.5 mm thickness) zipper bag and polyethylene cling film (of 0.06 mm thickness) were used as domestic packaging for the study.

The samples were treated immediately after harvesting with chlorinated (100 ppm, 20 °C) (Safe Practices for Food Processes, 1998) to remove the free heat and to disinfect the vegetables. The samples were kept without packaging, PP containers, in LDPE zipper and wrapped in cling film (Jacobsson et al. 2004; Thompson 2010) and ambient temperature (25 °C) and low (4 °C) at a relative humidity of 70% and 90%, respectively, for 3 days and 7 days of storage durations. Then, the physicochemical and nutritional values were measured.

2.2.Physicochemical Parameters

2.2.1.Moisture Content and Dry matter

The moisture content was determined by the procedure outlined by Raghuramulu et al (2003). Moisture content was estimated by keeping 15 g of each vegetable samples in hot air oven at 105^{o}C until a constant weight. Moisture content was determined as:

$$\text{Moisture content (g \%)} = \frac{W1-W2}{W1} \times 100 \quad (1)$$

where, W1=Initial weight of meat sample, g; W2=Final weight of meat sample, g
Dry Matter= (100- moisture content) g

2.2.2.pH and Titratable Acidity

The titratable acidity was measured according to the AOAC (2000) methods. The pH of the vegetable slurry was measured by electrode pH meter (Labman, LMPH-15). The vegetable slurry (obtained from blended and filtered vegetable sample) was centrifuged (REMI Bench top Centifuge, R4C) at 3000 rpm at RT for 15 minutes and the supernatant clear fluid was taken for estimation. 6g of supernatant was diluted with 50ml of double distilled water and the mixture was titrated (after adding 0.3ml of 1% phenolphthalein) with 0.1 (N) NaOH to the end point of pH 8.1 to 8.2 with permanent pink colour. Titratable acidity was expressed in gram per 100gram to the predominant organic acids as follows:

1ml of 0.1 (N) of NaOH $\approx$ Malic acid- 0.067

2.2.3.Titratable acidity(g/%)

=[ml of 0.1(N) NaOH used] X [concentration of 0.1(N) NaOH] x [milliequivalent factor] X 100 Gram of sample

(2)

2.2.4.Tissue Respiration Rate

The tissue respiration rate was measured as per method described by Guo et al(2008). 1000 g of vegetable sample was placed in a closed glass container, separated with 20 ml 0.1 M sodium hydroxide on the bottom. After 1 hour, the sodium hydroxide was mixed with 2 ml saturated $BaCl_2$ to precipitate the carbon as carbonates. The mixture was then titrated (using two drops of 1% phenolphthalein) by 0.2 M hydrochloride acid until pink colour disappeared, based on which, the carbon dioxide was calculated by a conversion table (Zhang et al., 2003).

2.3.Nutritional Parameters

2.3.1.Carbohydrate content

The total carbohydrate content was estimated by the Anthrone method (Dubois et al., 1956). In this method, carbohydrates are first hydrolyzed into simple sugars using dilute hydrochloric acid. In hot acidic medium, glucose is dehydrated to hydroxymethyl furfural. This compound forms a green coloured product with anthrone and measured at 630 nm.

2.3.2.Total Protein

The estimation of nitrogen was done by Kjeldahl method (Raghuramulu et al., 2003) which was based on the principle that organic nitrogen when digested with sulphuric acid in the presence of a catalyst (selenium oxide, mercury, or copper sulphate) was converted into ammonium sulphate. Ammonia liberated by making the solution alkaline was distilled into a known volume of a standard acid, which was then back- titrated. The protein content was obtained by multiplying the nitrogen value with 6.25.

2.3.3.Total Dietary Fibre

The total dietary fibre content was determined according to the AOAC (1986) methods. The principle of the method is that the defatted food samples are gelatinized, and protein and starch are removed by enzymatic digestion. The residue was filtered and washed and then measured gravimetrically. The total dietary fibre content calculated as:

$$B = \text{Blank (mg)} = \text{Weight Residue} - P_B - A_B \quad (3)$$

Where weight residue = Average of residue weights (mg) for duplicate blank determinations; and P_B and A_B = weights (mg) of protein and ash, respectively, determined in first and second residues.

$$\text{The TDF (g\%)} = [(\text{weight residue} - P - A - B)/\text{ weight test portion}] \times 100 \quad (4)$$

Where weight residue = average of weights (mg) for duplicate blank determination; and P and A = weights (mg) and ash (mg) respectively, in first and second test portion residues; weight portion= average of 2 test portion weights (mg) taken.

