

## **Effect of Aloe vera Gel and Gum Arabic Coating on Shelf Life and Nutrient Content of Green Capsicum (*Capsicum annuum* L.)**

**Amirthaveni M\* and Palak Daga**

Department of Food science and Nutrition, Avinashilingam University, India

**Research Article**

Volume 2 Issue 1

**Received Date:** January 18, 2017

**Published Date:** January 25, 2017

**\*Corresponding author:** M Amirthaveni, Department of Food science and Nutrition, Avinashilingam University, India, E-mail: amirthaveni@gmail.com

### **Abstract**

Capsicum, a common name of (*Capsicum annuum* L.), is an annual herbaceous plant of the *Capsicum* genus belonging to the *Solanaceae* family. India contributes to one fourth of the world production of capsicum with an average annual production of 0.9 million tons. About 1.67 million metric tons of capsicums were produced in India during the period of 2013-2014. According to data given by FAO: Food Waste Campaign, fruits and vegetables contribute to about 45 per cent of the food losses, which accounts to almost half of what is produced. Since capsicums are highly perishable and harvested over a restricted period, therefore the need for proper storage facilities arises to regulate marketing and to provide high-quality produce throughout the year. Edible coatings are thin layer of edible materials which can be applied directly onto the surface of the food and that can be eaten as part of the whole product without bringing any undesirable change in the foodstuff. Use of edible coatings as an alternative post harvest preservation technique for fruits and vegetables has been gaining an increasing interest. Green capsicums were coated with two different coatings made of *gum arabica* and *Aloe vera* gel and were kept at refrigerated and ambient storage for a period of 25 days and were observed for the post harvest quality characteristics. It was seen that these edible coatings were found to be effective and acceptable in extending the shelf life of capsicums in both refrigerated as well as ambient conditions. However, the capsicums stored in refrigerator were found to be marketable for a longer period of time. The edible coatings showed remarkable retention of nutrients during storage. The protein, fat, calcium, phosphorus, iron and vitamin C content of uncoated samples was significantly ( $p < 0.05$ ) lower than that of coated samples, at both ambient and refrigerated storage conditions.

**Keywords:** Capsicum; Food Waste Campaign; Perishable; Storage facilities; *Gum arabica*, *Aloe vera* gel; Ambient storage; Edible coatings

## Introduction

Green capsicums (*Capsicum annum L.*) are non-climacteric fruits that are produced in many parts of the world for culinary and vegetable uses [1]. Since capsicums are highly perishable and harvested over a restricted period, therefore the need for proper storage facilities arises to regulate marketing and to provide high-quality produce throughout the year. According to data given by FAO: Food Waste Campaign, fruits and vegetables contribute to about 45 per cent of the food losses, which accounts to almost half of what is produced [2]. So determining the best technique to preserve the post harvest quality of fruits and vegetables is of prime importance [3]. The purchase decision of the handlers and consumers depends on the quality characteristics like retention of fruit green colour, freshness, firmness as well as absence of defects and disease [4].

## Materials and Methods

Matured green capsicums were collected from the wholesale vegetable market in Sai Baba colony, Coimbatore. *Aloe vera* was procured from RGM *Aloe Vera* Products, Vellalore, Coimbatore, while, *Gum arabica* was obtained from New Market, Kolkata. The capsicums were transported immediately to the Nutrition Laboratory of The Department of Food Science and Nutrition, Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore on the 0<sup>th</sup> day of the experiment.

Capsicums with bruises, signs of infection or those different from the group were discarded from the samples. Uniform, unblemished fruits of similar size and green skin colour numbering 160 were then selected and hand washed with tap water to remove soil particles and to reduce microbial population on the surface. Then the capsicums were surface dried with soft cloth [5,1].

## Preparation of Coating Solution

All the coatings were specifically developed for the study at the Foods Laboratory of Department of Food Science and Nutrition, Avinashilingam Institute of Home Science and Higher Education for Women. The following edible coatings were developed:

**Aloe Vera Gel Solution (AV):** Mature green leaves of *Aloe vera* plant was procured and washed with tap water to remove dirt and soil particles. The skin of the leaves was peeled and gel matrix was then separated from the outer cortex of the leaves to obtain the colour less hydro parenchyma. *Aloe vera* gel solution with a concentration of 30 per cent (w/v) was used as a base coating which was prepared by blending 30 grams of the obtained gel in a Food Blender (Preethi Chefpro MG 128-750W). The solution obtained was then filtered using muslin cloth to remove the fibrous material. The liquid obtained constituted of fresh *Aloe vera* gel which was further dissolved in 100 ml of distilled water to get the desired concentration of solution [6,7].

