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Arabic/Acacia gum: Intensify the physiological life and postharvest quality of different horticultural crops

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Abstract

Gum Arabic, as a glazing material maintains the postharvest quality and shelf-life of horticultural produce by the way of developing a semi-permeable barrier on the outer surface of the fruits and vegetable. The eco-friendly, nontoxic, safe and excellent emulsifying properties make it very desirable as a coating or film. Gum Arabic alone or in combination with various types of coating material plays a significant role in reducing enzymatic activities, physiochemical changes, disease incidence, enzymatic activities and helps in increasing the shelf-life of various horticultural crops. Moreover, it helps in preserving nutrients, increasing the marketability period for the crop, getting better economic return and allow for the transport of produce to a longer distance. The intention of this paper is to review and illustrate effect of GA as an edible glazing on different fruit and vegetable properties and on their postharvest quality.

1. Introduction

Fruit and vegetable crop production has been growing for their various benefits in human health. Almost every component of fruits and vegetables has some worth and can be utilized (Duhan *et al*., 2022; Manickavalli *et al*., 2022). These can also be consumed as functional foods which is the best alternative to dieting for weight loss (Sharma and Sarwat, 2022). These constitutes a highly nutritious, low-energy diet with medicinal properties (Lakshmi *et al*., 2022; Vaidya *et al*., 2022). But, the worldwide postharvest loss of fruit and vegetables is still very high, between 45 to 55 % as indicated by the FAO report (Lipinski *et al.,* 2013; FAO, 2011). The causes of these losses are external (climate and weather conditions for instance oxygen, CO_2, temperature, ethylene ratios and stress factors) and internal (species, cultivars and the stage of growth) factors (Kulge *et al*., 2002). Several skills and methods have been developed in recent decades in respect to manage postharvest losses and to preserve quality factors that contribute to the good marketability. Edible coatings have shown promising results for preserving fruit quality under the modified atmosphere method (Guimaraes *et al*., 2018). These coatings also replace plastics used for betterment of shelf-life (Salehi, 2020). An edible glaze or coating is an extra thin film of material that protects fruits from the environment and is safe to eat alongside the full product (Baldwin *et al*., 2011) as these films does not impart unfavorable properties to the foodstuff (Baldwin, 1994). The key positive effect of these coats is covering of the stomata which promotes reduction in transpiration and subsequently, reduces weight loss, as has been established in extensive studies on various fruits and vegetables (Salehi, 2020). Moreover, according to many research studies, these coatings regulate the gaseous exchange, hence close the ripening process (Maringgal *et al*., 2020).

1.1 Gum Arabic (GA)

Owing to their texture capability, gums are utilized in edible coating preparation applied on different horticulture produce (Raghav *et al*., 2016) and the gums-based glazing has been successful in sustaining-quality of various fruits and vegetables (Figure 1) after harvest (Salehi, 2020). Arabic/Acacia gum is light-orange or pale-white water-soluble exudates from the *Senegal* and *seyal* species of genus *Acacia* trees belonging to the family Fabaceae subfamily Caesalpinioideae (Patel and Goyal, 2015). *A. senegal* is a plant with an umbrella-shaped crown that grows to a height of 2-6 m, occasionally reaching as high as 8 m. It has numerous upright twigs and is heavily branched (Mariod, 2018). It is renowned among all natural gums (Islam *et al*., 1997). These trees containing nutrients and healing components have been utilized as sedatives, relaxants, softeners, and healing agents in traditional medicine. It plays a role in internal as well as external traditional medical interventions for conditions like cough, haemorrhage, dysentery, diarrhoea, and intestinal mucosal inflammation (Salih, 2018).

This gum is a mixture of polysaccharides and glycoproteins (Patel and Goyal, 2015). It has high molecular weight and is composed of magnesium, calcium, potassium in addition to 2% proteins and a α-1, 3-linked galactose based complex carbohydrate coat (Dewey *et al*., 1997). D-glucuronic acid, D-galactose, L-rhamnose and L-arabinose are the chief carbohydrate constituents (Tiss *et al*., 2001) linked through the 1, 6 positions as side chains (Dewey *et al*., 1997). Among others, diverse industrial uses like in bakery, cosmetics, pharmaceuticals, *etc.* (Maqbool *et al*., 2011) in the recent past, it has also made its significance as an edible coating (Figure 2). In many

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studies, it delayed ripening of various food products after harvest when applied as an edible coating. Its exceptional emulsifying properties make it very desirable as a coating or film (Ali *et al.*, 2010).

