CHAPTER II
REVIEW OF LITERATURE

This chapter deals with the review of literature in regards storage of drumsticks including chemical pretreatment, edible coating, storage condition and statistical analysis of drumstick and other fruits and vegetables. The available information on the effect of different pretreatment, edible gum arabic coating, and storage condition were reviewed and reported in different sections and subsections.

2.1 Physical Properties

Oloyede et al. (2015) studied the measurement of engineering properties necessary to the design of drumstick pod sheller. Various physical properties like length, width, thickness, bulk density, porosity, mass, static coefficient of friction, and angle of repose were determined as a function of moisture content. The basic dimensions (length, width, and thickness) of moringa pods and seeds measured by measuring scale were found to increase linearly from 311.15 to 371.45 mm, 22.79 to 31.22 mm, and 22.24 to 29.88 mm, respectively, in the moisture range of 12 to 49.5% d.b. These results will help to determine the most suitable conditions for processing, transporting, and storage of moringa pods.

Patil et al. (2015) studied the performance evaluation of manually operated drumstick harvester. In order to reduce losses of drumstick during harvesting and to maintain fruit quality, manually operated drumstick harvester was developed. Some fruit parameters were measured for the design of harvester. The length of the drumstick pod (i.e. 50-65 cm) was measured by measuring scale. The pod diameter (i.e. 8-10 mm) was measured with the help of vernier caliper.

2.2 Pretreatment for Preservation

Hong and Gross (1998) studied effect of the surface sterilization of whole tomato fruit with sodium hypochlorite influences subsequent postharvest behavior of fresh-cut slices. They observed the effect of concentration (0, 0.26 or 1.05%) and duration (0, 20 or 60 sec) of sodium hypochlorite treatment on firmness, electrolyte leakage, respiration, and C₂H₄ production of light-red tomato fruit slices during
storage at 5°C under modified atmosphere (MA). After 12 days of storage, pericarp firmness of slices from fruit that had been treated with 1.05% sodium hypochlorite for 60 sec was less than one-half the firmness of water-treated controls and lower than the other sodium hypochlorite treatments. The effect of sodium hypochlorite on electrolyte leakage of slices stored at 5°C was more closely related to treatment duration than to sodium hypochlorite concentration. The difference in electrolyte leakage between control fruit and fruit treated with 1.05% sodium hypochlorite for 60 sec was 14.2, 25.6, and 25% at 4, 8, and 12 days, respectively. Their results suggested that routine surface sterilization of tomato fruit prior to postharvest experimentation may lead to physiological and biochemical alterations in the behavior of fruit.

Davoodi et al. (2007) studied the effect of different pre-treatments and dehydration methods on quality characteristics and storage stability of tomato powder. Different pre-treatments such as calcium chloride (CaCl₂), potassium metabisulphite (KMS), calcium chloride and potassium metabisulphite (CaCl₂ + KMS), and sodium chloride (NaCl) were given before dehydration of tomato slice. Untreated samples served as control. Quality characteristics of tomato slices like moisture content, sugar, titratable acidity, lycopene content, dehydration ratio, rehydration ratio and non-enzymatic browning as affected by dehydration process were studied. Pretreatment of 5 mm thickness of tomato slices with calcium chloride in combination with potassium metabisulphite and drying using a tunnel drier with subsequent storage of product in metalized polyester bags was selected as the best process.

Koley et al. (2009) studied the effects of sodium hypochlorite (NaClO), potassium metabisulphite (KMS) and carnauba wax on physiological activities, quality parameters of pointed gourd fruit. The sample were stored under cold storage condition (8-10°C and 85% RH) for 15 days. Fruits treated with (T₁) 1:10 wax emulsion, (T₂) 100 mg/l NaClO+500 mg/l KMS+1:10 wax, (T₃) 200 mg/l NaClO+500 mg/l KMS+1:10 wax, (T₄) 100 mg/l NaClO+1000 mg/l KMS+1:10 wax and (T₅) 200 mg/l NaClO+1000 mg/l KMS+1:10 wax. It was observed that T₂ reduced physiological loss in weight rate, retained higher hue angle and lower chroma value of the fruits throughout 10 days storage. T₂ and T₄ fruits retained firm pulp texture and lower seed hardiness. Chlorophyll retention in skin was twice higher in T₂ fruits than T₁. However, T₂ yielded best results in keeping sugars level
low up to 10 days.