2.4.Statistical analysis

The study was a completely randomized design (CRD), 2 farming varieties of *Luffa* (organic and conventional) collected from 2 locations stored in 3 types of packaging (plus sample stored without any packaging) at 2 storage temperatures for 2 storage durations. Fresh *Luffa* of both organic and conventional varieties were also experimented. The total number of samples for the study was 68. All the parameters were estimated in three replicas.

The statistical methods used in the study include percentage analysis and one way analysis of variance.

Statistical analysis was performed with standard technique of multivariate analysis using SPSS 20 software.

3.Results and Discussion

In this study, results were interpretated from both organic and conventional *Luffa* before and after storage in different domestic packaging at 25°C and 4°C with RH of 90% and 70% respectively both for 3 days and 7 days.

The physical–chemical properties of the *Luffa* were influenced by the types of domestic packaging, temperature, and storage duration. When stored in domestic packaging, it creates a altered environment within it causing changes in physicochemical and nutritional parameters. The following abbreviations were used for farming type and packaging types in the study: ORGN = organic Cucumis, CONV = conventional Cucumis, WP = without Packaging, CONT = PP container, ZIPPER = LDPE zipper bags and CF = cling film wrap, thereafter, in this study results and discussion.

3.1.Impact on Moisture Content and Dry matter(g%)

Table 1 and Fig 1 showed the comparison between organic and conventional *Luffa* in moisture content. From the Multivariate ANOVA, it was observed that there were no significant differences in moisture content among different types of farming (organic and conventional) packaged in different packaging systems (PP container, LDPE zipper bags, and Cling film wrap) and without any packaging and stored at different temperatures (25◦C and 4◦C) for 3 days and 7 days durations of storage. A similar study was conducted by Jahan et al (2020) on other gourd family vegetable i.e., conventional variety of cucumber in plastic wrap at ambient temperature and 5°C, showed that moisture content decreased with the extension in storage duration.

Table 1. Comparison between Organic and Conventional *Luffa* in Moisture Content (g%)

TYPE OF VEG.	TEMP. OF STORAGE	0 DAY	3 DAYS				7 DAYS			
		FRESH MEAN ± SE	WP MEAN ± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE	WP MEAN ± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE
ORGN	25ºC	95.73±0.04	94.08±0.01	96.44±0.13	95.66±0.49	96.46±0.05	92.76±0.13	96.49±0.09	92.17±0.03	95.34±0.08
	4 ºC		95.05±0.04	93.91±0.01	94.24±0.02	95.92±0.62	93.92±0.02	95.32±0.05	92.12±0.16	95.31±0.03
CONV	25ºC	95.39±0.01	95.03± 0.01	96.49±0.26	96.66±0.02	96.87±0.04	95.93±0.02	97.08±0.03	97.59±0.05	97.92±0.03
	4º C		94.75±0.002	94.75±0.01	95.08±0.001	95.27±0.04	94.90±0.03	95.14±0.08	95.85±0.02	96.37±0.12

 # Values bearing same or no superscript between column do not differ significantly.

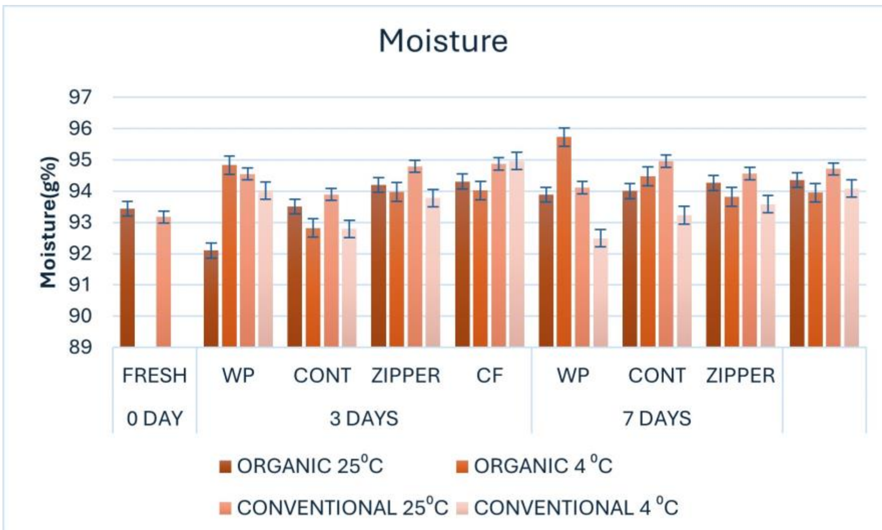

Figure 1. Comparison between Organic and Conventional *Luffa* in Moisture Content (g%)

Table 2 and Figure 2 showed the comparison between organic and conventional *Luffa* in dry weight. From the Multivariate ANOVA, it was observed that that dry weight of *Luffa* of both organic and conventional varieties, stored in different packaging systems (without packaging, PP container, LDPE zipper bags, and Cling film wrap) had a significant effect. A study by Valverde-Miranda et al (2021) concluded that dry matter may influence the shelf life of *Cucumis* i.e., the higher the dry weight at fresh condition, the longer the shelf life will be.