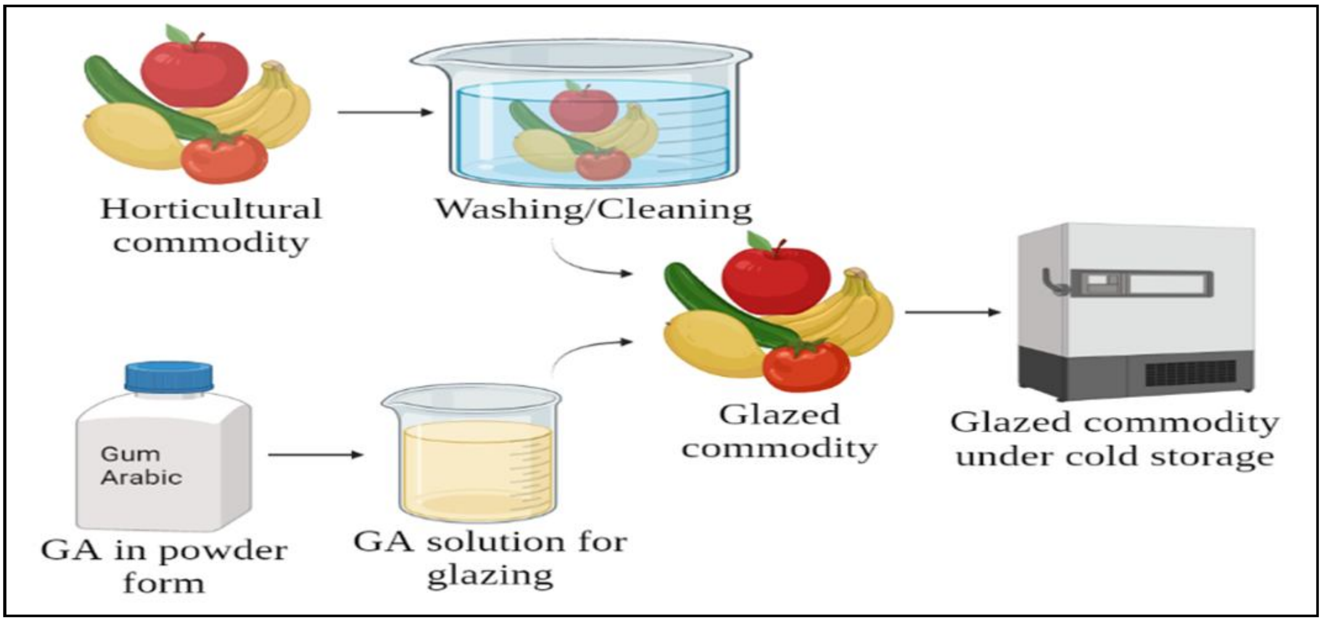

Figure 1: General process of GA glazing and storage of different horticultural commodity.

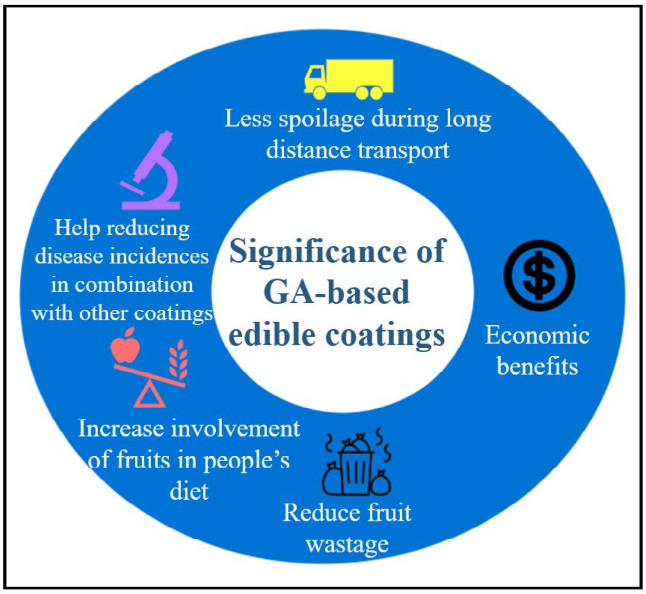

Figure 2: Significance of GA-based edible coatings on fruits and vegetables.

2. GA glazing properties

2.1 Effect on physiochemical properties

Applications of GA glazing have been found to preserve the physical and chemical properties of various horticultural crops *via* reducing ethylene synthesis and respiration speed (Cruz *et al.*, 2015; Kawhena *et al.*, 2022a). It reduces the physical losses in weight (Fawole *et al.*, 2020; Ochoa-Reyes *et al.*, 2013), firmness (Razak and Lazim, 2015; Al-Jhumaimi *et al.*, 2012), moisture (Kannaujia *et al.*, 2019) and decay percentage (El-Sharony *et al.*, 2015; Maklad, 2015). This could be because of the less gaseous exchange with external environment and maintained cell integrity caused by GA based coatings. It maintains the level of total soluble solid constituent present (TSS) in various horticultural crops (Daisy *et al.*, 2019; Jiang *et al.*, 2013). GA based coatings helps retain vitamin C during storage (Taher *et al.*, 2020; Muthmainnah *et al.*, 2019) and sustain total acidity (El-Anany *et al.*, 2009). It maintains a suitable level of pH in different fruit and vegetable crops after harvesting (Ghannam *et al.*, 2021; Minh *et al.*, 2019; Khorram *et al.*, 2017).