Chung et al. (2011) studied the bactericidal effects of fresh-cut vegetables and fruits after subsequent washing with chlorine dioxide. In this study six kinds of fresh-cut vegetables and fruits (cucumber, lettuce, carrot, apple, tomato and guava) evaluated for bactericidal efficacy of ClO\(_2\) and NaOCl solution. The samples were dipped and washed in 50, 100 and 200 ppm bactericide solution for 20 minutes and stored for 0, 1, 2, 4 and 7 days, then checked for microbial content and browning, respectively. They found that 100 ppm ClO\(_2\) solution can reduce 3.5-4.0 log CFU/g (p < 0.05) in total bacterial and coliform counts on lettuce, carrot and tomato which is better than sodium hypochlorite solution. As for the browning test, the apple slices treated with 50 ppm ClO\(_2\) solution showed anti-browning effects, but carrot slices treated with 200 ppm ClO\(_2\) solution displayed a fading effect. Gas chromatography-mass spectrometry (GC-MS) analysis also showed that using a 200 ppm ClO\(_2\) bactericide solution for 20 minutes, results in 12.85 ppb residiuary.

Prabhu et al. (2011) studied Comparative analysis of preservation techniques on *Moringa oleifera*. The *Moringa oleifera* leaves and pods preserved using various preservation techniques such as Germicide treatment (25% glutaraldehyde for 5 min), Germicide and Salt treatment (25% glutaraldehyde for 5 min + 10% salt solution), salting treatment (10% salt solution for 5 min), Turmeric and Salt treatment (2% turmeric with 10% salt solution for 5 min). Various biochemical tests were also done to assess the biochemical properties of the sample employed to different preservation techniques. It was observed that dehydrating *Moringa oleifera* sample yielded more or less similar results when employed with combination treatments. The results obtained are satisfactory and the preservation techniques engaged are useful in increasing the shelf-life of *Moringa oleifera* to a great extent.

Ediriweera et al. (2012) studied the effect of chemical pretreatments on the quality of minimally processed pineapple. Mauritius stored in Polystyrene packages at cold temperature (5-7°C and 80-85% RH) for seven days and were evaluated for physicochemical, sensory and microbiological qualities. Pineapple pieces were treated with 1% sodium chloride (NaCl), 1% calcium chloride (CaCl\(_2\)), a combination of 1% sodium chloride and calcium chloride (NaCl + CaCl\(_2\)), 1% ascorbic acid, 1% citric acid, 0.1% chitosan and distilled water (control). However, sodium chloride (1%) and
a combination of 1% sodium chloride and calcium chloride pretreatments resulted in maintaining a better flavour in pineapple after a seven day storage period than the rest of the treatments. Microbial counts for all treatments and the control were within safe-to-consume limits while Salmonella was not detected in any sample.

Gharezi et al. (2012) studied the effect of postharvest treatment on stored Cherry Tomatoes. The experiment involved three treatment such as fruits dipped in cold water for 5 minutes (control), fruit dipped in CaCl$_2$ @ 2% and fruit dipped in acetic acid @ 5% and stored at ambient temperature (25±2°C and relative humidity approx. 75±5%) and cold storage condition (10±2°C). Physicochemical changes recorded on 0, 2, 4, 6, 8, 10, 12, 14 days of storage. The data on physical characteristics (firmness, taste, juiciness, decay, colour, gloss, uniformity, shrivel) were recorded. CaCl$_2$ was the best treatment followed by control and acetic acid treatments. CaCl$_2$ had highest ascorbic acid, lycopene content and had lowest PLW, titratable acidity, moisture content.

