

Post Harvest Operation in Minor Fruits of Temperate and Subtropical Type

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ABSTRACT

A wide array of fruits is available in the market which we consume daily. But apart from these group of fruits there are some other categories of fruits also which are not often seen in the market and are less available and known to us. These are the underexploited league of fruits which are fewer seen. These fruits though have a huge stock of various nutrition's beneficial to us, but the problem is that they are less exploited. Furthermore, the minor fruit can also be differentiated according to their climatic requirement. Some may be the minor of tropics and other may be of temperate and subtropical origin. However, our country with its diversified climatic situation serves a great habitat for plants of all kind. These plants on the other hand help in feeding the nearby and rural population from their outputs. But today the country of ours is facing loss tremendously in the post harvest sector. The consumers are also getting aware of the food

security. Hence as these minor fruits are highly rich in important aspects, it is very much necessary to get desirable value added outputs from them so that unutilized fruits may get utilized, losses gets minimized and the fruits may not further remain lesser known.

Keywords Fruits, Temperate, Subtropical, Minor, Underutilized.

INTRODUCTION

Fruits are those substances which are indecisively very much important for maintaining the functional inputs of our body and not only this they have a huge export potential and can be highly transformed into various sorts of processed commodities. Today fruits are been felt as a crucial birthplace of market related activities and are gaining importance every day (Viswanath *et al.* 2018). Now in this group of fruits the minor fruits are classified as those type of fruits which are eaten by us but are comparatively a low in appetizing values then the major ones, also the requirement for them in the market is less. Furthermore, the cultivation of this category of fruits has been restricted to a low and in general there commercial growing is not being followed (Srivastava *et al.* 2017).

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Also, the minor fruits are divided as per the temperature condition in which they are cultivated upon. Not only this a particular crop because of its wide cultivated area and consumer choice can be major in a particular region or country, but the same crop in another landscape, variable geographical distribution or distinct country may be minor because of its limited growing and demand. The paper here is mainly discussed regarding minor fruits of temperate and subtropical type of our country. Today every consumer out there is smart, active and aware. People today like to think about the food value of the inputs they are consuming. Everyone today who is a bit aware and tries to keep themselves off from the unwanted chemicals and the artificial category of edibles and the preference is shifting towards naturally enriched food reserves (Viswanath *et al.* 2018). The group of fruits which are till date categorized as the minors have a significant part to act in supplementing the proper nutrition to the people, as these fruits have a typical flavor and extremely high medicinal property (Ravani and Joshi 2014, Gupta *et al.* 2018). Majority of this underexploited fruits have been used as principal food in many parts of the world or being utilized because of their curative potential (Gupta *et al.* 2018). From studies it has been found that the percentage share of the underutilized fruits in our country is about 27%. As told, they not only serve as major food in many parts but also act as the fruit to get the substitutional origin of capital. It is proven that in wild parts these fruits can be grown without requirement of proper care and management (Srivastava *et al.* 2017).

The problem of post harvest losses from fruits always is a matter of concern all cross the globe and the situation is more profuse in the third world countries as compared to the first world one. In these areas near about 30-40% losses occur due to inappropriate post harvest care and management and this sums up to a monetary value of crores of Indian currency. Therefore, it becomes very much important that proper steps after the harvest of the produce should be taken in order to make sure profitable returns to the persons involved at all levels (Viswanath *et al.* 2018). Value addition is one thus process where the commodity is replaced with a substance which is worth of higher value (Sharma *et al.* 2014, Srivastava *et al.* 2017). Therefore, as these underexploited fruits

possess tremendous nutraceutical importance and they can be changed in various accepted form of post harvest processed products, the paper here mainly deals about the processing and value addition of the underutilized fruits of our country of temperate and subtropical type.