2.2 Effect on color retention

Colour is a critical consideration for the perspective of the end consumer acceptability of horticultural crops, as it can be observed as an indicator of quality in crops (Ali *et al.*, 2013). GA based coating prevented tomatoes and mangoes from turning colour, which could be most likely caused by a rise in CO_2 and a fall in O_2 levels (Abu-Goukh, *et al.*, 2017; Ali *et al.*, 2010). In tomato, colour develops with maturity as a result of the *de-novo* synthesis of carotenoids, primarily lycopene and carotene, which is connected to the transition of the fruit's colour from green to red when chloroplasts become chromoplasts. Coating substance slows down the processes of lycopene synthesis, chlorophyll breakdown, and ripening (Sati and Qubbaj, 2021). GA based coatings help in maintaining the chlorophyll, lycopene and α-carotene content during ripening (Fashanu *et al.*, 2019; Valiathan and Athmaselvi, 2018). It is also helpful in maintaining the values of colour parameters such as lightness (L*), chroma (C*), hue angle (h°) (Van *et al.*, 2018; Khaliq *et al.*, 2015; Mahfoudhi *et al.*, 2012), reduced yellowness (depends on *b* values) and more redness (depends on *a* values), which ultimately lead to good color retention (Ullah *et al.*, 2017; Al-Juhaimi, 2014; Al-Juhaimi *et al.*, 2013). Hence, GA based coatings play a significant positive role in helping color retention (Fallah *et al.*, 2021).

2.3 Effect on disease and pest activity

GA do not contain any antifungal elements, but it helps in enhancing the ability of other antifungal coatings (Table 1) which may be linked to its being a very good emulsifier and the sticky texture (Figure 3). It binds to the fruit surface very well and may slow the growth of fungal germ tubes (Alamri *et al.,* 2019). Its composition includes glycoproteins, polysaccharides, and arabinogalactan oligosaccharides, which together create a semipermeable barrier that prevents microorganisms from growing on food goods (Mahfoudhi and Hamdi, 2015).

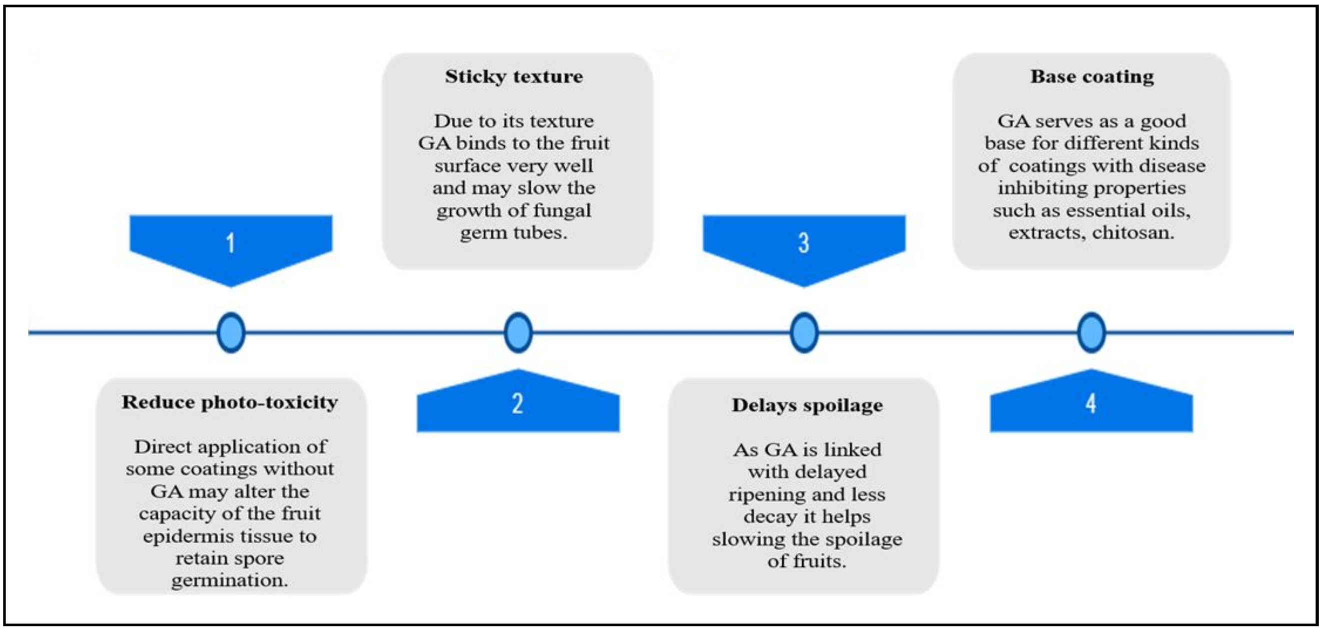

Figure 3: Desirable characteristics of GA that can be utilized in disease prevention using coatings.