Sun et al. (2012) studied the efficiency of sodium hypochlorite and acidified sodium hypochlorite in preventing browning and microbial growth on fresh produces. The objective of this study was to compare the washing effects of 100 mg/l sodium hypochlorite (SH) and 500 mg/l acidified sodium chlorite (ASC) on the prevention of enzymatic browning and the growth of microbial populations, throughout storage at 4°C and 10°C. Fresh-cut zucchini, cucumbers, green bell peppers, and root vegetables such as potatoes, sweet potatoes, carrots, and radishes were used. Compared to SH washing, ASC washing significantly (p<0.05) reduced microbial contamination on the fresh-cut produce and prevented browning of fresh-cut potatoes and sweet potatoes during storage. Polyphenol oxidase (PPO) activity of fresh-cut potatoes and sweet potatoes was more effectively inhibited after washing with ASC. The use of 500 mg/l ASC can provide effective antimicrobial and anti-browning treatments of fresh-cut produce, including processed root vegetable.

Hernandez et al. (2013) studied the dilute sulphuric acid pretreatment and enzymatic hydrolysis of moringa oleifera empty pods. The experiment performed at 130-190°C for 10-30 min, corresponding to a severity range between log $R_0$ = 1.9 and log $R_0$ = 4.2, the effect of pretreatment condition on the recovery of polysaccharides
and on the enzymatic convertibility of cellulose was evaluated. Overall cellulose recovery was above 95% in the pretreatment performed at 130 and 160°C and between 87 and 90% in the pretreatment at 190°C, while xylan recovery in the most severe pretreatments was only 24.7-50.2%. The highest sugar concentration in the acid prehydrolysates (15.0 g/l) was obtained in the pretreatment performed at 160°C and 20 min. The formation of degradation products was low at mild pretreatment condition, but it increased with the severity. Furfural concentration reached 4.04 g/l at log $R_0 = 3.1$ and decreased again with a further increase of the pretreatment severity. The pretreatment was effective for improving the enzymatic hydrolysis of cellulose, and the highest conversion (84.3%) was achieved in the material pretreated at mid severity (log $R_0 = 3.1$).

Hai et al. (2014) studied the effect of sodium hypochlorite (SH) soaking in combination with wax coating to control fruit decay and to maintain visual appearance of fresh Vietnamese longan fruit cv. Long. The experiments were carried out by soaking fruits in 100, 150 and 200 ppm SH solutions for 2 min. After drying, soaked fruits were coated in 6% bees carnauba mixed wax (MW) for 30 seconds, and stored at 5±1°C for 30 days. Untreated fruits were used as control. The parameter like pericarp browning, pericarp color, pericarp pH, total microorganisms, and percentage of fruit decay, weight loss, and total soluble solids content were monitored during the storage period. The results showed that 200 ppm SH in combination with 6% MW treated fruits did not decay throughout 25 days in storage, and kept visual appearance which was indicated by the lowest browning index, high lightness (L* value) and yellowness (b* value) of fruit pericarp, as well as low pericarp pH for 20 days in storage. Moreover, this treatment maintained low total microorganism levels, low weight loss, and the TSS content of the longan fruit remained unchanged.

Chandran et al. (2015) studied the effect of pre storage treatments on shelf life of fresh cut cabbage. Tropical cabbage was surface sanitized using 30 ppm sodium hypo chlorite solution for 10 min, then treated using different solutions such as $T_1$ - KMS + ascorbic acid (0.1%), $T_2$ - KMS + citric acid (0.1%), $T_3$ - Sodium benzoate + ascorbic acid (0.1%), $T_4$ - Sodium benzoate + citric acid (0.1%), $T_5$ - Calcium chloride (1%), $T_6$ - Calcium ascorbate (1%), $T_7$ - Sodium chloride (2%), $T_8$ - Acetic acid (0.1%), $T_9$ - control after that air dried and kept in aluminum trays wrapped with cling film under refrigerated storage. Analysis of physical, physiological
and chemical quality parameters and microbial shown 1% calcium chloride as the effective pretreatment chemical for shredded cabbages.