**Gum Arabica Solution (GA):** Gum Arabic with a concentration of 10 per cent (w/v) was prepared by dissolving 10 grams of *Gum arabica* in 100 ml of distilled water. The solution was then stirred on a magnetic stirrer/hot plate (Neolab Motorless Magnetic Stirrer + Hot Plate) at low temperature but high speed for 60 minutes. The prepared solution was then cooled and filtered through muslin cloth to remove any undissolved impurities [8].

## Coating of Capsicum

The capsicums were randomly divided into four sets. Each set contained 40 capsicums. Capsicum in each set was given different treatments which are as follows:-

1. Control (CC)
2. *Aloe vera* Gel Solution (AV)
3. *Gum Arabica* Solution (GA)

Each set was immersed in their respective coating solution for one minute. Capsicums dipped in distilled water were taken as control. Treated capsicum were kept over a metal sieve for 1 hour and a fan generating low speed air was used to accelerate drying and to remove surface moisture. Visual appearance of a dry layer with plastic texture was used as a criterion to determine the end of drying process [9].

## Storage of Coated Capsicum

After drying, each set was divided into two sub sets, each containing 20 capsicums, where one sub set was stored at ambient conditions (A) having a temperature range between 30 – 32°C and 65 – 67% Relative Humidity (RH), while the other subset was stored in Refrigerator (Mark 4) (LG GL-T342GL) and were coded as (R). Among

the two subsets, 10 capsicums labeled A were used for determination of Post Harvest quality characteristics, while the other 10 capsicums labeled B were used for nutrient analysis

In order to create a strong texture 2 grams/100 ml of calcium chloride was added to all the above coatings [5,10].

As an additional precautionary measure, the sorted capsicums were dipped in 0.05% Sodium Hypochlorite solution prior to dipping in coating solution, which acted as a disinfectant. After dipping, the capsicums were rinsed with de ionized water and air dried at ambient temperature.

### Post harvest quality characteristics and nutritive value

For post-harvest quality characteristics and nutrient analysis, the capsicums were analyzed after a regular interval of 5 days (0<sup>th</sup>, 5<sup>th</sup>, 10<sup>th</sup>, 15<sup>th</sup>, 20<sup>th</sup>, 25<sup>th</sup>) till the period they were acceptable for marketing [11].

### Determination of Post-Harvest Quality Characteristics

At 0<sup>th</sup> day and at the end of each storage interval, capsicums labeled A from each subset of both storage conditions were analyzed for post harvest quality characteristics.

**Percentage of Weight Loss:** Set A of each treatment, namely CCA, AVA, GAA, CCR, AVR and GAR were weighed at the 0<sup>th</sup> day and at the end of each storage interval. The difference between the initial weight and final weight of

fruit was considered as total weight loss which was expressed as percentage on a fresh weight basis as per standard method of AOAC, 1994 [12].

$$\text{Percentage weight loss (\%)} = [(A-B)/A]*100$$

Where A indicates the initial fruit weight and B indicated the fruit weight after storage intervals.

**Percentage of Decay:** The decay percentage of both coated and control capsicums were calculated as the number of decayed fruits divided by initial number of all fruits multiplied by 100 [13].

**Sharpness of Cut Surface:** The sharpness of cut surface was observed after cutting the capsicums with a stainless steel knife at the end of each storage interval [1].

**Marketable Quality of Capsicum:** During each sampling day, the marketability of the fruits were assessed using a 1-9 rating scale, which is shown in Appendix I. with 1 = unusable, 3 = unsalable (poor), 5 = fair, 7 = good, 9 = excellent. The colour, firmness, surface defects, signs of mould growth and shrivelling were used as visual parameters for the rating. Fruits that received a rating of five and above were considered marketable, while those rated less than five were considered unmarketable [1].

**Nutrient Analysis** At 0<sup>th</sup> day and at the end of each storage interval, 1 capsicum labeled B from each subset was analyzed for proximate composition and ascorbic acid using standard techniques of National Institute of Nutrition, Hyderabad [14].