Table 1: Utilization of GA in different composite coatings used to prevent fungal infection in different horticultural crops

Fruit	Scientific name	GA incorporated with	Impact	Reference
Avocado	*Persea americana*	Thyme oil (3:1 v/v)	Fungistatic effect on the *in vitro* mycelial development of *C. gloeosporioides*	Bill *et al.,* 2014
Banana	*Musa acuminate*	Chitosan (1%)/Cinnamon oil (0.4%)	Inhibited mycelial growth and spore germination of *C. musae*	Ali, *et al.,* 2012; Maqbool *et al.*, 2011
Chilli	*Capsicum annum*	Propolis (5%) + Cinnamon oil (0.5%)	Antifungal effect and lower mycelia growth of *C. capsici* was observed *in vitro*	Ali *et al.,* 2013
Papaya	*Carica papaya*	Chitosan (1%)/Cinnamon oil (0.4%)/Propolis (1.5%)/Ginger oil (2%)	Composite coatings worked synergistically with GA in controlling anthracnose of papaya. Inhibited *C. gloeosporioides* activity	Ali, *et al.,* 2012; Ali *et al.,* 2014; Maqbool *et al.*, 2011;
Peach	*Prunus persica*	Mint (0.2%)/thyme oil (0.2%) + Tween 20(0.1%)	Peaches are shielded from postharvest infections caused by *Rhizopus stolonifer, Penicillium expansum*, and *Botrytis cinerea*	Alamri *et al.,* 2019
Plum	*Prunus domestica*	Oregano (0.06µl/ml) and rosemary (0.25 µl /ml) essential oils	Repressed the mycelial growth, spore germination and sporulation of *Rhizopus stolonifer*	Andrade *et al.,* 2017
Pome-granate	*Punica granatum*	Thyme oil (0.25 and 0.5%)	Effective against mould and yeast as well as preserved quality for as long as 8 days during storage of pomegranate aril	Kawhena *et al.,* 2020
Cherry tomato	*Solanum lycopersicum*	GA (10%)	Control *Alternaria alternata* and *B. cinerea* infection	Mohammed *et al.*, 2021

Incorporation of GA with composite coatings such as thyme oil, chitosan and ginger oil/ethanolic extract of propolis/cinnamon leads to synergistic effects and helps in reducing disease incidences when applied on fruits and vegetables (Ali *et al.,* 2016; Bill *et al.*, 2014; Maqbool *et al*., 2011). Phytotoxic effects that may be caused due to application of unaided antifungal coatings is also observed to be reduced when coatings are combined with GA (Maqbool *et al*., 2011). Furthermore, various types of antifungal coatings have been mixed with GA that have given significant results in preventing and reducing the disease incidences on different kinds of fruits. However, solitary application of GA was found ineffective against fungi activity when used on 'Mexican lime' (Atrash *et al.,* 2018), but gave postive results when used on cherry tomatos, as a results of its high terpene content having antifungal and antibacterial potential (Mohammed *et al.,* 2021). Besides that, GA is also effective against mould, yeast, mesophilic aerobic bacteria (Kawhena *et al.,* 2020; Yang *et al.,* 2019) and is reported to be effective against fruit flies in guava (Kabbashi *et al.*, 2018). The GA coating incorporated with ZnO demonstrated good antibacterial capabilities against several microorganisms, including *Staphylococcus aureus, Escherichia coli,* and *Bacillus subtilis* in banana (La *et al.,* 2021).

2.4 Effect in nanocomposite coatings

Different types of nanoparticles have been shown to significantly improve the characteristics of gum Arabic, making their use in edible coatings a vital utilization of nanotechnology (Table 2). Addition of 4% cellulose nanocrystals (CNC) to GA film efficiently doubled its tensile strength and enhanced the elongation at break by 1.5 times.

Table 2: Different fruit and vegetables coated with GA based nanocomposite coatings and its impact

Fruit	Scientific name	Nanoparticle incorporated in GA	Impact	Reference
Avocado	*Persea americana* Mill.	ZnO (0.3 %)	Fruit appearance and lightness were significantly improved with smooth and uniform fruit surface without cracks	Le *et al.,* 2021
Banana	*Musa acuminata* L.	ZnO (0.5 %)	Smooth fruit surface with shelf-life of more than 17 days at 35ºC temperature and 54 % RH	La *et al.,* 2021
Strawberry	*Fragaria × ananassa*	Cellulose nanocrystals (4%)	A dense and uniform film structure was created with the help of the nanofiller. Reduced the fruit weight loss by 23.80%	Kang *et al.,* 2021
Tomato	*Solanum lycopersicum* L.	NaCl (0.5%)	Increase shelf-life of fruits by up to 14 days while minimizing nutritional and PLW loss	Krishnadev and Gunasekaran, 2017
Green bell pepper	*Capsicum annuum*	Silver nanoparticles (0.002%)	Limited physicochemical losses and microbial development	Hedayati and Niakousar, 2015

It improved the film's resistance to ultraviolet light and thermal stability while reduced its permeability to water vapour and oxygen by 10.61 per cent and 25 per cent, respectively (Kang *et al.,* 2021). The nontoxic zinc oxide (ZnO) nanoparticles incorporation in edible coatings, due its antimicrobial effects against bacteria such as *Bacillus subtilis, Staphylococcus aureus*, and *Escherichia coli,* produced positive outcomes (La *et al.*, 2021; Arroyo *et al.,* 2019). ZnO nanoparticles at different concentration blended with GA-chitosan based edible coating give positive result in maintaining quality of avocado and banana (La *et al.*, 2021; Le *et al.*, 2021). Hence, the beneficial properties of GA coating can be enhanced by using ZnO, NaCl, and CNC (Figure 4).