Kasim and Kasim (2015) studied the biochemical changes and colour properties of fresh cut green bean treated with calcium chloride during storage. Fresh-cut green beans were dipped in 0.5%, 1%, 2% and 3% solution of calcium chloride for 90 sec at 25°C. The fresh-cut green bean samples were packaged in polystyrene foam dishes, wrapped with stretch film and stored in a cold room at 5±1°C temperature and 85-90% RH. Calcium chloride treatments did not maintain the green color of samples. Whiteness index, browning index and total color difference (ΔE) values of CaCl₂ treated samples were high. Saturation index and hue angle were low compared to the control, especially at higher doses of CaCl₂. Polyphenol oxidase (PPO) enzyme activity in samples treated with CaCl₂ at 3% doses was low at the 7 days of storage than with other treatments. Fructose and sucrose content of samples increased in all treatment groups whereas glucose level decreased during the first 4th days of storage.

Park et al. (2016) studied the inactivation of Cronobacter sakazakii in head lettuce by using a combination of ultrasound and sodium hypochlorite. During study the effect of combine ultrasound (37 kHz, 380 W for 5-10 min) and sodium hypochlorite (NaOCl) (5-200 ppm) on reducing Cronobacter sakazakii in head lettuce was investigated. Their result shown that ultrasound was not enough to inactivate C. sakazakii (0.01-0.58 log reduction), whereas NaOCl significantly (P<0.05) reduced C. sakazakii (0.58-2.77 log reduction). Although the significant reduction in C. sakazakii with NaOCl treatment (200 ppm), the combination of 100 min ultrasound and 200 ppm NaOCl resulted in an additional 1.67 log reduction of C. sakazakii. These results indicate that combines treatment with 100 min ultrasound and 200 ppm sodium hypochlorite could be a potential approach to reduce C. sakazakii on post-harvest leaf vegetable.

Pusam et al. (2016) studied the nutritional changes and consumer acceptability of dehydrated garden peas as affected by different pretreatments. The nutritional status of dehydrated garden peas viz. protein, chlorophyll, total sugar, non-reducing sugar, reducing sugar and consumer acceptability of garden peas were evaluated. Amongst the different treatments, peas prickled and blanched in 6% NaCl + 0.1% MgO + 0.5% KMS + 1% NaHCO₃ for 5 min dried in cabinet dryer exhibited better performance throughout the storage period.
Sangeetha et al. (2017) studied the effect of time of harvest, method of harvest and prepackaging, calcium chloride treatments on shelf life and quality of moringa (*Moringa oleifera* L.) CV. PKM 1. To extend the shelf life of moringa, they were harvested in different times of a day viz., morning time, afternoon time, and evening time and also harvested with and without pedicel. Then they were pre-treated with CaCl$_2$ at 0.5%, 1.0% and 2.0% concentration. Untreated pods were kept as control. However, among the 24 treatmental combinations $T_1M_1P_3$ (Pods harvested at morning (7.00 to 9.00 am) with pedicel and treated with 1.0% CaCl$_2$) recorded minimum weight loss and had the shelf life of nine days under ambient temperature. They maintain its colour, firmness at ambient condition.

### 2.3 Reviews on storage

Ozden and Bayindirli (2002) studied the effects of combinational use of controlled atmosphere (CA), Semperfresh edible coating (sucrose polyester base coating) and cold storage on shelf life, quality attributes of green peppers. The sample was stored at CA (12°C), cold storage (12°C) and atmospheric temperature (23±2°C). For comparing the effects of the applied conditions, parameters like changes in weight, quality, pH, total titratable acidity, ascorbic acid, soluble solids, respiration rate and total chlorophyll content were recorded periodically. Application of CA storage was determined to give the best results in terms of the analyzed parameters. Use of Semperfresh plus cold storage was significantly effective in retaining higher contents of vitamin C, and total chlorophyll. Though, it didn’t provide a synergetic benefit for improving the quality of the peppers under CA and normal air conditions.