Fig

Fig is a crop of crucial significance not only in the present day however its utility ranges from the very early ages. The fruit crop is significantly rich in several nutraceutical attributes and functional ingredients. As a whole the total fruit as such comprises of pulp which is around 84% in it and the remaining 16% is its outer peel (Viswanath *et al.* 2018). Various parts of the fruit crop are useful ranging from the fruit itself, to leaves and even bi-products like latex. It has been found that the latex which is extracted or obtained from the fruit crop can be very much useful in milk condensation and not only this the leaves of the tress are also very much medicinally sound which can be utilized for various pharmaceutical purposes like, helping in urine function, providing protection against mouth irritation, moisturizing the skin and curing stomach infection (Viswanath *et al.* 2018). Commodities developed from the figs are further more enriched, good in taste and have a prominent storage life. Thus, the freshly harvested raw figs are very much healthy and can be used ideally in converting them in various post harvest value added products. Fig fruits can be widely used in post harvest operations for preparation of jam, cakes and jellies. Also, various sorts of puddings and canned fig items can be prepared from them (Viswanath *et al.* 2018). In a study conducted by Kharpe *et al.* (2015) fig fruits were first dehydrated and thereafter they were transformed to powdered form and were ultimately used to prepare cookies, which added new dimension to fig processing. Candies carved out of fig fruit can become a delicacy. Furthermore, raw fig can be subjected to recommended set of dehydrated temperature to develop an optimum and desirable dehydrated product (Viswanath *et al.* 2018).

Kiwi

Another name for the fruit of kiwi is called as the Chinese gooseberry and is a very important fruit crop of

New Zealand. However, in particular to India's overview this particular one is new to the peninsular country (Vaidya *et al.* 2007). Kiwi is a minor fruit in our country, though it is a fruit of commercial importance in New Zealand. It has specifically been found that the fruit contains a wide array of health benefitting constituents. The fruit in particular is a huge reservoir of antioxidants that helps in lowering down various heart related problems and not only this consumption of it helps in prevention of certain forms of cancer and brings down the process of ageing happening in our body (Vaidya *et al.* 2007). Eating kiwi fruit not only in raw but in various processed and preserved form is also very much helpful for us. Kiwi can be converted into various forms of value-added products. Kiwi jam is one such example where pulp of the fruit can be mixed with the sugar at a ratio of 45 parts to 55 parts in order to achieve the final concentration at 68 °Brix. Kiwi fruit butter is another example of preserve product where the material possesses a brix value of 45° (Vaidya *et al.* 2007). Processing of kiwi has not been limited up to this only but subsequently some other lucrative and demandable products can also be prepared from them. Fruit leather is one such product where by using the process of dehydration, it can be prepared from the kiwi pulp, maintaining the desirable TSS and preservative constituents. Lastly toffees can be developed by incorporation of sugar and fat to the pulp which can catch up to the market trend and choice (Vaidya *et al.* 2007).

Longan

Longan is fruit which is mainly seen to be grown in the subtropical region of the country like china, however other countries like parts of Asian pacific has been seen to cultivate the fruit to a certain extent (Prasad *et al.* 2017, Huang 1995). Longan is an important fruit and it can be passed through different operations after harvest to transform it to some value added substance. Various post harvest procedures like freezing, bottling into cans and moisture removal process can be employed to create something of added utility from longan. The fruits of the longan can be preserved by removing the moisture from them by discarding their pericarp or they can be subjected to dehydration as such (Prasad *et al.* 2017). There are various process under taken by various scientists

where the methodology of conversion to dehydrated longan fruits from raw has been studied. One such method has been described in the works of Subhadra-bandhu, (1990) where longan can be dehydrated with or without their pericarp. Here in the process the fruits are first boiled then dried in sun at 55°C, then as soon as the drying starts to being the temperature is elevated to 70°C for a period of around 19-20 hours till drying is accomplished. In this method the final fruits have a moisture value of 18-19% and TSS of 60-65 °Brix (Prasad *et al.* 2017). Thus, as mention above not only dehydration but the process of freezing and bottling in cans, can be employed for longan. For freezing the fruit can be used along with the peel and when the process of thawing becomes completed there won't be any loss in aroma and flavors. Bottling and canning are also very much accepted for the fruit, also furthermore for syrupeing the juice of longan itself can be employed (Prasad *et al.* 2017, Cheng *et al.* 2014, Pham *et al.* 2013).