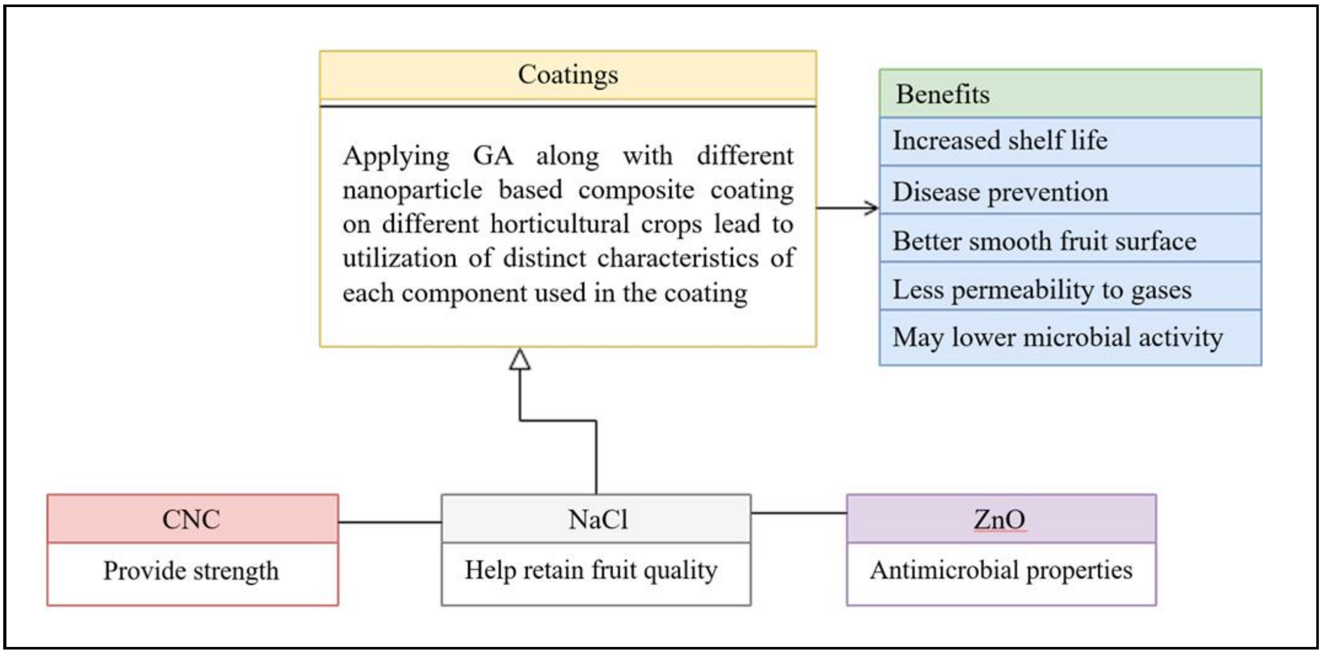

Figure 4: Properties of different nanoparticles used in GA based coating and their benefits.

2.5 Effect of GA on different enzymatic activities

2.5.1 Effect on enzymatic browning (PPO and POD)

GA based coatings help in reducing the various enzyme activities (Figure 5). Oxidation of phenolics results in O-quinones, and the polymerization of these compounds produces brown pigments. Generally, surface browning of a product is a result of polyphenols oxidation (Anjum *et al*., 2020). Enzymes such as polyphenol oxidase (PPO), and peroxidase (POD) are one of the essential enzymes causing browning of fruits and vegetables (Kannaujia *et al*., 2020). Loss of membrane integrity may expose phenolic components to oxygen and causes enzymes like PPO to oxidize those (Hashemi *et al.,* 2021). GA alone or blended with different essential oils and extracts, *etc.,* reduce the activity of browning enzyme in several fruits and vegetables (Hashemi *et al.,* 2021; Tahir *et al.,* 2019; Murmu and Mishra, 2018; Sedaghat and Zahedi, 2012). The lack of oxygen accessible for oxidation reactions caused by GA coating may be the cause of this reduced browning (Sultan, 2014) and due to the presence of secondary metabolites such as polyphenols, catechin, and flavone in GA (Yang *et al.,* 2019). Similar results are obtained on tomato as GA coating protected the product from its surroundings (oxygen) and minimized the amount of browning on the tomato slices (Adiamo *et al.,* 2017; Babiker and Eltoum 2014; Eltonum and Babiker, 2013).