Table 2. Comparison between Organic and Conventional *Luffa* in Dry Weight (g%)

TYPE OF VEG.	TEMP. OF STORAGE	0 DAY	3 DAYS				7 DAYS			
		FRESH MEAN ± SE	WP MEAN ± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE	WP MEAN± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE
ORGN	25ºC	6.56±0.18	7.87±0.07	6.49±0.02	5.80±0.01	5.5±0.30	6.11±0.06	6.65±0.04	5.77±0.04	5.65±0.03
	4 ºC		5.26±0.17	7.18±0.03	6.04±0.10	5.98±0.04	4.27±0.02	5.49±0.01	6.11±0.01	6.05± 0.04
CONV	25ºC	6.83±0.20	5.5±0.02	6.45±0.57	5.78±0.50	5.13±0.06	5.89±0.18	5.04±0.02	5.46±0.01	5.33± 0.17
	4º C		5.74±0.43	7.20±0.011	6.23±0.02	5.04±0.03	6.77±0.02	7.51±0.08	6.46±0.05	5.92±0.05

 # Values bearing same or no superscript between column do not differ significantly.

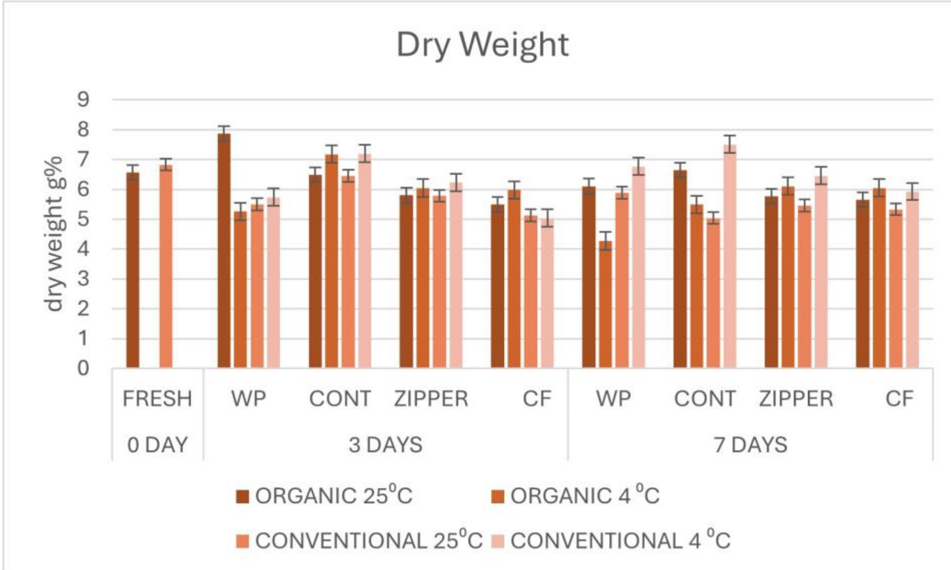

Figure 2. Comparison between Organic and Conventional *Luffa* in Dry weight(g%)

3.2.Impact on pH and Titratable Acidity

Table 3, Table 4 and Figure 3, Figure 4 showed the comparison in pH and Titratable acidity of organic and conventional *Luffa of* stored in different packaging (PP container, LDPE zipper bags, and Cling film wrap) and without any packaging at different temperatures (25ºC and 4ºC) for different days (3 days and 7 days).

The multivariate ANOVA represented that the pH and Titratable acidity of *Luffa* for different types of farming (organic and conventional) stored in different packaging (without packaging, PP container, LDPE zipper bags, and Cling film wrap) at different temperatures (25ºC and 4ºC) for different days (3 days and 7 days) had a significant effect.

It was observed that the TA (g%) was reduced during storage of both organic and conventional *Luffa*. The result obtained was correlated with results found in pH value. The results obtained was in agreement with the study findings of Patil et al(2010) who had conducted the similar study with bottle gourd stored in polyethylene bag and Corrugated Fiber Board (CFB) box packing.