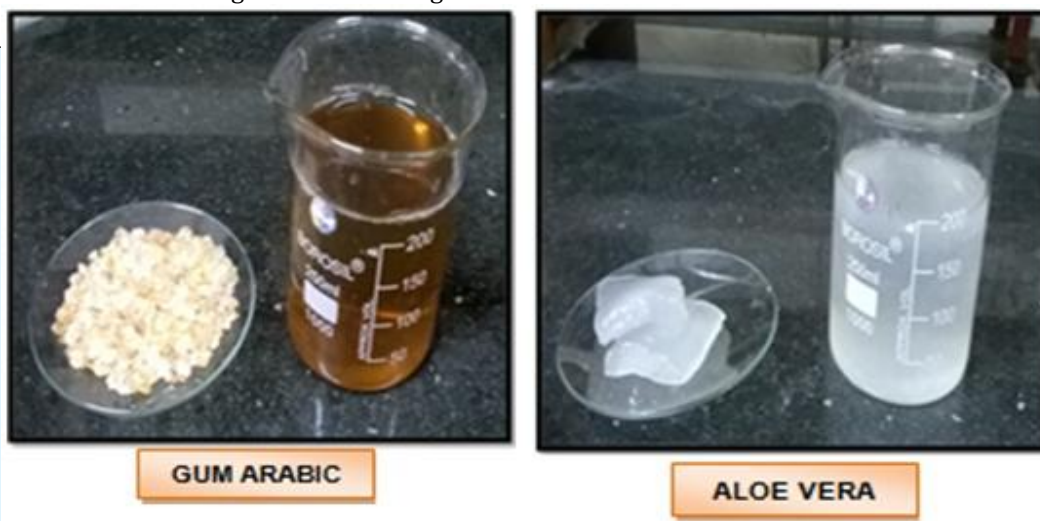


Plate 1: The coating solutions prepared.

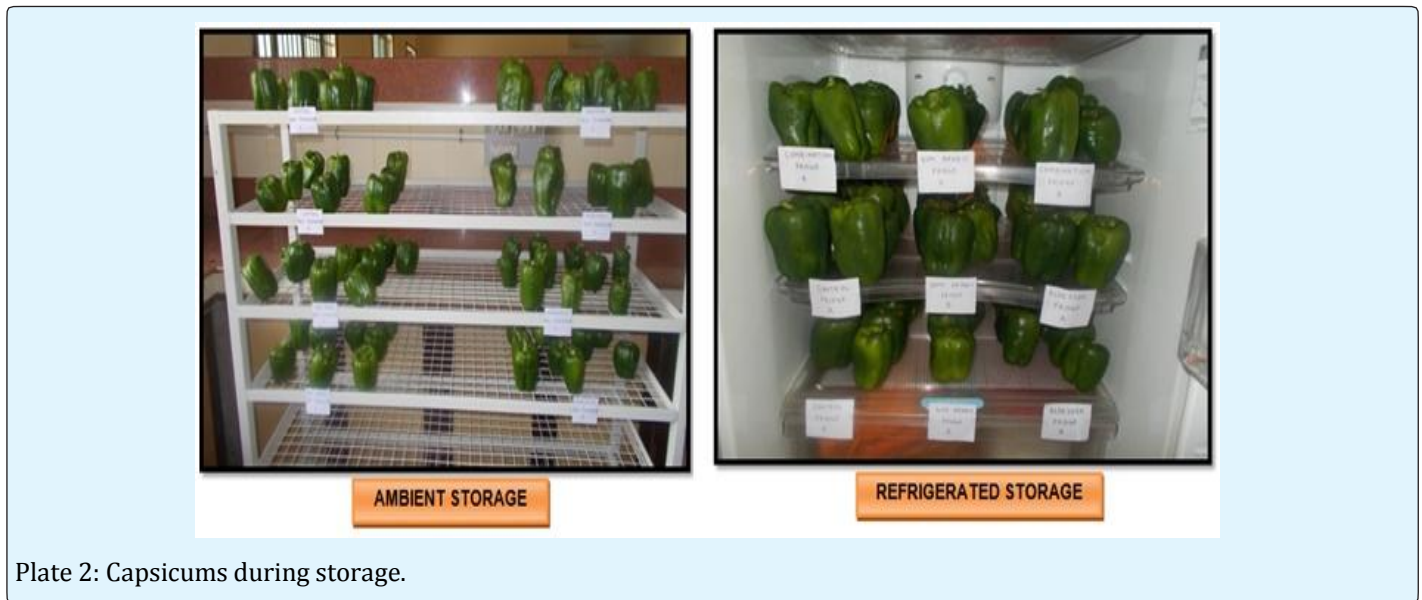


Plate 2: Capsicums during storage.

## Results and discussion

### Post- Harvest Quality Characteristics

Postharvest quality is a combination of characteristics or attributes, which gives value to the commodity in terms of its intended use.

The capsicums stored in ambient conditions started deteriorating after the 15<sup>th</sup> day, whereas those stored in refrigeration were in better condition. So the data for capsicums stored in ambient conditions is recorded till 15<sup>th</sup> day, while for capsicums stored in refrigeration the data is collected till 25<sup>th</sup> day.

• **Percentage of Weight Loss** -The percentage of weight loss in control samples was found to be significantly ( $p < 0.05$ ) higher than that of coated samples (Table 1). Even among the coatings a significant difference was seen at both storage conditions. The highest weight loss was seen in CCA (22.93%) followed by AGA (17.20%), AVA (16.80%) and GAA (15.98%) at the end of storage period for capsicums stored in ambient conditions. But for capsicums stored in refrigerated condition, highest weight loss percentage was seen in CCR (21.44%), followed by AVR (16.05%), AGR (15.81%) and GAR (14.31%) during the end of 25<sup>th</sup> day.

