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Value Added Products from Ber

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A B S T R A C T

Ber (*Zizyphus mauritiana* Lamk) belongs to the *Rhamnaceae* family and is also called as jujube. It grows in arid and semi-arid regions of India and there are 125 varieties of b*er* in India. The cultivars Umran, Kathapal and Gola are the most promising varieties of *ber* in North India. Although known for its rich taste and high nutritional value, ber is an under utilised fruit and is available only for a short period of time. Value addition is a great way to increase the shelf life of the product along with adding economic value to it. It is an effective to use the surplus and meet the demands during scarcity. In the following review different processing aspects of *ber* are discussed and ways in which we can utilise this under-appreciated fruit to its full potential. Products like jam, candy, preserve, powder, murabba, beverages, wine, pickle etc. can be prepared from *be*r. Apart from this *ber* is also used in traditional medicinal systems in India and other countries.

Introduction

India is one of the few countries in the world where climatic variations allow production of different types of fruits and vegetables. The Indian arid zone covers around 12 % of country's geographical area occupying 31.8 million ha of land. It covers parts of Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, Punjab and Rajasthan states of India. With the increasing biotic pressure, most of the arid and semi-arid regions are confronted with the challenges of producing more per unit land with uncertain and dwindling supplies of water. *Ber* (*Zizyphus mauritiana* Lamk) is one such fruit that has stood the test of such climatic conditions and can be easily grown. It grows even on marginal lands or inferior soils where most other fruit trees either fail to grow or give very poor performance (Nandwani and Duquesne, 2014). It is regarded as the king of arid zone fruits and also as poor man's apple. There are three main species found in the country. The *Z. mauritiana* is the main species of commercial importance with its several varieties. *Ber* belongs to the Rhamnaceae family and is also called as jujube. The area under cultivation with this fruit is 8.7 lakh ha with an annual production of 8.9 lakh tones in India (Baloda *et al.*, 2012). About 125 varieties of *ber* are

available in India. A few of these varieties are known for taste, size, amount of pulp and higher yields. The cultivars Umran, Kathapal and Gola are the most promising varieties of *ber* in North India (Azam-Ali *et al.*, 2001).

Most fruits are seasonal and highly perishable and it is estimated that the total loss of fruits in India, for want of adequate post harvest care, transportation and storage is around 20-30 per cent (Madan and Ullasa, 1993).

Desiccation damage in *ber* is caused by high cuticular transpiration, which is reported to be associated with high levels of fatty acids and low levels of aldehydes and alcohols in the wax cuticle rather than with the thickness of the cuticle and wax itself (Rao *et al.*, 1981). *Ber* is a seasonal fruit and can be made available throughout the year with different food products with longer shelf life.

Value addition

Selling the products at the lowest market value just to survive economically is not sustainable. It can lead to stress on the land as well as on the farmer. "Value-added" is simply anything we can do to raise the value of our product in the market. Value-added practices are key to future of sustainable farming, because they enable growers to advance economically without having to "pump-up" the production of raw materials from the land. USDA defines value addition as:

A change in the physical state or form of the product (such as milling wheat into flour or making strawberries into jam).

The production of a product in a manner that enhances its value, as demonstrated through a business plan (such as organically produced products).

The physical segregation of an agricultural commodity or product in a manner that results in the enhancement of the value of that commodity or product (such as an identity preserved marketing system).

As a result of the change in physical state or the manner in which the agricultural commodity or product is produced and segregated, the customer base for the commodity or product is expanded and a greater portion of revenue derived from the marketing, processing or physical segregation is made available to the producer of the commodity or product (http://www.agmrc.org/business-development/getting-prepared/valueadded-agriculture/articles/usda-value-added-ag-definition/)

Advantages of value addition are:

Improve the profitability of farmers
Reduces the glut in market during peak season of produce
Produce that cannot be stored can be converted into value added product increasing the profit
Empower the farmers and other weaker sections of society especially women through gainful employment opportunities and revitalize rural communities
Provide better quality, safe and branded foods to the consumers
Odd looking fruits and vegetables (too big to too small in size, overripe, partially infected, etc) can be easily converted into value added products
Emphasize primary and secondary processing
Reduce post harvest losses
Reduction of import and meeting export demands
Way of increased foreign exchange
Encourage growth of subsidiary industries
Reduce the economic risk of marketing
Increase opportunities for smaller farms and companies through the development of markets

Diversify the economic base of rural communities
Overall, increase farmers' financial stability

It is a paradox in India that even though we are the 2nd largest producers of fruits and vegetables in the world but our shard in world food trade is a merely 1.6%. The post harvest losses in India are estimated to be 3-16% which amount to a whopping 92,651crores. Only 2% of fruits and vegetables are India is processed even though we have a large population of middle class with apt purchasing power and a young generation that is open to new food choices (http://mofpi.nic.in/e-book). The next logical step after self sufficiency in food production after green revolution is to increase the quality of food.

In times when time is of essence, food that can last longer with high nutritional value is preferred by the customer. That is where preservation of food through value addition comes in. People don't want to preserve food at home and want food that can easily be consumed and are healthy at the same time. Value addition is the need of the hour due changing market trends and changing lifestyle.