Table 3. Comparison between Organic and Conventional *Luffa* in pH (g%)

TYPE OF VEG.	TEMP. OF STORAGE	0 DAY	3 DAYS				7 DAYS			
		FRESH MEAN ± SE	WP MEAN ± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE	WP MEAN ± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE
ORGN	25ºC	6.63±0.09	6.25±0.03	6.43±0.01	6.46±0.01	6.53±0.05	6.44±0.07	6.52±0.09	6.42±0.007	6.51±0.006
	4 ºC		6.17±0.01	6.36±0.01	6.33±0.09	6.26±0.07	6.37±0.03	6.46±0.07	6.36±0.007	6.40±0.02
CONV	25ºC	6.59±0.02	6.08±0.03	6.22±0.07	6.22±0.07	6.30±0.02	6.36±0.01	6.49±0.07	6.50±0.003	6.62±0.01
	4º C		5.95±0.03	6.16±0.07	6.13±0.01	6.24±0.02	6.26±0.03	6.43±0.05	6.46±0.01	6.52±0.01

 # Values bearing same or no superscript between column do not differ significantly.

Table 4. Comparison between Organic and Conventional *Luffa* in Titratable Acidity (g%)

TYPE OF VEG.	TEMP. OF STORAGE	0 DAY FRESH MEAN ± SE	3 DAYS WP MEAN ± SE	3 DAYS CONT MEAN ± SE	3 DAYS ZIPPER MEAN ± SE	3 DAYS CF MEAN ± SE	7 DAYS WP MEAN ± SE	7 DAYS CONT MEAN ± SE	7 DAYS ZIPPER MEAN ± SE	7 DAYS CF MEAN ± SE
ORGN	25ºC	0.69±0.05	0.17±0.01	0.11±0.01	0.09±0.01	0.09±0.003	0.22±0.02	0.17±0.02	0.16±0.01	0.15±0.02
	4 ºC		0.17±0.01	0.11±0.001	0.09±0.02	0.08±0.01	0.22±0.01	0.17±0.02	0.16±0.01	0.15±0.01
CONV	25ºC	0.89±0.004	0.08±0.02	0.06±0.02	0.07±0.01	0.06±0.003	0.47±0.01	0.17±0.01	0.90±0.06	0.77±0.02
	4º C		0.07±0.01	0.05±0.01	0.07±0.02	0.05±0.003	0.45±0.09	0.17±0.01	0.89±0.02	0.79±0.01

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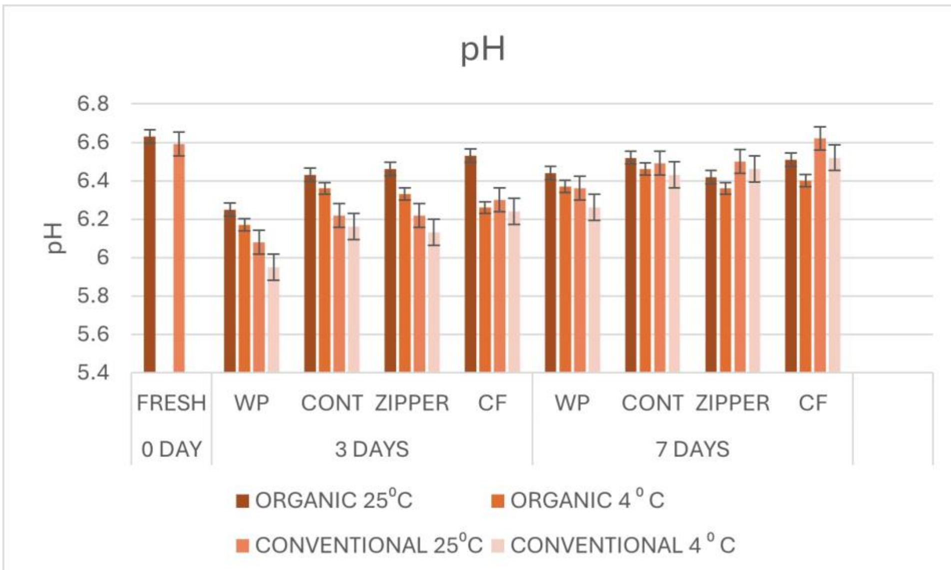