• **Decay Percentage**- During the storage period, coatings were found to significantly ( $p < 0.05$ ) reduce the decay percentage when compared to the control samples. Among the coatings a significant ( $p < 0.05$ ) difference in the decay percentage was seen (Table 3). At the end of 25<sup>th</sup> day, decay percentage was found to be highest in CCR (8.92%) followed by AGR (7.13%), AVR (6.74%), and GAR (6.23%). Whereas for capsicums stored in ambient conditions, the decay percentage was found to be highest in CCA (9.27%) followed by AVA (6.92%), GAA (7.82%) and AGA (7.69%).

• **Marketable Quality and Moisture Content:** Table 3 shows the marketable quality and moisture content of capsicum during storage. The coatings showed a significant ( $p < 0.05$ ) decrease in the percentage of moisture content when compared with the control samples. Among the coatings there existed a significant difference in ambient conditions, but in refrigerated conditions no significant difference was seen among the coatings. At the end of 15<sup>th</sup> day, higher moisture content was retained by GGA (90.47%) followed by AVA (89.19%) and AGA (87.02%), with the least in CCA (81.80%). For the capsicums stored at refrigerated condition, highest moisture content was retained by AVR (90.86%) followed by GAR (90.28%) and AGR (88.10%) where the control samples showed least moisture retention (86.32%).



**Nutrient Content of Capsicum during storage:** Table 4 & 5 shows the nutrient content of the capsicums during storage.

- The protein content of uncoated samples was significantly ( $p < 0.05$ ) lower than that of coated samples, at both ambient and refrigerated storage conditions. However among the coatings no significant difference in the protein content was observed. For capsicums stored at ambient condition, at the end of storage period CCA had the highest decrease in the protein content (1.12g), followed by AGA (1.25g), AVA (1.26g) and GAA (1.27g). At the end of the 25<sup>th</sup> day, highest decrease in protein content was recorded in CCR (1.04g), followed by AVR (1.24g), AGR (1.26g) while GAR (1.27g) showing the least.

- The fat content of uncoated samples was significantly ( $p < 0.05$ ) lower than coated samples at both ambient and refrigerated storage conditions. Among the coatings there was no significant difference in ambient condition, whereas at refrigerated condition, GAR showed significantly different among AVR and AGR. The decrease in the fat content was recorded to be highest in control sample (0.27g). Among the coatings, AGA showed the lowest fat content of 0.30g, while AVA and GAA were recorded to show the same fat content of 0.34g. For capsicums stored at refrigerated condition, highest decrease in fat content was seen in CCR (0.22g), followed by AGR (0.28g), GAR (0.29g) while AVR (0.32g) showing the least.

- The control capsicums showed significantly ( $p < 0.05$ ) lower retention of calcium content when compared with coated samples at both ambient and refrigerated storage conditions. Among the coatings significant difference was seen at both storage conditions, except for capsicums stored at ambient condition CCA showed the highest decrease in calcium content (7.39 mg), and followed by AVA (8.84 mg), GAA (9.22 mg) and AGA (9.32 mg). Similarly at the end of 25<sup>th</sup> day, highest decrease in

calcium content was recorded for CCR (7.47 mg), followed by AVR (8.92 mg), AGR (9.26 mg) while GAR (9.48 mg) showing the least decrease AGA and GAA where no significant difference was seen among them.

- At the end of 15<sup>th</sup> day for capsicums stored at ambient condition, there was significant ( $p < 0.05$ ) decrease in the Phosphorus content of CCA and AVA, whereas GAA and AGA showed significantly higher retention of Phosphorus, 30.31 mg and 30.48 mg respectively, when compared to CCA (29.81mg). In case of refrigerated storage, at the of storage period, maximum loss of Phosphorus was seen in case of CCR (29.63 mg) and AVR (29.66 mg). GAR and AGR showed significantly higher retention of Phosphorus, having 30.35 mg and 30.54 mg respectively.

- At ambient storage at the end of 15<sup>th</sup> day, the capsicum of all treatments showed no significant ( $p < 0.05$ ) difference amongst each other. For capsicums stored at refrigerated condition at the end of 25 days, no significant difference ( $p < 0.05$ ) was seen in the iron content of CCR, AVR and AGR, while GAR showing a significant loss of 0.49 mg.

- The decrease in Vitamin C was found to be gradually increasing during the storage period and it was significantly ( $p < 0.05$ ) more in control samples when compared to coated capsicums at both storage conditions. Among the coatings at both storage conditions, significant difference was seen. For capsicums stored at ambient conditions, the decrease in Vitamin C content was highest in CCA (69.0 mg), followed by AVA (75.3 mg), AGA (79.4 mg) while GAA (81.9 mg) which showed the maximum retention of ascorbic acid at the end of 15<sup>th</sup> day. At the end of 25<sup>th</sup> day, the decrease in Vitamin C content was recorded to be highest in CCR (59.0 mg), followed by AVR (69.8 mg), AGR (80.8 mg) while GAR (2.8mg), showing the highest retention.