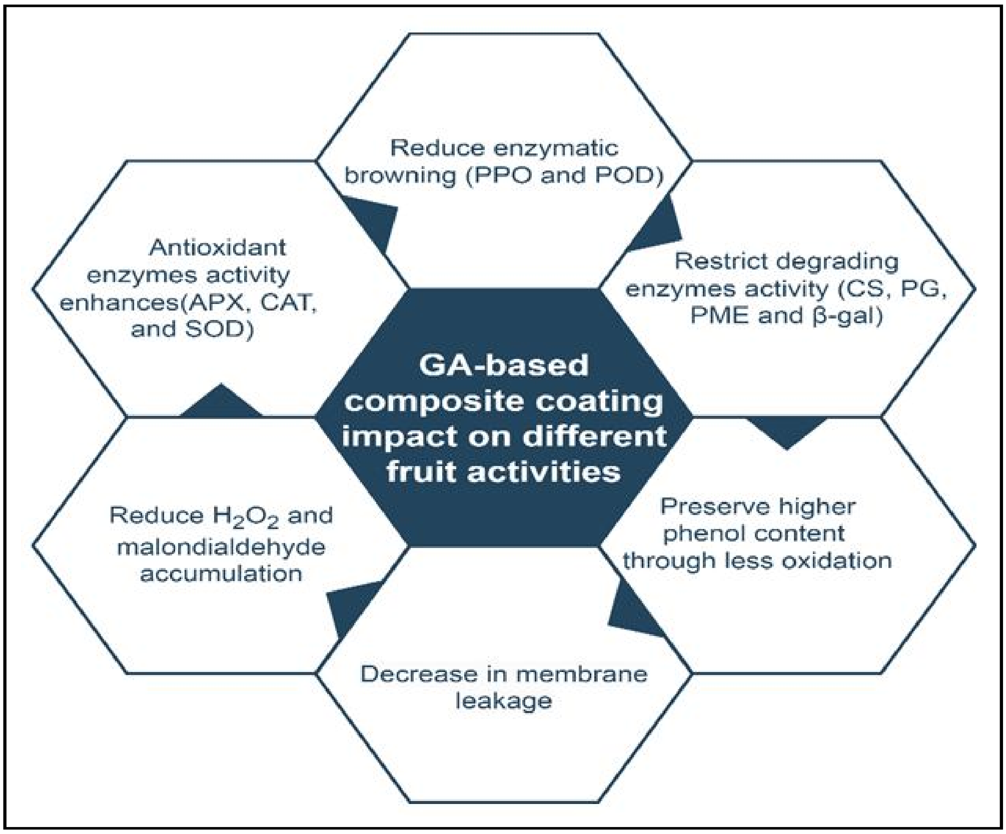

Figure 5: Effect of GA-based coatings on different fruit activities.

2.5.2 Effect on antioxidant enzymes, H_2O_2 and malondialdehyde accumulation

Antioxidant activity is very important for scavenging of free radicals that get produced during senescence. Higher catalase (CAT), peroxidase (POD), ascorbate peroxidase (APX), and superoxide dismutase (SOD) enzymes activities aid in scavenging different reactive oxygen species (ROS) and extend the fruit's ability to be stored (Ali *et al.,* 2021). The reduction in senescence due to GA based coatings can lead to a rise in the activity of antioxidative enzymes and longer shelf-life in fruits (Ebrahimzadeh *et al.,* 2019; Saleem *et al.,* 2020). Furthermore, reduction of H_2O_2 and malondialdehyde accumulation decrease in fruits when GA coating is applied (Ali *et al.,* 2021; Khaliq *et al.,* 2016)). Leakage of electrolytes is typically seen as an indirect indicator of membrane degradation. The result of lipid peroxidation is MDA. Lipid breakdown may result in alterations to the cell's membrane composition (Etemadipoor *et al*., 2020). Reduction in H_2O_2, which can escalate the oxidative stress and promote the electrolyte leakage, helps in maintained integrity of cell membrane. Lower -H_2O_2 accumulation coupled with lower activity of lipoxygenase also results in reduced browning and oxidative rancidity (Ebrahimzadeh *et al.,* 2019).

2.5.3 Effect on degrading enzymes

The primary cause quick deterioration of fruit is their softening. During senescence, the activity of softening enzymes increases and catalyses the depolymerization and breakdown of cell wall pectin. However, GA coating through controlled environment show reduced activity of such enzymes (Table 3), *i.e.*, α-galactosidase (α-gal), cellulase (CS), pectin methylesterase (PME) and polygalacturonase (PG) in several fruits (Ali *et al.,* 2021; Saleem *et al.,* 2020; Maqbool, *et al.,* 2016).