Figure 3. Comparison between Organic and Conventional *Luffa* in pH

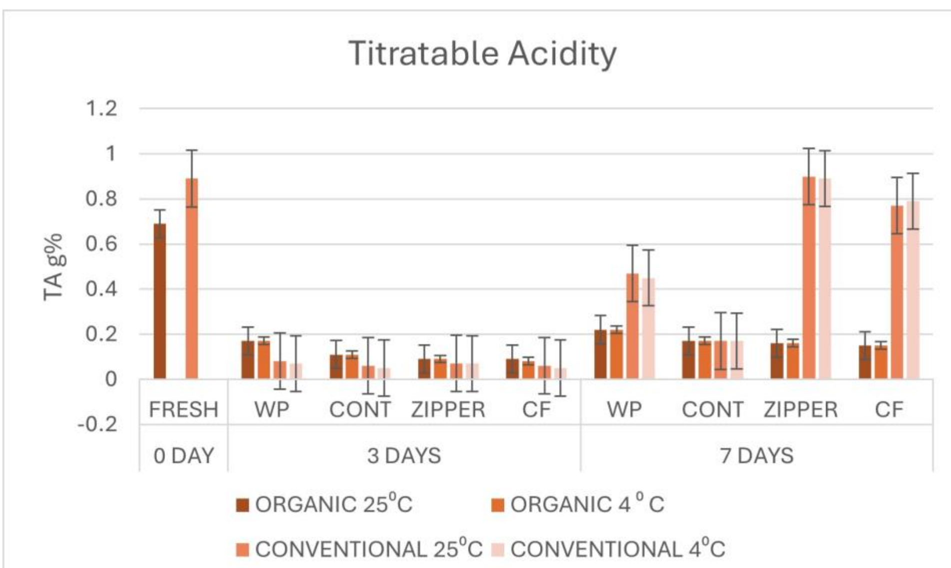

Figure 4. Comparison between Organic and Conventional *Luffa* in Titratable Acidity(g%)

3.3.Impact of Storage Conditions on Tissue Respiration Rate

The comparison of tissue respiration rate (TRR) in both conventional and organic *Luffa in* different storage conditions *was* presented in Table 5 and Figure 5. It was observed that the TRR of cling film wrapped *Luffa* was low both for organic and conventional *Luffa,* whereas for PP container the TRR was the highest. Cling film creates an optimum modified atmosphere with optimal membrane gas permeability thus controlling the postharvest TRR (Exama et al, 1993).

As postharvest losses are caused by continuous respiration and transpiration, So reduction in TRR rates can be the strategy to retain quality of vegetable during storage (Kaur, Kumar, Devgan, and Kumar, 2019). In a recent study by Das et al (2022), it was observed that TRR decreased during storage in different packaging, thus enhancing shelf life of other gourd family vegetable cucumber. Such studies on *Luffa* were not found in previous literature.

It was observed from multivariate ANOVA that the tissue respiration rate of both organic and conventional *Luffa*, stored in different packaging (PP container, LDPE zipper bags, and Cling film wrap) and without packaging, at different temperatures (25ºC and 4ºC) for different days (3 days and 7 days) had a significant effect.

Table 5. Comparison between Organic and Conventional *Luffa* in Tissue Respiration Rate (mg of CO2/ kg)

TYPE OF VEG.	TEMP. OF STORAGE	0 DAY FRESH MEAN ± SE	3 DAYS WP MEAN ± SE	3 DAYS CONT MEAN ± SE	3 DAYS ZIPPER MEAN ± SE	3 DAYS CF MEAN ± SE	7 DAYS WP MEAN ± SE	7 DAYS CONT MEAN ± SE	7 DAYS ZIPPER MEAN ± SE	7 DAYS CF MEAN ± SE
ORGN	25ºC	13.78±0.05	6.05±0.01	8.9±0.01	4.37±0.01	6.65±0.03	5.68±0.02	7.46±0.02	5.06±0.01	0.15±0.02
	4 ºC		4.76±0.01	3.1±0.01	2.04±0.02	3.04±0.01	3.04±0.01	3.84±0.01	3.93±0.01	0.15±0.01
CONV	25ºC	11.23±0.04	5.77±0.02	8.81±0.02	3.54±0.01	6.82±0.03	6.82±0.01	7.55±0.01	5.18±0.06	0.77±0.02
	4º C		4.81±0.01	4.22±0.01	3.03±0.02	4.11±0.03	4.11±0.09	4.29±0.09	3.2±0.02	0.79±0.01