WEIGHT LOSS (%)							DECAY (%)					
Days	AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)			AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)		
	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)
0	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

5	10.52 ± 0.09 <sup>a</sup>	7.03 ± 0.04 <sup>b</sup>	7.83 ± 0.07 <sup>c</sup>	4.34 ± 0.11 <sup>a</sup>	2.98 ± 0.05 <sup>b</sup>	2.37 ± 0.08 <sup>c</sup>	3.21 ± 0.07 <sup>a</sup>	0.00 ± 0.00	1.33 ± 0.04 <sup>b</sup>	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
10	16.63 ± 0.12 <sup>a</sup>	11.18 ± 0.11 <sup>b</sup>	12.23 ± 0.14 <sup>c</sup>	9.01 ± 0.11 <sup>a</sup>	6.49 ± 0.06 <sup>b</sup>	5.62 ± 0.06 <sup>c</sup>	5.62 ± 0.11 <sup>a</sup>	2.40 ± 0.06 <sup>b</sup>	3.49 ± 0.07 <sup>c</sup>	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
15	22.93 ± 0.18 <sup>a</sup>	16.80 ± 0.17 <sup>b</sup>	15.98 ± 0.09 <sup>c</sup>	12.44 ± 0.12 <sup>a</sup>	9.15 ± 0.11 <sup>b</sup>	7.92 ± 0.08 <sup>c</sup>	9.27 ± 0.12 <sup>a</sup>	6.92 ± 0.11 <sup>b</sup>	7.82 ± 0.13 <sup>c</sup>	2.11 ± 0.05 <sup>a</sup>	1.92 ± 0.04 <sup>b</sup>	2.40 ± 0.09 <sup>c</sup>
20	-	-	-	17.89 ± 0.09 <sup>a</sup>	15.03 ± 0.08 <sup>b</sup>	13.18 ± 0.09 <sup>c</sup>	-	-	-	7.88 ± 0.10 <sup>a</sup>	4.62 ± 0.07 <sup>b</sup>	4.23 ± 0.05 <sup>c</sup>
25	-	-	-	21.44 ± 0.12 <sup>a</sup>	16.05 ± 0.09 <sup>b</sup>	14.31 ± 0.10 <sup>c</sup>	-	-	-	8.92 ± 0.11 <sup>a</sup>	6.74 ± 0.09 <sup>b</sup>	6.23 ± 0.08 <sup>c</sup>

Table 1 : Weight Loss and Decay percentage of Capsicum during Storage

Values are mean ± SD of three samples in each group

Values with different superscript letters in the same row for each treatment are significantly different at the 0.05 level ( $p \leq 0.05$ ).

Days	MARKETABLE QUALITY (%)						MOISTURE CONTENT (%)					
	AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)			AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)		
	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)
0	100.00 ± 00 <sup>a</sup>	100.00 ± 00 <sup>a</sup>	100.00 ± 00 <sup>a</sup>	100.00 ± 00 <sup>a</sup>	100.00 ± 00 <sup>a</sup>	100.00 ± 00 <sup>a</sup>	93.72 ± 0.18 <sup>a</sup>	93.74 ± 0.16 <sup>a</sup>	93.62 ± 0.17 <sup>a</sup>	93.72 ± 0.23 <sup>a</sup>	93.74 ± 0.28 <sup>a</sup>	93.62 ± 0.24 <sup>a</sup>
5	85.46 ± 0.16 <sup>a</sup>	91.28 ± 0.19 <sup>b</sup>	92.43 ± 0.17 <sup>c</sup>	94.16 ± 0.28 <sup>a</sup>	95.32 ± 0.27 <sup>b</sup>	97.19 ± 0.26 <sup>c</sup>	90.04 ± 0.16 <sup>a</sup>	93.08 ± 0.15 <sup>b</sup>	93.12 ± 0.14 <sup>b</sup>	93.02 ± 0.19 <sup>a</sup>	93.71 ± 0.22 <sup>b</sup>	93.60 ± 0.26 <sup>b</sup>
10	42.83 ± 0.09 <sup>a</sup>	65.43 ± 0.07 <sup>b</sup>	69.18 ± 0.10 <sup>c</sup>	70.63 ± 0.18 <sup>a</sup>	78.13 ± 0.15 <sup>b</sup>	77.17 ± 0.16 <sup>c</sup>	86.53 ± 0.12 <sup>a</sup>	91.52 ± 0.18 <sup>b</sup>	92.42 ± 0.19 <sup>c</sup>	91.15 ± 0.24 <sup>a</sup>	93.63 ± 0.26 <sup>b</sup>	93.58 ± 0.23 <sup>b</sup>
15	18.75 ± 0.06 <sup>a</sup>	24.18 ± 0.05 <sup>b</sup>	20.32 ± 0.04 <sup>c</sup>	52.86 ± 0.19 <sup>a</sup>	65.16 ± 0.21 <sup>b</sup>	69.13 ± 0.23 <sup>c</sup>	81.80 ± 0.13 <sup>a</sup>	89.19 ± 0.11 <sup>b</sup>	90.47 ± 0.13 <sup>c</sup>	89.47 ± 0.14 <sup>a</sup>	92.43 ± 0.21 <sup>b</sup>	92.65 ± 0.23 <sup>b</sup>
20	-	-	-	41.92 ± 0.13 <sup>a</sup>	48.34 ± 0.16 <sup>b</sup>	51.36 ± 0.19 <sup>c</sup>	-	-	-	88.12 ± 0.18 <sup>a</sup>	92.14 ± 0.21 <sup>b</sup>	91.65 ± 0.23 <sup>c</sup>
25	-	-	-	15.12 ± 0.09 <sup>a</sup>	21.16 ± 0.14 <sup>b</sup>	22.32 ± 0.16 <sup>c</sup>	-	-	-	86.32 ± 0.17 <sup>a</sup>	90.86 ± 0.23 <sup>b</sup>	90.82 ± 0.21 <sup>b</sup>