Moreover, some of these values added or preserved products such as canned mangoes, fruit juices, salted cashews, dehydrated foods, and frozen fruits are gaining popularity in the foreign market and are good foreign exchange earners. Value addition can be achieved by processing the fruits into various forms. These forms are liquid and solid, semi-solid and solids forms. Liquid forms include unfermented beverages (pure fruit juice, fruit juice beverage, squash, cordial, crush, fruit juice concentrate, RTS, nectar, crush, syrup, sarbat, barley water, carbonated beverage) and fermented beverages (alcohol, vinegar), puree, sauce, ketchup etc. Semi-solid forms include pulp, jam, jelly, marmalade and chutney. Solid forms include canning, drying, preserves, candy and pickling (Devi *et al.*, 2015).

Nutritional value of ber fruit

Indian *ber* is mainly valued for its sweet, sour and delicious fruits. The ripe fruit is of great medicinal value and supports blood pressure lowering, aids stomach and diarrhoea infection, cures sore throat and regulates excess bile secretion. The pulp of the *ber* fruits is of most importance in relation to nutrition.

The *ber* fruit pulp has high sugar content (sucrose, glucose fructose and starch); it is, therefore, high in carbohydrates, which provide energy. The fruits also contain protein with many essential amino acids like asparginine, arginine, glutamic acid, aspartic acid, glycine, serine and threonine (Bal, 1981). It contains good amount of vitamins A, B complex and C in comparison to other fruits (Anon 1976). *Ber* fruits are also higher in calorific value and ascorbic acid as compared to apple and orange. It is also rich in calcium, phosphorus and protein (Jawanda and Bal 1978).

Caffeic acid, p-hydroxybenzoic acid, ferulic acid and p-coumaric acid are predominant phenolics reported in *ber* (Tanmay *et al.*, 2011; Ayaz *et al.,* 2012) which account for its significant antioxidant activity, reducing power activity and scavenging of free radical activity (Krishna and Parashar, 2012). Indian *Ber* contain good source of ascorbic acid and total phenolics ranging from 19.54 to 99.49 mg/100g and 172 to 328.6 mg GAE/100g respectively (Koley *et al.,* 2011) and average antioxidant activities were 1.6–6.33 and 1.22 –5.49 μ mol TE/g as the CUPRAC and FRAP assays, respectively (Krishna and Parashar, 2012).

Different value-added products that can be

prepared with *Ber* are:

Ber candy
Ber jam
Ber preserve
Dehydrated and sundried *ber*
Ber beverages
Ber pickle

Ber candy

Singh *et al.,* (1944) standardized the candying of *ber*. The punctured fruits were cured in brine for 6-7 days, washed free of salts and boiled for 2-5 minutes to soften them. Sugar syrup of 30°B having 0.1% citric acid was then poured on the fruits which were kept submerged for 24 hours. The density of the syrup was raised gradually to 75°B in a course of 10-12 days. The syrup was drained to and fruits were dried in shade to make *ber* candy. Singh (1975) did not recommend curing in brine but the latter process was same.

Kaikadi *et al.,* (2006) prepared *ber* candy from 'Umran' cultivar by slow syruping method. For this, mature *ber* fruits after pricking, destined and blanched in hot water for 5minutes. Sulphur fumigation was done @ 2g/kg for 2 hours. Then sugar syrup of 40° Brix was prepared and fruit was added to it. At this stage, 1 per cent citric acid was added and stored for 24 hours. Next day the strength was increased by 10° Brix with addition of 1 per centcitric acid. The process was repeated till 70° Brix was reached with addition of 1 per centcitric acid. The fruits were stored for 7-8 days. The fruits were washed quickly and dried in shade until the moisture content was below 18 per cent. The moisture, reducing sugar, total sugar and ascorbic acid content was 19.8%, 29.5%, 77.0% and 24.8 mg/100g, respectively. In all cases, storage container was not found to have significant influence on any chemical component of *ber* candy.

Kumar *et al.,* (2007) prepared RTS using *ber* powder at different concentrations of 5, 10 and 15% and recorded ascorbic acid from 2.02 to 6.03%, reducing sugars from 3.87 to 4.36% and non-reducing sugars from 6.28 to 6.77%. The total sugars content was 10.64%. All the RTS prepared could be stored safely up 00000.to 3months and were liked moderately during storage. Take and Bhotmage (2012) prepared candy from *ber*. Cleaned and matured pricked *ber* fruits were subjected to sodium metabisulphite and blanching treatments. The latter process remained more or less the same. Results showed that candy treated with sodium metabisulphite scored higher than that of blanched with hot water.

Ber jam

Jams are most popular fruit preserves (or) conserve is the product prepared from whole fruit, pieces of fruit, fruit pulp or fruit puree and with or without fruit juice or concentrated. Fruit juice as optimal ingredients and mixed with carbohydrate sweetener, with (or) without water and processed to a suitable consistency" (Ranganna, 1977).