 # Values bearing same or no superscript between column do not differ significantly.

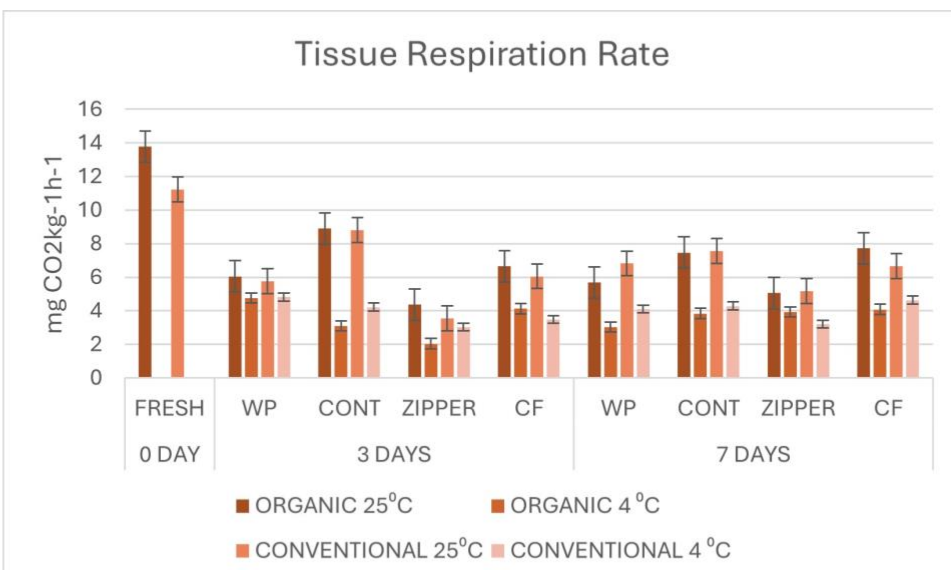

Figure 5. Comparison between Organic and Conventional *Luffa* in Plant Tissue Respiration Rate (mg CO2kg-1.h-1)

3.4.Impact of Storage Conditions on Carbohydrate Content

Table 6 and Figure 6 represented the comparison between organic and conventional *Luffa* in carbohydrate content at different storage conditions. During storage due to increased microbial growth induced carbohydrate breakdown, the carbohydrate content decreased (Swain, Anandharaj, Ray, and Parveen Rani, 2014).

In the present study, substantial losses in carbohydrate content was found may be due to respiratory activity in extended storage at relatively high temperature as described in an earlier study by Kramer(1977). Similar studies by Das et al (2022) on other gourd family cucumbers showed similar results.

Table 6. Comparison between Organic and Conventional *Luffa* in Carbohydrate (g%)

TYPE OF VEG.	TEMP. OF STORAGE	0 DAY FRESH MEAN ± SE	3 DAYS WP MEAN ± SE	3 DAYS CONT MEAN ± SE	3 DAYS ZIPPER MEAN ± SE	3 DAYS CF MEAN ± SE	7 DAYS WP MEAN ± SE	7 DAYS CONT MEAN ± SE	7 DAYS ZIPPER MEAN ± SE	7 DAYS CF MEAN ± SE
ORGN	25ºC	1.68±0.13	3.26±0.01	1.49±0.01	1.35±0.01	2.04±0.31	2.74±0.01	1.70±0.01	1.56±0.003	2.79±0.03
	4 ºC		3.91±0.01	1.60±0.002	1.44±0.01	2.09±0.04	2.96±0.013	1.93±0.01	1.71±0.002	2.8±0.04
CONV	25ºC	1.75±0.01	2.82±0.01	1.07±0.01	1.46±0.01	2.03±0.015	2.63±0.04	1.72±0.01	1.79±0.007	2.04±.0.03
	4º C		3.89±0.02	1.75±0.01	1.89±0.07	2.04±0.015	2.78±0.03	2.09±0.04	2.10±0.01	2.04±0.03