Table 2: Marketable Quality and Moisture content of Capsicum during Storage.

Values are mean ± SD of three samples in each group.

Values with different superscript letters in the same row for each treatment are significantly different at the 0.05 level ( $p \leq 0.05$ ).

PROTEIN CONTENT (g/100g)							FAT CONTENT (g/100g)					
Days	AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)			AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)		
	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)
0	1.32 ± 0.04 <sup>a</sup>	1.39 ± 0.07 <sup>a</sup>	1.35 ± 0.06 <sup>a</sup>	1.32 ± 0.04 <sup>a</sup>	1.39 ± 0.65 <sup>a</sup>	1.35 ± 0.05 <sup>a</sup>	0.30 ± 0.03 <sup>a</sup>	0.37 ± 0.06 <sup>b</sup>	0.35 ± 0.07 <sup>c</sup>	0.30 ± 0.02 <sup>a</sup>	0.37 ± 0.05 <sup>b</sup>	0.35 ± 0.07 <sup>b</sup>
5	1.29 ± 0.09 <sup>a</sup>	1.38 ± 0.03 <sup>b</sup>	1.34 ± 0.04 <sup>b</sup>	1.30 ± 0.03 <sup>a</sup>	1.39 ± 0.06 <sup>b</sup>	1.34 ± 0.04 <sup>ab</sup>	0.29 ± 0.09 <sup>a</sup>	0.37 ± 0.06 <sup>b</sup>	0.34 ± 0.04 <sup>b</sup>	0.29 ± 0.09 <sup>a</sup>	0.36 ± 0.05 <sup>b</sup>	0.34 ± 0.04 <sup>b</sup>
10	1.20 ± 0.04 <sup>a</sup>	1.31 ± 0.06 <sup>b</sup>	1.31 ± 0.04 <sup>b</sup>	1.24 ± 0.02 <sup>a</sup>	1.37 ± 0.04 <sup>b</sup>	1.35 ± 0.04 <sup>b</sup>	0.29 ± 0.05 <sup>a</sup>	0.36 ± 0.04 <sup>b</sup>	0.33 ± 0.03 <sup>b</sup>	0.28 ± 0.07 <sup>a</sup>	0.36 ± 0.06 <sup>b</sup>	0.33 ± 0.06 <sup>b</sup>
15	1.12 ± 0.05 <sup>a</sup>	1.26 ± 0.06 <sup>b</sup>	1.27 ± 0.06 <sup>b</sup>	1.20 ± 0.05 <sup>a</sup>	1.33 ± 0.03 <sup>b</sup>	1.32 ± 0.07 <sup>b</sup>	0.27 ± 0.02 <sup>a</sup>	0.34 ± 0.04 <sup>b</sup>	0.34 ± 0.01 <sup>b</sup>	0.26 ± 0.04 <sup>a</sup>	0.35 ± 0.05 <sup>b</sup>	0.32 ± 0.04 <sup>b</sup>
20	-	-	-	1.14 ± 0.04 <sup>a</sup>	1.29 ± 0.09 <sup>b</sup>	1.30 ± 0.05 <sup>b</sup>	-	-	-	0.25 ± 0.03 <sup>a</sup>	0.33 ± 0.03 <sup>b</sup>	0.30 ± 0.06 <sup>b</sup>
25	-	-	-	1.04 ± 0.04 <sup>a</sup>	1.24 ± 0.02 <sup>b</sup>	1.27 ± 0.06 <sup>b</sup>	-	-	-	0.22 ± 0.05 <sup>a</sup>	0.32 ± 0.03 <sup>b</sup>	0.29 ± 0.04 <sup>c</sup>

Table 3: Protein and Fat Content of Capsicum during Storage.