Dubey *et al.,* (2014) evaluated the quality of *ber* jam during storage period. The physicochemical attributes of *ber* jam results showed that there were slight differences in the various constituents of *ber* jam made on 0.2 and 0.3% citric acid. The *ber* jams contained moisture 29.16 % and 29.80%, pH 3.69 and 3.90, TSS 70° B, acidity 0.5%and 0.57%, ascorbic acid 27.03 and 27.98 mg/100g, reducing sugars 19.23 and 19.10%, non reducing sugars 39.78 and 40.62%, calcium 9.01 to 9.95 mg/100g and phosphorus 4.02 and 4.33 mg/100g product, respectively. A gradual decrease in ascorbic acid content and calcium content was reported in the *ber*

jam. It was concluded that the *ber* jam having 0.3% citric acid could be well stored upto 60 days without deterioration of the product quality.

Sucharitha *et al.,* (2012) evaluated the quality of *ber* and pineapple jam during storage period for their significant nutritional and medicinal value. It was found that the final product which consists of *Ber* pulp (60% w/w), pineapple pulp (40% w/w), and sugar as its major ingredients, the energy was 493.4 Kcal, 121.5 of carbohydrates and 1.056 of proteins and 0.31g of fat for 100g. The carotene and Vitamin C content of the Jam were 30.75 µg, 95.4 mg. The calcium and iron content in the final product was 30.1mg and 2.355mg respectively. Other micronutrients magnesium and Potassium content was found to be 35mg and 27.38mg respectively for 100g. Goyal *et al.,* (2008) studied the vitamin C content and overall acceptability of *ber* jam. It was observed that the content in the raw *ber* was found to be 84 mg/100g whereas it was recorded as 27.32 mg/100g in *ber* jam.

Ber preserve

Mature fruits can be used to make a preserve, known locally in India as murabba. Fruits of the cultivars Umran, Banarsi, Karaka and Kaithli are the best for the preparation of preserve (Pareek, 2001).The best preserve is made from fully mature fruits that are at the hard stage. Ripe fruits are not suitable since the structure will be too soft.

Khurdiya and Singh (1975) standardized the process of *ber* murraba. Fully mature *ber* fruits wer blanched in boiling water for 6 minutes followed by rinsing in cold water. The fruits were then peeled and pricked. Destoning with cork borer could also be done, if desired. The prepared fruit was kept overnight in 20 to 30 per cent sugar syrup containing 0.5 per cent citric acid. Next day more sugar was added to the syrup at the rate of 250 g per 'kg of prepared fruit and boiled for few minutes, the process being repeated on fourth and sixth day. After one week, the syrup was concentrated to 70 per cent. Murraba thus prepared could be stored easily for a year.

Goyal *et al.,* (2008) studied the vitamin C content and overall acceptability of *ber* preserve. It was observed that the content in the raw *ber* was found to be 84 mg/100g whereas it was recorded as 50.83 mg/100g in *ber* preserve.

Dehydrated and sun-dried ber

When 85–88 % moisture is evaporated artificially from fruits or vegetable slices, either by keeping them in the sun or under controlled temperature and humidity conditions inside an oven, this is known as drying. Drying done by sun exposure is sun drying; when done under controlled temperature and humidity in a closed chamber (dehydrator), this is known as dehydration. The main idea behind dehydration or drying is to reduce the moisture level to a point where microorganisms cannot grow.

Ber fruit has high nutritive value, especially carbohydrates and vitamin C with good amounts of minerals like phosphorus, calcium and iron and high sugar to acid ratio at ripe stage. These attributes are ideal for a fruit to be dehydrated. Kumar and Nath (2002) studied dehydration of *ber* fruits and reported that there was non-significant difference in pretreatment and osmo-drying on fat content of *ber* fruits. The ash content of pre-treated air dried fruits was highest (0.63 per cent) as compared to untreated osmo dried fruits (0.51 per cent) and pre-treated osmo air dried (0.43 per cent).

For making a superior dried product with *ber*, the fruits should be blanched for 5 minutes in boiling water before dehydration (Pareek,

1983). Khurdiya and Singh (1975) have recommended exposure of the blanched fruit to sulphur dioxide fumes in a sulphur box by burning sulphur powder at the rate of 3.5 to 10 g per kg of fruit for 3 hours. They are dried to 15-20% moisture. The dehydrated fruit can be eaten as such or can be reconstituted in 10% sugar solution to be consumed as liquid beverage. Powder from *ber* fruit can be rehydrated into RTS beverages (Kadam, 2001).

Khurdiya (1980b) studied the effect of dehydration on different varieties of *ber*. 'Umran, 'Bagwari' and 'Chhuara' varieties were good for drying. Fruits having golden yellow to reddish brown colour were found superior for drying. Sulphuring at the rate of 150g\8kg of fruits was considered optimum. The rate of browning increased during storage for 6 months at room temperature (21-38°C). All the varieties except 'Ilaichi' were found acceptable organoleptically. Chawan *et al.*, (1993) studied processing of *ber* and papaya and indicated that the overall organoleptic score of bertuty-fruity was better than that of papaya tuty-fruity.