Sanjuan et al. (2004) studied the changes in the quality of the dehydrated broccoli florets during storage. It is stored at 5, 15, 25, and 40°C. Parameter were studied like rehydration capacity, firmness and chlorophyll content. Sample stored at 5°C suffered slight changes in all parameters studied during storage time considered (427 days). At 15 and 25°C the equilibrium moisture content ($W_e$) and the effective diffusivity ($D_{eff}$) varied linearly with time. At 40°C sharp changes were observed up to 116 days of storage $W_e$ decreased and $D_{eff}$ increased. Firmness of samples stored at 5, 15, and 25°C showed a similar trend without any significant changes through the period. At 40°C the firmness increased with time. As increased in time with temperature chlorophyll content degradation also increased.
Babarinde and Fabunmi (2009) studied the effect of packaging materials and storage temperature on quality of fresh okra fruit. Parameter such as weight loss, colour, titratable acidity, microbial load, moisture, ascorbic acid, pH and ash contents of okra were monitored during storage at room temperature (28±2°C) and refrigerating condition (15±2°C) using three different packages (open plastic bowl (control), plastic sieve over-wrapped with low density polyethylene bags, low density polyethylene bags (LDPE: 5 × 15 cm). Their results showed that packaging materials had a significant (p<0.05) effect on weight loss, firmness, pH and ascorbic acid. Ash content was better preserved in low density polyethylene (LDPE) bags stored in both storage media. They reported LDPE was better than other storage materials in okra storage, with refrigeration better than room condition storage medium.

Negi and Roy (2009) evaluated the shelf life of amaranth and fenugreek and their quality on the basis of retention of β-carotene, ascorbic acid and chlorophyll during storage. They found that the losses of β-carotene ranged from 46.5 to 85.0% for amaranth and 24.0 to 73.0% for fenugreek depending on duration and conditions of storage. Likewise ascorbic acid retention varied from 9–32% for amaranth and 23–80% for fenugreek. They also found that the degradation of quality parameters faster at ambient conditions and packaging of leaves in low density polyethylene (LDPE) bags was beneficial in improving shelf life and nutritive value.

Kulkarni and Vijayanand (2012) studied the effect of pretreatment on quality characteristics of dehydrated evy gourd (Coccinia indica L). Dehydrated slices were packed in low density polyethylene (LDPE) and metallized polyester polyethylene (MPP) pouches and stored at room temperature (27–35°C) for 6 months. The parameters like physicochemical composition and sensory quality characteristic such as color and appearance, texture and overall quality were analyzed for changes during storage. Dehydrated ivy gourd slices remained acceptable during storage of 4 and 6 months in LDPE and MPP pouches, respectively, at room temperature.

Swain et al. (2013) studied the effect of packaging materials and storage conditions on quality of dried capsicum (red and yellow). To dry the capsicum they used microwave drying method. The samples were heat sealed and packaged in: polypropylene (PP), Laminated Aluminum (Al) and High density polyethylene (HDPE) and stored at ambient atmosphere (21.7-44.7°C) for 4 month. They investigated that
storage period had significant effect (P<0.05) on response variables after 45-60 days of storage except sensory score. Laminated Aluminum (Al) was least affected by the ambient environment followed by HDPE and PP having low.

Selvi and Varadharaju (2016) studied controlled atmosphere storage of moringa pod. A fungicidal treatment of 1% given for 2–3 min. The study of respiration of moringa pods were conducted at three different temperatures (14º, 21º and 28ºC) with product to free volume ratios at 1:5, 1:10 and 1:20. Moringa were stored at two different temperatures (14ºC and ambient) in a specially designed PVC chamber with 3, 4 and 5% O₂ concentration. Loss in firmness for both ‘Local’ and ‘PKM 1’ was 12.9, 13.2 and 16.9% for 14 ºC with 3, 4 and 5% O₂ concentration, respectively during 40 days of storage. The ambient stored moringa pods had higher ascorbic acid loss of 8.2% as compared to 5.5% at 14ºC. The results were comparable with local variety also. ‘PKM 1’ showed higher reduction of ascorbic acid of 54.1, 5.3 and 5.9%, respectively for 3, 4 and 5% O₂ concentrations at 14ºC in 40 days. The best treatment for increasing the shelf life of moringa pods up to 40 days at 14ºC was 4% O₂ and 5% CO₂.

2.4 Coating technology

2.4.1 Edible coatings material

Edible coatings are thin films that improve product quality and can be safely eaten as part of the product and do not add unfavourable properties to the foodstuff (Baldwin, 1994; Ahvenainen, 1996). Edible coatings provide a barrier against external elements and therefore increase shelf life (Guilbert et al. 1996) by reducing gas exchange, loss of water, flavors and aroma and solute migration towards the cuticle (Saltveit, 2001). Water loss is another problem that can be controlled with edible wax coatings (Debeaufort et al. 1998). Edible waxes can also offer protection against cold damage under storage. (Nussinovitch and Lurie, 1995).