 # Values bearing same or no superscript between column do not differ significantly.

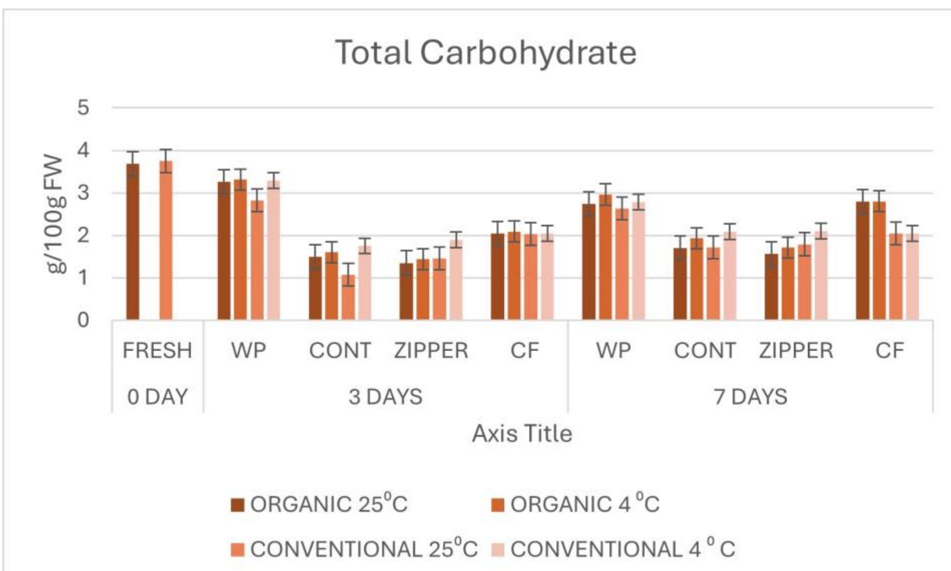

Figure 6. Comparison between Organic and Conventional *Luffa* in Carbohydrate Content(g%)

3.5.Impact of Storage Conditions on Protein Content

Table 7 and Figure 7 represented the comparison between organic and conventional Luffa in carbohydrate content at different storage conditions.

From the multivariate ANOVA, it was found that the total protein content of organic and conventional *Luffa*, stored in different packaging (PP container, Polyethylene zipper bags, and Cling film wrap) and without packaging at different temperatures (25ºC and 4ºC) for different days (3 days and 7 days) had a significant effect. A recent similar study by Das et al (2022) on other gourd family cucumber showed similar results.

Table 7. Comparison between Organic and Conventional *Luffa* in Protein (g%)

TYPE OF VEG.	TEMP. OF STORAGE	0 DAY	3 DAYS				7 DAYS			
		FRESH MEAN ± SE	WP MEAN ± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE	WP MEAN ± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE
ORGN	25ºC	1.43±0.03	1.42±0.003	1.32±0.01	1.35±0.001	1.36±0.01	0.92±0.003	0.89±0.003	0.91±0.01	0.98±0.01
	4 ºC		1.49±0.002	1.54±0.001	1.39±0.004	1.47±0.01	1.11±0.003	0.95±0.002	0.82±0.001	1.47±0.006
CONV	25ºC	1.48±0.07	1.55±0.003	1.48±0.003	1.40±0.01	1.48±0.01	1.53±0.002	1.38±0.001	1.47±0.003	1.48±0.01
	4º C		1.47±0.02	1.47±0.003	1.54±0.001	1.01±0.02	1.93±0.003	1.51±0.01	1.27±0.01	1.39±0.01

 # Values bearing same or no superscript between column do not differ significantly.

Table 8. Comparison between Organic and Conventional *Luffa* in Total Dietary Fibre (g%)

TYPE OF VEG.	TEMP. OF STORAGE	0 DAY	3 DAYS				7 DAYS			
		FRESH MEAN ± SE	WP MEAN ± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE	WP MEAN ± SE	CONT MEAN ± SE	ZIPPER MEAN ± SE	CF MEAN ± SE
ORGN	25ºC	3.66±0.02	3.51±0.003	3.36±0.003	3.22±0.003	2.97 ±0.01	2.92±0.003	2.90±0.01	2.91±0.003	3.02±0.001
	4 ºC		2.96±0.003	3.64±0.003	3.32±0.003	3.55±0.01	3.13±0.01	2.84±0.003	2.70±0.003	2.95±0.001
CONV	25ºC	3.47±0.03	3.25±0.003	3.16±0.003	3.08±0.003	3.11±0.003	3.15±0.01	3.17±0.001	3.22±0.001	2.98±0.01
	4º C		3.23±0.004	2.99±0.001	3.21±0.003	3.16±0.01	3.88±0.007	2.90±0.006	3.17±0.001	3.22±0.003