Kumar (2006) prepared *ber* powder by dehydrating ripe *ber* fruits using sun drying and oven drying techniques with different pre-treatments and reported that the powder contained total sugars 57.38%, reducing sugars 36.98%, non-reducing sugars 20.40% and ascorbic acid 35.17%. Nutritional composition of *Ber* candy in terms of moisture content, TSS, ascorbic acid, acidity, total sugars and reducing sugar was found to be as 10.08 %, 48 °B, 95.97 mg/100gm, 0.225 %, 21.65 % and 9.67 % respectively (http://vikaspedia.in/agriculture/post-harvest-technologies/technologies-for-agri-horti-crops/preparation-of-*ber*-candy). Kumar and Nath (2002) developed the conditions for preparation for chuhura like products from *ber* by osmo-air drying process. 'Umaran', a commercial variety of *ber*, was pre-treated by dipping in boiling 1% NaOH solution for 1 min followed by rinsing in water and 5% citric acid and dipping in 4000 ppm KMS solution for 12 hours. Pre-treated bets when osmotically dried using 30 - 60°Brix sugar syrup reduced moisture content from 84.4 to 48.4%. Further drying at 52±2°C for 29 h in a cross flow cabinet air drier gave yellow, sweet, chewable and appealing product with 12.7% moisture. Its water activity was 0.43 and the product stored well under relative humidity of 40.0 - 56.3%. Gupta and Kaul (2011) prepared Chuhura-like product from *ber* by osmo-air drying process Before making chuhara, the *ber* (*Zizyphus mauritiana* Lamk.) fruits were subjected to different pre-treatments, viz., lye peeling (5% NaOH for 5 min.), citric acid treatment (5% for 5 min.) and KMS treatment (@ 4000 ppm for 12 h). Pretreated *ber* were dipped in different sugar concentrations of 40, 50, 60 and 70° Brix at 24, 48 and 72 hours. The treated fruits were then dried at 52°C for 6 h in a dehydrator till a chewable and appealing product was developed. Sensory evaluation revealed that 70°Brix at 72 hours gave best chuhara-like product from *ber* through osmo-air drying process and could be an acceptable product.

Bajaj (2013) prepared value added products with *ber* powder from Gola, Umaran and Kaithali varieties. The acidity, total soluble sugars/acid ratio and browning of powders ranged from 2.09 to 2.19%, 8.82 to 9.66 and 0.08 to 0.09, respectively. The moisture, crude protein, crude fat, crude fiber and ash content of *ber* powders varied from 5.21 to 5.68, 6.92 to 7.83, 0.99 to1.07, 3.52 to 3.91 and 4.27 to 4.49%, respectively. The total soluble sugars, reducing sugars and non reducing sugars content of powders ranged from 19.08 to 20.17, 3.61 to 3.98 and 15.47 to 16.19%, respectively. The calcium, iron, magnesium and zinc content of powders varied from 148.56 to 153.63, 17.87 to 18.65,

84.43 to 90.33 and 0.91 to 0.98 mg/100g, respectively. The ascorbic acid and β-carotene content of powders varied from 46.77 to 48.23 and 2.38 to 2.94 mg/100g, respectively. The *in-vitro* protein and starch digestibility of powders ranged from 76.53 to 78.53 per cent and 40.13 to 41.80 mg maltose released/ g powder, respectively. All the powders were studied for shelf-life for two months and were found to be organoleptically acceptable during storage. Powder of Umran variety of *ber* was used for the development of value-added products due to superior qualities. The products were developed under four categories which included traditional (custard and *kheer*), baked (biscuits and cake), extruded (pasta and noodles) and unfermented beverage (RTS beverage) by using different concentrations of *ber* powder. All the baked products had good acceptability scores. The traditional products and extruded products were best acceptable up to 30% supplementation while and unfermented beverage up to 20% supplementation with *ber* powder. Results of nutritional analysis indicated that all the nutrients content increased as the supplementation level of powder increased except the protein content of baked and extruded products. All the stored products were organoleptically acceptable except RTS beverage prepared using 40%*ber*powder. Biscuits prepared with 10, 20 and 30% and pasta, noodles and RTS beverage prepared with 10 and 20%*ber*powder were best acceptable among all during storage.

Ber beverages

All drinks, unfermented or fermented, sweetened or unsweetened, are designated as beverages. It includes squash, nectar, crush, wine, RTS etc.

Fruit based beverages are becoming increasingly popular in the market with the growing consciousness of people in the nutritive value of fruits (Srivastava and Kumar, 2002).Investigations on preparation of various products from *ber* fruits (*Zizyphus mauritiana*) were conducted by Bal and Ranadhava (2005). They concluded that the juicy varieties such as Sanour-2, ZG-2, and Kaithli can be converted into pulp to serve as base material for squash.