Mangosteen

It has been believed that the edible portion which is obtained from a mangosteen tree is in fact one amongst the best thing of the earth that appeals to our taste buds. The plant however though is of warm condition preferable type and the center of origin is in the provinces of Indonesia (Palakawong and Delaquis 2018, Gunasekera 2010). Mangosteen contains a very unique and a characteristic aroma of its own which is very much necessary to preserve. However as soon as the rind is detached from the fruit it becomes extremely problematic to contain its volatiles. Certain important and innovative approach of post harvest methods like minimal processing and low temperature treatment have been used in maintenance of certain intricate cultivars, so that their desirable attribute may remain and likewise a new product can be developed from them (Palakawong and Delaquis 2018). Apart from these two above mentioned methods other technologies with respect to post harvest operations can be adapted in mangosteen also. Mangosteen has been found metamorphosed to bottled items, candies lucrative to persons of all ages can be prepared from them and also dehydrated mangosteen products can also be developed. However, during dehydration utmost care has to be taken that due to enzymatic

activity browning of the aril should not take place, as the white color of dehydrated mangosteen aril is what is preferred (Palakawong and Delaquis 2018). As said in the overhead few lines that minimal processing is one of the important techniques in mangosteen which is now gaining up speed. The technique has become very much beneficial for selling of fast degradable fruits like mangosteen, however a lot of inedible part has to be removed from the fruit, prior to get rid of it in the market in this form. The freezing or low temperature technology is also getting extensively used in the field of mangosteen preservation. By the methods of prompt freezing the standards of the fruit can be withhold but necessary measures are required to achieve a command over the browning and also to lower down the diversities associated to texture. But that is not the matter of extreme concern as many things can be done to overcome the situation. In the work of Bennion and Shoyle (2000) it has been mentioned that enzymatic browning can be overcome by chemicals or before the process of low temperature treatment the fruits if provided with sugar syrup then also the problem can be minimized (Palakawong and Delaquis 2018). Product development from mangosteen has not been limited up to this but in a study conducted by Minh (2014) standardization for preparation of wine from mangosteen fruit was done. Mangosteen juice is another important product of its which is gaining rapid fame as it contains all the valuable nutrients of the fruit. It has been found that drinking juice of the fruit on a daily basis provides a constructive influence over our body (Palakawong and Delaquis 2018, Tang *et al.* 2009).

Bael

The fruit obtained from the tree of the bael is widely popular and accepted for its curative and therapeutic abilities. The evidence of its possessing strong dietetics is widely reflected in its riboflavin content. Studies in the past have confirmed that the fruit of bael possess riboflavin which is around 1.19 milligram per 100 grams of consumable mass (Viswanath *et al.* 2018). In the study conducted by Gehlot and Dhawan (2005) it has been shown that roots, flowers, leaves and barks also have remedial characteristics (Gupta *et al.* 2018). The bael is externally very hard and the internal pulp is very much difficult to extract. In previous work of

Viswanath *et al.* (2018) it has been said that in order to simplify the process of extraction of pulp, i.e., prior to taking to the extractor, the pulp can be mixed with equal quantities of water (as per to the weight of the pulp), thereafter addition of citric acid in order to tune the pH at 4.3 and finally warming it at 80°C for a period of about one minute can be done. The technique thus elaborated helps in easing out the extraction of the pulp from the otherwise difficult to extract fruit. In the above-mentioned process of extraction of pulp water was added as it helped in proper infusion of the mucilage throughout and thereafter temperature was provided which facilitated two things as it further dissolved the mucilage and secondly it helped in pacification of the enzymes. Therefore, the pulp ultimately obtained through this is very much viscous in nature. Gupta *et al.* (2018) in their previous work throw us an insight that how preserve and squash from bael can be successfully prepared. A dense pulp obtained from bael can be used in preparation of various other post harvest entities. Various products like nectars can be developed from them. Dehydration technology can be used for the preparation of bael leathers and bael powders can also be developed.