2.4.2 Edible coatings as gum arabic

Gum Arabic is the natural exudation from stems and branches of hashab tree (Acacia senegal). Gum Arabic is used widely as an additive in food materials. It is classified as an edible coating and it is used to increase stability and shelf life of food product.
2.5 Reviews on gum arabic coating

Li and Barth (1998) studied the impact of edible coatings on nutritional and physiological changes in lightly-processed carrots. They observed the effects of two edible cellulose-based coatings (EC) of varying pH (2.7 and 4.6) on carotene retention and other physiological changes in lightly-processed (LP) carrots which were packaged and stored at 1°C for 28 days. Their results showed that carotene retention was 15% greater in the EC treatments versus control treatment throughout the 28 days. Samples treated with the lower pH EC had the highest CO₂ and lowest O₂ concentrations in the headspace. Whiteness index (WI) scores were significantly lower in both coated samples. Ethylene production was greatest in carrots treated with the lower pH coating on removal from sealed bags to air after each storage period.

El-Annay et al. (2009) studied the effect of edible coating on the shelf life and quality of Anna apple during storage. They evaluate the effect of soybean gum, jojoba wax, glycerol and Arabic gum as an edible coatings instead of paraffin oil on the shelf-life and quality of Anna apple during cold storage at (0°C, 90-95% RH). The results indicated that coated apples showed a significant delay in the change of weight loss, firmness, titratable acidity, total soluble solids, decay and color compared to uncoated ones. Sensory evaluation results showed that coatings maintained the visual quality of the Anna apple during the storage time. The results suggested using soybean gum, jojoba wax, glycerol and Arabic gum as edible coatings instead of paraffin oil.

Maqbool et al. (2011) studied the effect of edible coating based on gum arabic and chitosan on biochemical and physiological responses of banana fruits during cold storage. Banana were coated with different concentration of gum Arabic (5, 10, 15 and 20%) and chitosan (1.0%) then stored at 13±1°C and 80±3% RH for 28 days and afterward for 5 days at stimulated marketing condition (25°C, 60% RH). The result showed that after 33 days of storage, the weight loss and soluble solid content of fruits treated with 10% GA plus 1.0% CH were 24 and 54% lower, however firmness, total carbohydrate and reducing sugar were 31, 59 and 40% higher than the control respectively. Moreover, it is delayed colour development and reduced the rate of respiration and ethylene evolution during storage as compared to control.
Al-Juhaimi et al. (2012) studied the effect of application of gum arabic edible coating on weight loss, firmness and sensory characteristics was investigated for cucumber fruits during storage. Cucumber was coated with gum Arabic at different concentration (5, 10, 15 and 20%) and stored at 10 and 25°C for up to 16 days. They found that gum coating significantly reduced weight loss of the fruits at both storage temperatures. The firmness of the control fruits significantly (p ≤ 0.05) decreased with the storage time at both 10 and 25°C. The application of gum edible coating delayed softening of cucumber fruit during 16 days of storage at 10 and 25°C. Sensory characteristics of cucumber such as color, taste, tenderness, appearance and overall acceptability of coated (5-20%) cucumbers were much better preserved while storing at 10 and 25°C for 16 days.

Ali et al. (2013) studied the effect of gum arabic as an edible coating on antioxidant capacity of tomato fruit during storage. Gum arabic solution of 5, 10, 15 and 20% was applied to green mature tomato which stored at 20°C and 80-90% RH for 20 days. Fruit coated with 10% gum arabic delayed the ripening process by slowing down the rate of respiration and ethylene production and also maintained total antioxidant capacity, lycopene content, total phenolic and total carotenoids during storage as compared to uncoated control and fruit treated with 5% gum arabic.