Khurdiya (1980a) studied on a Ready to Serve beverage containing 33.3 % juice prepared from dried *ber* fruit after cooking and extracting the juice in a basket press. The juice had a pH of 3.75 and 19.6°Brix with 0.56% acidity. The juice extracted from *ber* fruits and processed at 80°C for 10 min. stored well for 9 months at room temperature (20-38°C). The beverage was organoleptically acceptable on evaluation. Goyal *et al.,* (2008) studied the vitamin C content and overall acceptability of *ber* squash. It was observed that the content in the raw *ber* was found to be 84 mg/100g whereas it was recorded as 39.90 mg/100g in *ber* squash.

Kavitha and Kuna (2012) studied the effect of processing on antioxidant properties of *ber*. *Ber* fruit was blanched and RTS was prepared to evaluate the antioxidant activity by different methods, viz. DPPH radical activity, reducing power assay, superoxide anion radical activity, TBARS, total phenolic content and total flavonoid content. Blanching of *ber* fruits enhanced the total flavonoid content and super oxide anion radical activity but, at the same time, it reduce the scavenging radical activity, reducing power activity and total phenolic content compared to fresh fruit. Secondary processing of *ber* fruits slightly slowed down the scavenging radical activity, reducing power activity, total flavonoid content and total phenolic content but raised the super oxide anion radical activity in RTS *Ber* beverage. TBARS activity of fruit increased 29% on blanching and 52% in RTS *ber* beverage. Younis *et al.,* (2014) prepared wine from ripe guava and *ber* fruit. Juices of

both the fruit were used to prepare wine. Further the juices were adjusted with different TSS as 10, 15, 20, 25 and 30% by adding cane sugar in powder form and samples were fermented at 30 °C. It was seen that juice having TSS 15% showed higher ethanol production as compare to juices having different TSS in both guava and *ber* fruit juices. 15% TSS juices were further adjusted with different pH by using diluted NaOH and H_2SO_4 and kept for fermentation at 30°C. It was shown that *ber* and guava juices having pH 4 yield higher alcohol as compare to samples having different pH. It was also seen that there was very less production of alcohol percentage in case of *ber* juices.

Jakhar and Pathak (2012) prepared RTS by blending *ber* and *jamun* pulp. The different blending ratios of *ber* and *jamun* pulp were 75:25, 50:50, and 25:75, respectively. RTS using 100 per cent *ber* pulp and 100 per cent *jamun* pulp were also developed. They found that RTS prepared using 25% *ber* pulp and 75% *jamun* pulp scored highest mean scores followed by RTS prepared using *ber* and *jamun* pulp in the ratio of 50:50 and RTS prepared using 100 per cent *jamun* pulp. All the prepared RTS blends were organoleptically acceptable. There was a gradual decrease in organoleptic score of the blended RTS beverage during the storage period at room temperature. The RTS was found acceptable up to five months of storage.

Ber pickle

Pickling is the process of preserving or expanding the life span of food by either anaerobic fermentation in brine or immersion in vinegar. *Ber* fruit are highly mucilageous, have low acidity and are not ideally suitable for pickling. Shobha and Bharati (2007) standardized the procedure for pickling of *ber* as a form of value addition. The acidulants used in pickle preparation were lemon and salt and three variants were prepared with varying concentrations of salt, lemon and spices. When freshly prepared, vinegar based pickle scored maximum for texture (2.73) and taste (2.86) compared to lemon based pickle. Lemon treated pickle was better accepted up to three months of storage compared to vinegar based pickle, both at the laboratory and consumer level. With the advancement of storage the loads of bacteria increased in pickle with lemon as acidifying agent. There were no fungal colonies in the vinegar added pickle throughout the storage period.

Medicinal uses

Ber contains numerous ethnopharmaceutical compounds. These include ascorbic acid, thiamine, riboflavin, bioflavonoids, alkaloids, pectin A, glycosides (spinosins, saponins, triterpenoic acids, betulinic acid and oleanolic acid) and lipids (Azam-Ali *et al.*, 2001). *Ber* also have neurological properties (hypnotic-sedative and anxiolytic effect and cognitive activities), hypotensive and antinephritic effect, cardiovascular activity, immunostimulant effects, antifungal, antidiabetic, antiallergic, antiulcer, anti-inflammatory, antispastic, antioxidants and antibacterial activities (Azam-Ali *et al.*, 2001).

Uses of *ber* not only involve its use as food ingredient, but it also has diverse uses in traditional medicine. This knowledge is passes down from generation to generation and may or may not be based on knowledge of the constituents of the *ber* fruit. The traditional medicinal uses of *ber* are culturally relevant in areas where the production of *ber* is abundant. Those that are prevalent and used consistently are summarised below. According to Ayurveda, the fruit of *Z. nummularia* is cooling, digestible, tonic, aphrodisiac, laxative and removes biliousness, burning sensations, thirst, vomiting and is

also good in treating tuberculosis and blood diseases. The seeds cure eye diseases and are also useful in leucorrhoea (Oudhia, 2001-3).