Persimmon

The fruit of persimmon has originated or is indigenous to the Asian subcontinent and with respect to its climatic regime it prefers low temperature situations and subtropical conditions for its proper growth and development (Curi *et al.* 2017a, Martineli *et al.* 2013, Del Bubba *et al.* 2009). The fruit of persimmon is very much demanded by consumer of various sorts in different market types. The requirement of the fruit in commercial market is very good as it contains its own typical and characteristic aroma and unique flavors. The external appearance of the fruit is also very good. The fruit can be very readily consumed and used for table purposes and like wise it can be converted into various preserved substances (Curi *et al.* 2017a). Many things can be prepared out of persimmon by incorporation of post harvest technologies which not only helps in value addition but also increases the storage life of the fruit. Some of the post harvest items which can be very much developed from the persimmon fruit are persimmon jellies and persimmon juices are which can be easily sold in the

market (Curi *et al.* 2017a).

Carambola

Due to the presence of five ridges throughout the fruit it is also called as the five-star fruit, which is majorly cultivated in the warmer parts of many regions which includes the countries of the Latin American parts. The fruit of carambola is very rich in juice having a luscious internal content and the color of the external outlook varies from green to yellow. With respect to taste the fruit of carambola is available in sugary and tart flavor (Roopa *et al.* 2012, Prati *et al.* 2002). However, regarding to the preservation of the carambola fruit there are some post harvest challenges that has to come across. The fruits high internal moisture content makes it very much perishable and along with this the inability of it to withstand low temperature conditions (situation lower than 10°C develops injury symptoms) restricts its storage in such conditions (Perez-Tello *et al.* 2001). Hence processing of the fruit through primary or secondary approach becomes very important (Roopa *et al.* 2012). The market demand and consumer preferability of various products developed from the five-star fruit are very much. Products developed from it are very much favored because as they have a bright appeal also the aroma and the internal chemical characteristic are very good. One such product from carambola is fruit jam which is less fattening, made from incorporation of certain added agents (Roopa *et al.* 2012, Abdullah and Cheng 2001). Processing of the five-star fruit has not only been limited to this but many new things are also coming up. Beverages or drinks from carambola which can be instantly used can be prepared from carambola (Soyad 1999, Abdullah Liew *et al.* 2007) and apart from these cordials which are clear and sparkling drinks, can be made out of the fruit (Yusof and Lee 1997). Furthermore, minimal processing of the said fruit has been initiated (Weller *et al.* 1997, Teixeira Gustavo *et al.* 2008). By employment of dehydration through foam mat method the puree of the fruit can be converted into useful substances (Abd-Karim and Chee-Wai 1999). Many scientists have studies and have demonstrated many ways in order to bring the process of dehydration into the post harvest betterment of the fruit. In the previous works of Mauro *et al.* (2005), Ruiz-Lopez *et al.* (2011) and Roopa *et al.* (2012) they have conducted their

research and study regarding the osmotic dehydration of the five-star fruit.