Table 3: Effect of GA based coatings on different enzymatic activities

Crops	Botanical name	Treatment	Impact on browning	Impact on antioxidants, H_2O_2 and malondialdehyde	Impact on degrading enzymes	References
Apricot	*Prunus armeniaca* L.	GA (10%)	-	Maintained higher SOD, APX, and CAT enzymes activity; lowered the, H_2O_2 and malondialdehyde accumulation	Inhibited cellulase, PME and PG activity	Ali *et al.*, 2021
Blueberry	*Vaccinium sect. Cyanococcus*	GA with roselle extract or African baobab fruit extract	Inhibit POD and PPO enzyme activities	-	-	Tahir *et al.*, 2020; Yang *et al.*, 2019
Banana	*Musa* sp.	GA (10%) with chitosan (1%)	-	-	Reduced PME, PG and β-gal enzymatic activity	Maqbool *et al.*, 2016
Guava	*Psidium guajava* L.	GA (5%) plus sodium caseinate (1%) and cinnamon (2%)/ lemongrass (2%)	Reduced the PPO and POD enzyme activity	-	-	Murmu and Mishra, 2018
Litchi	*Litchi chinensis*	GA (10%)	Delayed pericarp browning of the fruit	-	-	Sultan, 2014
Pistachio	*Pistacia vera* L.	GA (6%) with thyme (0.3 and 0.5 %)	PPO activity and colour change reduced; higher PAL activity	-	-	Hashemi *et al.*, 2021
Persimmon	*Diospyros kaki* L.	GA (10%)	-	Exhibited higher APX, SOD, and CAT activities; lowered malondialdehyd, membrane leakage, and H_2O_2	Suppressed PG, PME and cellulase enzymes	Saleem *et al.*, 2020
Summer squash	*Cucurbita pepo* L.	GA (10%)	-	-	Lessened PME activity	Kannaujia, *et al.*, 2020
Tomato	*Solanum lycopersicum*	GA (10%)	Reduced browning of slices	-	-	Adiamo *et al.*, 2017; Babiker and Eltoum 2014; Eltonum and Babiker, 2013
Walnut	*Juglans* spp.	GA enhanced with γ-aminobutyric acid (GABA)	Reduced PPO; higher PAL and whiteness index	Lower peroxide lipoxygenase value plus lessened H_2O_2 and malondialdehyde accumulation	-	Ebrahimzadeh *et al.*, 2019

3. Significance of GA-based coating in relation to marketability and nutritional value

Marketability is an important factor from the economic perspective of the horticultural crops. Being perishable in nature the shelf-life of such commodities is generally very short and is have limited time of marketability. Thus, utilization of different GA based coatings on fruit can help in extending the market period for even highly perishable fruits such as carambola by maintaining the quality of fruit (Gol *et al.,* 2013). Marketable percentage is positively correlated with acidity, firmness, total chlorophyll, *etc.,* and negatively correlated with, decay, weight loss, TSS, rot, antioxidant, *etc.* Hence, physiochemical changes during ripening of fruits also affects-consumer acceptance (Gioushy *et al.,* 2022). Physiological weight loss, and incidence of decay rise as a result of increased transpiration rate, ethylene generation, and cellular disintegration leading to decrease in marketable percentage (El-Khalek, 2018). The cause for fruit weight loss and fruit decay percentage are mostly thought to be the water exchange between the internal and exterior atmosphere (El-Abbasy *et al.,* 2019). Since GA can reduce the effect of atmosphere as a post-harvest coating, GA based coatings can be utilized in enhancing the marketability of fruits and vegetables (Gioushy *et al.,* 2022; Mohammadi and Saidi, 2021). Moreover, GA coating along with extended postharvest shelf-life, it also helps in retaining nutrients as reported in matured green capsicums (Amirthaveni and Daga, 2016).

4. Glazing of gum Arabic on some important fruit and vegetables crops

GA (1%) with chitosan (1.5%) and rice bran oil (1%) combinedly were found effective at room temperature for temporary storage of 'Nam Dok Mai Si Thong' Mango (Sae-tang *et al*., 2020). GA (5%)

coating on mango cv. 'Kesar' improved quality and extended shelf life (Patel and Patil, 2017). Mango cv. 'Kesar' coated with GA (15%) show minimum physiological loss, maximum firmness with prolonged shelf-life up till 18 days (Ganvit *et al.,* 2014). Coating of GA (1%) mixed with glycerin (2%) on plum cv. 'Fazle Manan' fruits placed in soft board carton show good storage stability (Sohail *et al.,* 2014). Physicochemical characteristics, texture profile along with antioxidant activity of coated apricots were also found to be better (Wani *et al*., 2017). GA (10%) application on cherry fruits lessens the respiration rate and ethylene synthesis, which subsequently enhanced shelf-life and postharvest quality (Mahfoudhi and Hamdi, 2015). Application of calcium lactate (2%) solution followed by coat of GA (1%) and glycerin (2.5%) mixture on peach fruits maintains overall acceptability with decrease in decay index and weight loss (Asghar *et al.,* 2014).