The natives of Chhattisgarh, India use fresh *Z. nummularia* fruit to treat common fevers. In cases of vomiting, the seeds with bar sprouts (*Ficus benghalensis*) and sugar are used. According to the Unani system of medicine, the fruits are sweet and sour, and can cause diarrhoea in large doses. The seeds are astringent, are a tonic to the heart and brain and relieve thirst. Powder made by crushing the dried seeds of *Z. nummularia* is said to improve digestion and acts as carminative is consumed in appropriate amounts (Oudhia, 2001-3).

Chinese herbology describes *Z. spinosa*, the wild spiny *Z. jujuba*, as sedative and hypnotic. Traditionally it is used to nourish the heart, calm the nerves and is useful for insomnia and dream disturbed sleep (Zhu, 1998). It is a common belief in China that if the wild Z. jujube (suan-tsao) is taken on a daily basis, it will improve skin colour and tone, both signs of physical wellbeing. Its domestic equivalent (pei-tsao), is said to reduce pain, distress and sleeplessness.

They are used to treat rheumatic symptoms and are said to rejuvenate the body, whether it is suffering from stress or age. Fresh *Z. Jujube* is also used to increase strength of the seriously ill and reverse the process of disease.

In modern Chinese medicine, *Z. jujube* is used to tone the spleen and stomach, to treat shortness of breath and severe emotional upset and debility due to nerves, and to mask the flavours of unpleasant-tasting herbs (Plant Botanic). The Arabs use the fruits of *Z. jujuba*, Z. *mauritiana* and *Z. spina-christi* to ensure health. The leaves of the plant kill diarrhoea-causing parasites and worms in the intestinal tract. The fruits are said to cure coughs, resolve any other lung complaints, soothe the internal organs and reduce water retention. In Saudi Arabia, fruits of *Z. spina-christi* when in sufficient strength act as a laxative (Azam-Ali *et al.*, 2001). In Haiti, fruits, leaves and roots of introduced *Z. jujube* are boiled to make a decoction and this is used as tea for an antidote to poison (Plant Botanic).

Other uses

In Zambezi valley in Zimbabwe, the dry powder is used in baking and to prepare jam (Maposa and Chisuro, 1998) and a traditional loaf (Kadzere, 1998), and kachaso, a crude spirit (Arndt, 2001). An alcoholic drink is also made in Malawi (FACT Net).In West Africa wild *Z. mauritiana* fruits are used to produce an alcoholic drink (Hutchinson and Dalziel, 1958). Cakes are made out of dried and fermented pulp in western Sudan (Dalziel, 1937), and in Zambia (Kalikiti, 1998).

The Touareg nomads in Mali make flatbread from dry fruit pulp (Chevalier, 1947) using wild species. In Niger *ber* fruits are dried and pounded into flour as a famine food (Williams, 1998). In Namibia, wild *Z. mucronata* Willd, is used for making a hot liquor (Hailwa, 1998).

In Venezuela a liqueur is made from the fruits and sold as ‘Crema de ponsigue’ (Morton, 1987). Of the 7 species of *Ziziphus* indigenous to the New World, *Z. mistol* Grisels was found in the Andes of Argentina and Paraguay to be used for making ‘mistol jam’.

In the Indian state of Chattisgarh, *Z. nummularia* fruits are sun dried and crushed to make a power called ‘Birchun’ or ‘Borkut’ (Oudhia, 2001-03).

Future prospects

Ber, as an indigenous fruit also has the potential of a huge market in India. The potential of market of *ber* in India is untapped since there are no major products of *ber*. Another circumstance in favour of *ber* is the production requirements. As mentioned earlier, *ber* doesn't require extensive water to grow and thus can be grown over a large part of India. It can easily replace water extensive crops and thus bring down the cost of farming and save water, which is the need of the hour. Fruits like anola, mango, apple etc. have multitude of products available due to their easy availability and market demand. Also, since people are evidently accustomed to the taste of *ber*, it can easily create a niche for itself in the Indian market. The availability of the fruit only for a few months in a year can further widen the demand. The same strategy, if applied to *ber* for production of variety of products with a decent shelf-life can lead to market gains which in turn would lead to more demand and provide prosperity to the farmers. The availability of advanced methods of storage like cold chain stores can make sure that the fruit is available throughout the year for processing.

More studies can be executed on preparation of value added products with *ber*. Addition of other fruits and flavouring ingredients like spices can further broaden the prospects of usage of *ber*. Advanced methods of preservation and processing can be used to obtain a product of higher nutritional value and more retention of natural characteristics of the original fruit. Possibility of preparation of other products like squashes, concentrates, marmalades, butter, jellies etc. can be explored and exploited. Not only will such products will be a treat to the consumer, but they would also have a higher nutritional value that will add to their aesthetic appeal.

It is concluded that in the underutilized status of *Zizyphus mauritiana* Lamk can be changed by different value additions to it. In India the cultivated horticultural varieties grown are *Gola*, *Umran*, *BanarasiKarka*, *Mundia*, *Kaithli*, *Umran*, *Mehrun*, *Parbani*, *Elaichi* and *Sanam*. The seasonal and perishable nature of *Ber* leads to the various value added products like *Ber* candy, *Ber* jam, *Ber* preserve, dehydrated and sundried *ber*, *Ber* beverages, *Ber* pickle are used for keeping best quality of this fruit. The medicinal properties like neurological properties, anti-nephritic effect, cardio-vascular activity, immuno-stimulant effects, antifungal, anti-diabetic, anti-allergic, antiulcer, anti-inflammatory, anti-spastic, anti-oxidants and anti-bacterial activities have been used since ancient times for curing various illnesses.