Patel et al. (2013) studied the influence of wax coating on shelf life of pointed gourd. The effect of carnauba wax (1 and 2%) with or without 6N benzyleadnine (BA) 25 ppm on storage behavior of pointed gourd fruit was investigated under ambient conditions for 6 days. Fruit treated with 2% CW and + BA (T₄) and CW 2% effectively reduced physiological loss in weight and shrinkage during storage in comparison with CW 1% (T₁), CA 1% + BA (T₃), BA (T₅) and control (T₆). Fruit skin yellowing in (T₂) and (T₄) was nil throughout the year and better sensory score for (T₂) and (T₄) .TSS remained lower in (T₂) and (T₄) at different days of storage compared to other treatment. Degradation of chlorophyll was less in (T₂) and (T₄) during storage. Thus coating treatment with carnauba wax 2% or carnauba wax 2% + BA (T₄) can be adopted for fruit quality for longer period of time.

Escandari et al. (2014) reported that the effects of gum arabic coating (concentrations of 0, 5, 10 and 15%), olive oil (concentrations of 0, 15, 30 and 45%) and the combination of them in storage life increase of sweet lime fruit and estimated
TSS, titratable acidity, ascorbic acid, pH, weight loss, percentage of fruit infection and the total phenolic in two times of storage at 1.5 and 3 months. They were observed that 10% GA solution mainly reduced fruit rot and skin color changes after 3 months of storage. But olive oil treatments increased the level of fruits contamination, maximum weight loss of control treatments after 1.5 and 3 months of storage. Concentrations of 5 and 10% GA solution increased TSS, vitamin C and reduced pH, phenolic substances and titratable acidity. Concentrations of 30 and 45% olive oil also reduced soluble solids, vitamin C and weight loss, and total phenols increased, but had no significant effect on acidity and pH.

Yarahmadi et al. (2014) studied the effect psyllium mucilage with concentrations of 6.25, 12.5 and 25 ml/l and gum arabic and arjan with the amount of 0.5, 1 and 1.5 g/l on post-harvest life and quality of strawberry. Placed in PE at 4°C and measured the pH, fresh weight, acidity, TSS, wrinkles on 0, 2, 4, 6, 9 and 12 days after storage. The results obtained that fruits treated with 12.5 ml/l psyllium mucilage, arabic gum 0.5, arjan 1, and 1.5 g/l and psyllium mucilage 25 ml/l showed the retention of water. They concluded the quality of the fruit was good, in coated with gum treatments for arjan 1 and 1.5 g/l.

Binsi et al. (2016) studied the comparative evaluation of gum arabic coating and vacuum packaging on chilled storage characteristics of Indian mackerel. They observed the effect of gum Arabic coating on biochemical, microbiological, textural and sensory characteristics of fresh gutted mackerel stored at 4°C. The results were further compared against the samples packed under vacuum (VP) and conventional polyethylene pouches (CP). They found that coating with gum arabic (GC) markedly retarded lipid oxidation process in gutted mackerel compared to VP and CP samples. Furthermore, VP and CP samples showed higher degree of textural deterioration compared to GC samples. The sensory analysis scores confirmed the efficacy of gum coating in retarding the spoilage process during chilled storage.

Bhattacharjee and Dhua (2017) studied the impact of edible coatings on the postharvest behaviour of bitter gourd. Treatment of edible coatings mainly Carnuba wax and chitosan can be used (T1 - Control, T2 - Carnuba wax 0.25%, T3 - Carnuba wax 0.50%, T4 - Carnuba wax 1.0%, T5 – Chitosan 0.25%, T6 - Chitosan 0.50% and T7-Chitosan 1.0%). for enhancing the storability of bitter gourd fruits under ambient
storage conditions (temperature 27.4-32.3°C and 70-81% RH). The results shown that bitter gourd fruits coated with 1.0% Carnuba wax maintained higher sensory score of 6.67 and minimum physiological loss in weight with a 4.61% by the end of storage period. The fruits treated with Carnuba wax (0.50 and 1.0%) recorded no spoilage respectively up to 4 days. The chlorophyll content remained high on 2\textsuperscript{nd} day, 4\textsuperscript{th} day as well as on 6\textsuperscript{th} day in storage with maximum retention of chlorophyll a (9.67mg/g), chlorophyll b (4.60 mg/g) and total chlorophyll (14.28 mg/g) in 1.0% Carnuba wax coated fruits.