Loquat

The fruit crop of loquat is indigenous to the continent of Asia which includes the parts of India, Japan and China. These are the few places where the farming of the fruit has very much taken up. The fruit though conventionally is of subtropical type but can also be successfully grown in low as well as high temperature regimes (Curi *et al.* 2017b, Morton 1987, Gong *et al.* 2015). The extraction of the pulp is a challenge in the post harvest operation or procedures for the fruit of loquat. In order to extract out the pulp from the fruit, first of the fruit is needed to be divided into four segments and the seeds has to be separated, thereafter water has to be incorporated at the ratio of 1: 4 to the pulp and finally warming up or heating the mixture has to be done for a period of another 30 minutes. Later on, the paste which is thus obtained has to be screened to get the ultimate filtered juice (Curi *et al.* 2017b). Once the clarified juice has been obtained from the fruit, it can be prepared in various sorts of value added products. Jelly is an important commodity which is developed from loquat. As per the works of Curi *et al.* (2017b) loquat jelly can be prepared by sugar and pulp in ratio of 1:1 with 1.5% of pectin which was added after the boiling has accomplished (Macanuda, SC, Brazil). The final product had a brix value of 65° (Curi *et al.* 2017b). Loquat can also be turned into dehydrated loquat slices which also have a market value and importance of their own.

Wood apple

Wood apple is another fruit which can be turned into different types of post harvest items so as to preserve them for an extended period of time with an adequate shelf life. They can be made available to the households in their offseason and furthermore if a majority of the production share goes to processing then the market glut during the on season would also be checked to a considerable extent (Ravani and Joshi 2014). Various forms of Intermediate Moisture Foods can be developed from wood apple which are tasty as well as nutritious. Wood apple jam is an example of one such type of food which is very thick, healthy

and contains good flavor (Ravani and Joshi 2014; MacLeod and Pieris 1981) as for preparation of jam mature fruits are only used and during maturity the flavor completely develops (Ravani and Joshi 2014), Aside with the Intermediate Moisture Foods, dehydration is also readily used for wood apple to prepare commodities. Leathers developed from wood apple are very functionally rich and can be well accepted. These bars carry an appreciable amount of innate sugars and fibers. Wood apple can also be converted into powder form by the process of freeze drying and subsequently used. In the study conducted by Mozzem *et al.* (2019) beverage from freeze dried wood apple powder was created and it was found that the permissibility of the product to the consumer was good. Wood apple juice can be mixed with other fruit juices or sources which yielded very good quality consumable beverage (Ravani and Joshi 2014).

Rambutan

The fruit of rambutan has been originated in south eastern part of the Asian continent. The fruit is associated with the family of Sapindaceae, in which some sub tropical types of fruits come from, like for example litchi (Marisa 2006). This particular fruit of rambutan is very much commonly cultivated in the Asian region, where in the province apart from being used up for table purpose it is also bottled as like in caning and is being converted in many processed forms. The fruit is in great demand because of its particular flavor (Sukasih and Setyadjit 2015, Ong *et al.* 1998). Rambutan, as said can be converted into many post harvest or processed items which further increases its popularity. One such way of making available the nutritive properties of the fruit readily to the consumers is by converting the fruit into fruit juices. Also, development of rambutan juice provides a newer dimension to the processing sector (Sukasih and Setyadjit 2015). Various new things can be tried while preparation of juice from the fruits of rambutan as it would again enhance its consumer appeal but can also elongate the storage life. Development of pulpy juicy is a very innovative approach towards rambutan processing. In the work conducted by Sukasih and Setyadjit (2015) such type of pulpy juice from rambutan was prepared by further incorporation

of citrus pulp.

CONCLUSION

Our country is an agriculturally based country and majority of the population still lives in the rural areas, thus these people in spite of consuming the mainstream fruits they usually eat the fruits which are easily available to them and those are the minor and under exploited. These groups of fruits through their sound functional status and tremendous ability to get converted into various value added substances acts as a crucial part in the income reliability of the village people as chances of employment generation increases and developed capital earnings happen. Furthermore, the great advantage of these minor groups of fruits is that they can be grown with least amount of care and money investment. Therefore, they become very easy to cultivate. Hence in the present-day situation it is very much required that the cultivation scenario of these types of fruits which are underexploited should be increased. Focus should be provided that the raising of these crops should be done in systematic layouts which would ultimately result in their development. Finally, more and more care has to be provided towards the processing sector. More ways to create value added products from them should be find out so that the utility of these lesser-known crops can be greatly increased.

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