Values are mean ± SD of three samples in each group.

Values with different superscript letters in the same row for each treatment are significantly different at the 0.05 level ( $p \leq 0.05$ ).

CALCIUM CONTENT (mg/100g)							PHOSPHORUS CONTENT (mg/100g)					
Days	AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)			AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)		
	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)
0	9.82 ± 0.09 <sup>a</sup>	9.64 ± 0.08 <sup>b</sup>	10.02 ± 0.06 <sup>c</sup>	9.82 ± 0.09 <sup>a</sup>	9.64 ± 0.08 <sup>b</sup>	10.02 ± 0.06 <sup>c</sup>	30.12 ± 0.09 <sup>a</sup>	29.87 ± 0.07 <sup>b</sup>	30.42 ± 0.06 <sup>c</sup>	30.12 ± 0.09 <sup>a</sup>	29.87 ± 0.08 <sup>b</sup>	30.42 ± 0.12 <sup>c</sup>
5	9.01 ± 0.06 <sup>a</sup>	9.53 ± 0.11 <sup>b</sup>	9.96 ± 0.12 <sup>c</sup>	9.28 ± 0.09 <sup>a</sup>	9.58 ± 0.11 <sup>b</sup>	9.97 ± 0.12 <sup>c</sup>	30.08 ± 0.11 <sup>a</sup>	29.86 ± 0.10 <sup>b</sup>	30.42 ± 0.12 <sup>c</sup>	30.11 ± 0.10 <sup>a</sup>	29.87 ± 0.09 <sup>b</sup>	30.40 ± 0.13 <sup>c</sup>
10	8.24 ± 0.06 <sup>a</sup>	9.32 ± 0.11 <sup>b</sup>	9.72 ± 0.12 <sup>c</sup>	8.69 ± 0.06 <sup>a</sup>	9.46 ± 0.11 <sup>b</sup>	9.83 ± 0.12 <sup>c</sup>	29.97 ± 0.12 <sup>a</sup>	29.73 ± 0.14 <sup>a</sup>	30.36 ± 0.13 <sup>c</sup>	29.98 ± 0.11 <sup>a</sup>	29.74 ± 0.10 <sup>b</sup>	30.41 ± 0.13 <sup>c</sup>
15	7.39 ± 0.09 <sup>a</sup>	8.84 ± 0.11 <sup>b</sup>	9.22 ± 0.14 <sup>c</sup>	8.18 ± 0.12 <sup>a</sup>	9.24 ± 0.13 <sup>b</sup>	9.83 ± 0.15 <sup>c</sup>	29.81 ± 0.14 <sup>a</sup>	29.71 ± 0.18 <sup>a</sup>	30.31 ± 0.17 <sup>c</sup>	29.97 ± 0.12 <sup>a</sup>	29.70 ± 0.14 <sup>b</sup>	30.41 ± 0.17 <sup>c</sup>
20	-	-	-	7.82 ± 0.12 <sup>a</sup>	9.03 ± 0.14 <sup>b</sup>	9.65 ± 0.16 <sup>c</sup>	-	-	-	29.84 ± 0.15 <sup>a</sup>	29.66 ± 0.13 <sup>b</sup>	30.37 ± 0.17 <sup>c</sup>
25	-	-	-	7.47 ± 0.09 <sup>a</sup>	8.92 ± 0.10 <sup>b</sup>	9.48 ± 0.12 <sup>c</sup>	-	-	-	29.63 ± 0.14 <sup>a</sup>	29.66 ± 0.16 <sup>a</sup>	30.35 ± 0.23 <sup>b</sup>

Table 4: Calcium and Phosphorus Content of Capsicum during Storage.

Values are mean  $\pm$  SD of three samples in each group.

Values with different superscript letters in the same row for each treatment are significantly different at the 0.05 level ( $p \leq 0.05$ ).