GA (10%) enriched with cinnamon essential oil (1%) or with oleic acid (1%) plus CEO (1%) sustained the quality and appearance of guava fruit and improved storability (Pereira *et al.,* 2021; Etemadipoor *et al.,* 2019). GA (10%) coating preserved quality of guava cv. 'Shweta' fruit stored at room temperature (Gurjar *et al*., 2018). Coating of GA (5%) with tulsi extract (2.5%) delayed ripening of guava cv. 'Desi' with enhanced overall acceptability of fruits (Murmu and Mishra, 2017). GA (10%) treatment preserve the quality of banana cv. 'Grand Nain' for up to 9 days (Alalia *et al*., 2018). Application of GA (10%) and Jojoba oil (5%) mixture on date palm cv. 'Zaghloul' limits the water loss, retain firmness and bioactive components during cold storage (Aboryia and Omar, 2020). GA (10%) coating on 'Kinnow' mandarin minimized the decay loss and preserved quality of fruit throughout the storage (Ahlawat *et al.,* 2018). GA (1%) in combination with several other natural fruit glazes maintained 'Kinnow' mandarins' quality after harvest (Ali *et al.,* 2015). Desirable results of GA (5 and 10%) on 'Olinda Valencia' orange have been noticed but chitosan found to be more effective (Khedr and Ali, 2017). GA on 'Sweet Lemon' fruits at 5% and 10% concentrations preserved solids soluble and vitamin C (Eskandari *et al.,* 2014). GA extend the shelf-life of Daisy mandarin fruits for 30 days under ambient condition (Figure 6). Similarly, the combination of GA (0.5%), maize starch (0.5%) and micro-perforated Xtend® polyliner decreased respiration rate, weight loss with preserved overall quality of pomegranate cv. 'Wonderful' (Kawhena *et al.,* 2022). Coating of GA (1%) combined with clove oil (0.5%) extended the life of 'Camarosa' strawberry fruits after harvest with maintained visual appearance, reduced weight loss and decay incidence (Jodhan and Nataraj, 2019).

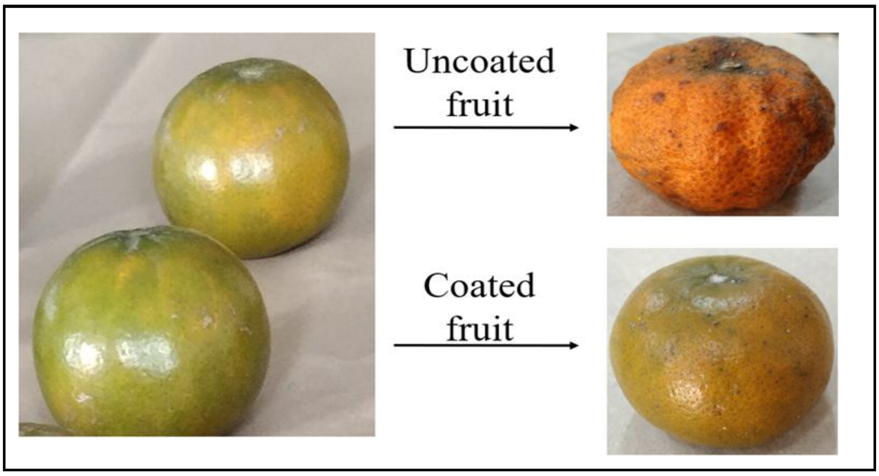

Figure 6: Effect of GA coating on Daisy mandarin fruits after 20 days after treatment.

GA (10%) combined with natamycin (200 mg/l) coating on black 'Périgord' truffles arrest changes in volatile organic compounds (VOCs) resulting in preservation of truffle aroma profile during the storage phase (Choo *et al.,* 2021). Similarly, GA (1%) mixed with CMC (1%) and glycerol (1%) coated 'Button Mushroom' stored at refrigeration temperature in heat sealed LDPE packaging show increased shelf-life due to reduced metabolic activity and respiration rate (Srivastava and Bala, 2016). Application of anti-browning solutions with emulsified GA coating solution, *i.e.*, GA (5%) mixed with edible soybean oil (1.3%) and Tween-80 (20%) lessened the softening and weight loss of the 'Button mushroom' (Sedaghat and Zahedi, 2012).

5. Scope and conclusion

GA have been succesfully utilized on various whole fruits and presented fruitful results in preserving fruit quality. It has been successfully applied in combination with essential oils, fruit peel extracts and in novel approaches' nano particles are also incorporated in the GA to improve its effect (Hedayati and Niakousari, 2015; Le *et al.,* 2021). Despite its various beneficial properties, sometimes GA based coatings fail to outperform other similar coatings in maintaining the postharvest quality of fruits (Handojo *et al.,* 2022; Wani *et al.,* 2021). Several such cases have been reported in different fruits, so it becomes very important to consider suitable coating according to the fruit for better economic results (Totad *et al*., 2019; Mani *et al.,* 2018). In future, with gradually increasing demands of fresh cut fruits in customers' more research on effects of GA glazing on shelf-life and quality of fresh-cut fruits is needed. The application of other edible coatings have been found to maintain fresh-cut fruits' quality at storage and transportation level with sufficient shelf-life throughout the distribution (Maringgal *et al*., 2020). This can provide a thrust to growth of value addition of fruits and prevent losses.

It can be concluded that gum Arabic (GA) plays a significant role as an edible coating on horticultural crops and helps in the preservation of quality and extension of shelf-life. GA exhibits exceptional emulsifying properties and potential for helping reduce the post-harvest losses caused due to perishable nature of fruits and vegetables. Additionally, GA can also be incorporated with many other composites such as nanoparticles, essential oils, plant extracts, *etc.*

to enhance its effect. Moreover, continued research on potential of GA for preserving various horticultural crops especially fresh-cut fruits and ornamentals is required for its safe and complete utilization.

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Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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