 # Values bearing same or no superscript between column do not differ significantly.

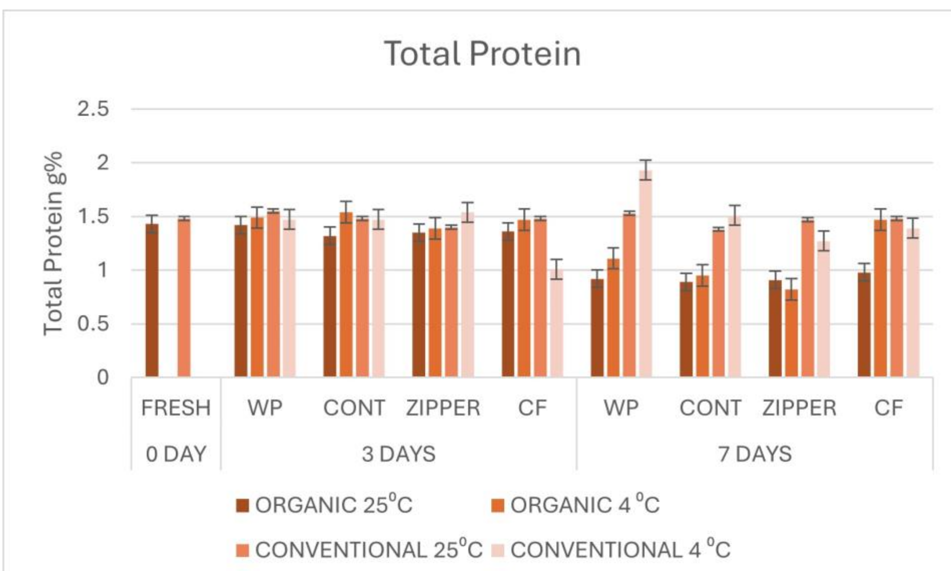

Figure 7. Comparison between Organic and Conventional *Luffa* in Total Protein Content(g%)

3.6.Impact of Storage Conditions on Total Dietary Fibre Content

Table 8 and Figure 8 represented the comparison between organic and conventional *Luffa* in total dietary fibre (TDF). From the multivariate ANOVA, it was observed that the total dietary fibre of organic and conventional *Luffa*, stored in different packaging (PP container, Polyethylene zipper bags, and Cling film wrap), and without packaging, at different temperatures (25ºC and 4ºC) for different days (3 days and 7 days) had a significant effect. In a recent study on other gourd family vegetables-cucumber showed similar results for TDF content (Das et al, 2022).

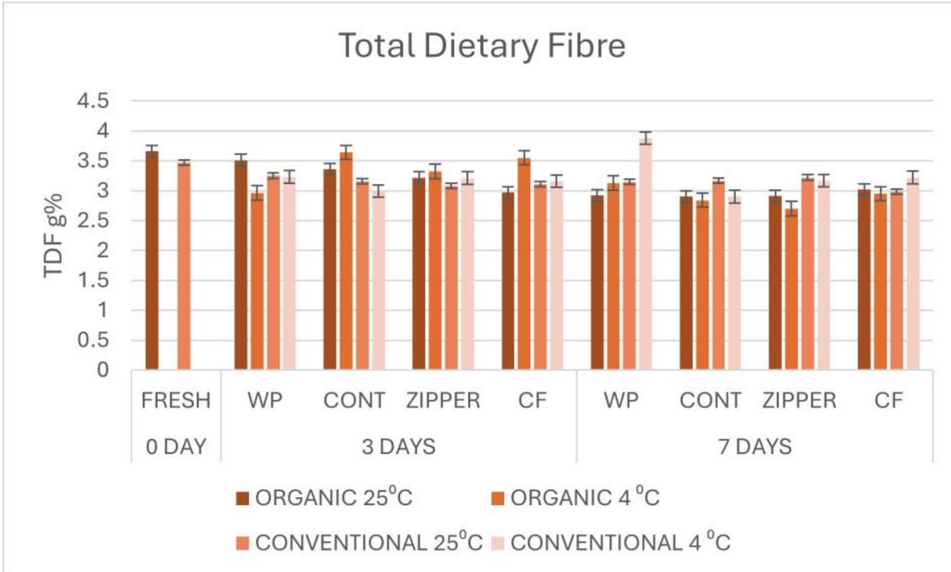

Figure 8. Comparison between Organic and Conventional *Luffa* in Total Dietary Fibre (g%)

4.Conclusions

From the study it can be concluded that there were no significant differences in physicochemical parameters-moisture, dry weight content, the pH and Titratable acidity, and tissue respiration rate, and nutritional parameters such as total protein and total dietary fibre, among different types of farming (organic and conventional) packaged in different packaging systems (PP container, LDPE zipper bags, and Cling film wrap) and without any packaging and stored at different temperatures (25◦C and 4◦C) for 3 days and 7 days durations of storage. Storage in cling film wrap decreased the tissue respiration rate, thereby increasing shelf life of both organic and conventional *Luffa.* The carbohydrate content was decreased due to microbial induced carbohydrate breakdown and hence during storage in domestic packaging carbohydrate breakdown can be prevented. Therefore, packaging in domestic packaging and temperature management can be considered as a devising strategy to enhance shelf life of both organic and conventional *Luffa.*

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Declaration of Conflict of interest

The authors declare no competing interests