Days	IRON CONTENT (mg/100g)						VITAMIN C CONTENT (mg/100g)					
	AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)			AMBIENT STORAGE (A)			REFRIGERATED CAPSICUM (R)		
	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)	Control (CCA)	<i>Aloe vera</i> (AVA)	Gum arabic (GAA)	Control (CCR)	<i>Aloe vera</i> (AVR)	Gum arabic (GAR)
0	0.60 $\pm$ 0.08 <sup>a</sup>	0.58 $\pm$ 0.04 <sup>b</sup>	0.54 $\pm$ 0.02 <sup>bc</sup>	0.60 $\pm$ 0.05 <sup>a</sup>	0.58 $\pm$ 0.07 <sup>a</sup>	0.54 $\pm$ 0.04 <sup>a</sup>	126.1 $\pm$ 0.22 <sup>a</sup>	126 $\pm$ 0.31 <sup>a</sup>	128.4 $\pm$ 0.28 <sup>b</sup>	126.1 $\pm$ 0.22 <sup>a</sup>	126.0 $\pm$ 0.31 <sup>a</sup>	128.4 $\pm$ 0.28 <sup>b</sup>
5	0.58 $\pm$ 0.06 <sup>a</sup>	0.57 $\pm$ 0.03 <sup>a</sup>	0.54 $\pm$ 0.04 <sup>c</sup>	0.60 $\pm$ 0.09 <sup>a</sup>	0.57 $\pm$ 0.07 <sup>a</sup>	0.55 $\pm$ 0.04 <sup>a</sup>	96.8 $\pm$ 0.19 <sup>a</sup>	100.4 $\pm$ 0.21 <sup>b</sup>	104.6 $\pm$ 0.23 <sup>c</sup>	102.2 $\pm$ 0.34 <sup>a</sup>	106.1 $\pm$ 0.29 <sup>b</sup>	112.7 $\pm$ 0.25 <sup>c</sup>
10	0.56 $\pm$ 0.05 <sup>a</sup>	0.56 $\pm$ 0.08 <sup>a</sup>	0.53 $\pm$ 0.03 <sup>c</sup>	0.58 $\pm$ 0.08 <sup>a</sup>	0.56 $\pm$ 0.05 <sup>a</sup>	0.53 $\pm$ 0.04 <sup>a</sup>	81.2 $\pm$ 0.11 <sup>a</sup>	86.7 $\pm$ 0.14 <sup>b</sup>	92.2 $\pm$ 0.16 <sup>c</sup>	91.6 $\pm$ 0.22 <sup>a</sup>	94.5 $\pm$ 0.24 <sup>b</sup>	105.2 $\pm$ 0.30 <sup>c</sup>
15	0.52 $\pm$ 0.05 <sup>a</sup>	0.57 $\pm$ 0.06 <sup>a</sup>	0.52 $\pm$ 0.04 <sup>a</sup>	0.56 $\pm$ 0.06 <sup>a</sup>	0.57 $\pm$ 0.05 <sup>a</sup>	0.51 $\pm$ 0.07 <sup>a</sup>	69.0 $\pm$ 0.12 <sup>a</sup>	75.3 $\pm$ 0.11 <sup>b</sup>	81.9 $\pm$ 0.13 <sup>c</sup>	78.2 $\pm$ 0.21 <sup>a</sup>	84.5 $\pm$ 0.26 <sup>b</sup>	95.9 $\pm$ 0.32 <sup>c</sup>
20	-	-	-	0.55 $\pm$ 0.06 <sup>a</sup>	0.54 $\pm$ 0.04 <sup>a</sup>	0.50 $\pm$ 0.05 <sup>a</sup>	-	-	-	66.8 $\pm$ 0.15 <sup>a</sup>	76.3 $\pm$ 0.13 <sup>b</sup>	88.1 $\pm$ 0.21 <sup>c</sup>
25	-	-	-	0.53 $\pm$ 0.02 <sup>a</sup>	0.52 $\pm$ 0.05 <sup>a</sup>	0.48 $\pm$ 0.07 <sup>b</sup>	-	-	-	59.0 $\pm$ 0.14 <sup>a</sup>	69.8 $\pm$ 0.19 <sup>b</sup>	82.8 $\pm$ 0.23 <sup>c</sup>

Table 4: Iron and Vitamin C content of Capsicum during Storage.

Values are mean  $\pm$  SD of three samples in each group.

Values with different superscript letters in the same row for each treatment are significantly different at the 0.05 level ( $p \leq 0.05$ ).

## Summary

The present study was aimed at extending the shelf life of capsicum, as it is a nutrient rich vegetable but being perishable in nature large amount of nutrient and organoleptic loss is seen. Further, the aim was to study the efficacy of *Aloe vera* gel and *Gum arabica* coatings on capsicum and to analyse the effect of these coatings on nutrient content of the capsicum during storage. From the foregoing study, it may be concluded that *Aloe vera* gel and *Gum arabic* holds potential for the development of edible coating. These edible coatings were found to be effective and acceptable in extending the shelf life of capsicum in both refrigerated as well as ambient conditions. However, the capsicums stored in refrigerator were found to be marketable for a longer period of time. The edible coatings showed remarkable retention of

nutrients during storage. The quality characteristics of the coated capsicum were noted to be better compared to the uncoated samples. The studied coatings being economical and bio degradable, emerges as a promising alternative in reduction of post harvest losses and thereby enhancing food security.

## Recommendations for further research:-

1. Physical, chemical and rheological characterization of the developed coatings
2. Study the combinational effect of coating and modified atmosphere storage on capsicums
3. Study on feasibility of developing nano particles from *Gum arabic* and *Aloe vera* gel

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