References

Anon (1976) In: Karnataka Statistics, Department of Horticulture Govt of India 1

Arndt S. K. (2001) http://chemsrv0.pph.univie.ac.at/ska/ziplant.htm

Ayaz, A.M., Najma, M., Devan, L.L, Amanat, A.P and Muhammad, I.B. (2012). Phenolic Compounds and Seed Oil Composition of *Ziziphus mauritiana* L. Fruit. *Polish Journal of Food Nutrition Science,* 62 (1): 15 -21.

Azam-Ali, S., Bonkoungou, E., Bowe, C., DeKock, C., Godara, A and Williams, J.T. 2001. Fruits for the future (revised edition) *Ber* and other jujubes. International Centre for Underutilised Crops, University of Southampton, Southampton, SO17 1BJ, UK.

Bajaj, M. (2013). *Nutritional evaluation and utilization of ber (Ziziphus mauritiana Lamk.) powder for the development of value added products* (Doctoral dissertation, CCS Haryana

Agricultural University, Hisar, Haryana.

Bal J. S. (1981). A note on sugars and amino acids in ripe *ber*. *Progressive Horticulture*, 13 (3/4): 41-42.

Bal, J. S., Ranadhava, J. S. (2005). Studies on the preparation of various products from the fruits. *International Journal of Agricultural Sciences*,1(1): 56-57

Bolada, S., Sehrawat, S. K., Yadav, B. S., Ahlawat, V. P. and Sulthan, S. (2012). Present status of *ber* production and future thrusts in India- a review. *Agriculture Reviews*, 33(3): 256 – 264.

Chawan, U. D., Adsule, R. N. and Kadam, S. S. (1993) processing of *ber* preparation of dried *ber* powder and tuty-fruity. *Beverage & Food World*,20 (9): 28-29.

Chevalier, A. (1947) Les jujubier on *Ziziphus* del'ancien monde etl'utilisation de leurs fruits [in French]. *Revue Internationale de botanique appliqué etd'agriculture tropicale* (Paris), 27 (301/2): 470-483.

Dalziel, J. M. (1937) *The Useful Plants of West Tropical Africa*. Crown Agents, London, 2nd reprint, 1955.

Devi, M. P., Bhowmick, N., Bhanusree, M. R., and Ghosh, S. K. (2015). Preparation of Value-Added Products Through Preservation. In *Value Addition of Horticultural Crops: Recent Trends and Future Directions* (pp. 13-41). Springer India.

Dubey, H., Parihar, P. and Kumar, S. (2014). Quality attributes of *ber* jam during storage. *JNKVV Research Journal*, 48(2): 203-206

Elevitch, C. R. (2004). *The Overstory Book: Cultivating Connections with Trees*. PAR.

FACT Net http://v1.winrock.org/forestry/ factnet.htm

Hailwa, J. (1998) Non-wood forest products in Namibia. Directorate of Forestry, Ministry of environment and Tourism. In: http://www.fao.org/documents/ show_cdr.asp?url_file=/DOCREP/003 /X6694E/X6694E00.HTM

http://vikaspedia.in/agriculture/post-harvest-technologies/technologies-for-agri-horti-crops/preparation-of-*ber*-candy

http://www.agmrc.org/business-development/getting-prepared/valueadded-agriculture/articles/usda-value-added-ag-definition/

Hutchinson, J. and Dalziel, J. M. (1958) *Flora of West Tropical Africa*. Crown Agents, London.

Jakhar, M.S. and Pathak, S. (2012). Studies on the preparation and storage stability of blended ready to serve from *Ber (Zizyphus mauritiana* Lamk.) and *jamun (Syzigium cumini Skeels.)* pulp. *Plant Archives*,12(1): 533-536.

Jawanda, J. S. and Bal, J. S. (1978). Studies on physicochemical characteristics of *ber* CVS grown at Ludhiana. *Horticulture Journal*, 1: 42.

Kadam, S. S. (2001). New products from arid and semi-arid fruits. *Indian Journal of Horticulture*, 58 (1&2): 170-171.

Kadzere, I. (1998) Role of *Ziziphus mauritiana* in the livelihood of some communities in Zimbabwe. In *International Workshop on Ziziphus mauritiana*, Harare, Zimbabwe, 13-16 July, 1998.

Kaikadi, M.A., Chavan, U.D. and Adsule, R.N. (2006). Studies on preparation and shelf-life of *ber* candy. *Haryana Journal of Horticulture Sciences,* 35(3&4): 49-50.

Kalikiti, F. (1998) *Ziziphus mauritiana* in Siavonga district, Zambia. In *International Workshop on Ziziphus mauritiana*, Harare, Zimbabwe, 13-16 July, 1998.

Khurdiya, D. S.(1980a). A new beverage from dried *ber* (*Zizyphus mauritiana*

L). *Journal of Food Science and Technology*,17: 158-159.

Khurdiya, D. S.(1980b). Studies on dehydration of *ber* (*Zizyphus mauritiana* L) fruit. *Journal of Food Science and Technology*,17:127-130.

Khurdiya, D.S. and Sinoh, R.N. (1975). *Ber* and its products. *Indian Horticulture*, 20: 5-25.

Koley, T.K., Charanjit, K., Shweta, N., Shweta, W., Seema, J and Sarika. (2011). Antioxidant Activity and phenolic content in genotypes of Indian jujube (*Zyziphus mauritiana* Lamk.). *Arabian Journal of Chemistry*.

Krishna, H. and Parashar, A. 2012. Phytochemical Constituents and Antioxidant Activities of Some Indian Jujube (*Ziziphus mauritiana* Lamk.) Cultivars. *Journal of Food Biochemistry*. 1-6.

Kumar, D. and Nath, N. (2002). Development of chuhara-like product from *ber* by osmo-air drying process. *Journal of Food Science and Technology*, 39(5):484-488.

Kumar, D. and Nath, N. (2002). Development of chuhara-like product from *ber* by osmo-air drying process. *Journal of Food Science and Technology*,39(5): 484-488

Kumar, M. (2006). Studies on suitability of *ber* fruits for preparation of different products. Ph. D. Thesis, CCS Haryana Agricultural University, Hisar, Haryana.

Kumar, M., Singh, D., Godara, R.K., Sandooja, J.S. and Singh, S. (2007). Quality evaluation of ready to serve beverage from chemically preserved *ber* pulp. *Haryana Journal of Horticulture Sciences*, 36(3&4): 255-258.

Madan, M. and Ullasa, B.A. (1993).Post harvest losses in fruits. Advances in Horticulture, vol. IV. (eds. Chadha, K. I. and Pareek, O. P.), Malhotra Publishing House, New Delhi, pp. 1795-1810.

Maposa, M. and Chisuro, D. (1998) Importance of *Ziziphus mauritiana* (masau) in the Mukumbura area of Zimbabwe - From a farmer's and extensionist's point of view. In *International Workshop on Ziziphus mauritiana*, Harare, Zimbabwe, 13-16 July, 1998.

Nandwani, D., and Duquesne, I. (2014). *Sustainable Horticultural Systems*. Springer International Publishing.

Neeraj, G. and Kaul, R. K. (2011). Preparation of Chuhara-like product from *ber* (*Zizyphus mauritiana* Lamk.) through osmo-air drying process. *Applied Biological Research*, 13(2): 94-98.

Oudhia, P. (2001-2003) Research Note on Medicinal herb of Chhattisgarh, India having less known traditional uses, IX. Boir (*Ziziphus nummularia*, family: Rhamnaceae).

Plant Botanic. Searching for the truth about herbal medicine. http://www. planetbotanic.ca/fact_sheets/jujube_fs. htm

Ranganna, S. (1977). Handbook of Analysis and Quality Control for Fruit and Vegetable Products, Jams, Jellies, Marmalade and Preserve.

Rao, J. V. S., Reddy, K. R. and Das, V. S. R. (1981). Physiological studies of some semi arid scrub species. *Indian Journal of Experimental Biology*,19(3): 256-260.

Shobha, D. and Bharathi, P (2007). Value Addition to *Ber* (*Zyziphus mauritiana* Lamk.) Through Preparation of Pickle. *Karnataka Journal of Agriculture Sciences*, 20(2): 353-355

Singh, K.K. (1964). The *ber* in India. *Fill. Bull. ICAR. New Delhi*. 17: 31.

Singh, L., Lal, G. and Singh, S.(1944). Candying of bers *(Zizyphus jujuba)* and orange peel. *Punjab Fruit Journal*,8: 29-30.

Srivastava, R. P. and Kumar, S.(2002). Fruits and vegetable Preservation: Principles and Practices. International Book Distributing company, Lucknow.

Sucharitha, K. V., Beulah, A. M. and Sathiya, C. (2012). Development and standardization of *ber*-pineapple jam. *International Journal of Food, Agriculture and Veterinary Sciences*, 2(3): 126-130.

Take, A. M., and Bhotmange, M. G. (2012). Preparation of candy from *ber*-a value addition. *Food Science Research Journal*, *3*(2), 217-220.

Tanmay, K.K., Shweta, W., Prerna, N., Awasthi, O.P. and Charanjit, K. (2011). Nutraceutical composition of *Zizyphus mauritiana* Lamk (Indian *ber*): Effect of enzyme-assisted processing. *International Journal of Food Sciences and Nutrition,* 62(3): 276–279.

Williams, T. O. (1998) *Multiple uses of common pool resources in semi-arid West Africa: A survey of existing practices and options for sustainable resource management.* http://www.odi.org.uk/nrp/38.html

Younis, K., Siddiqui, S., Jahan, K. and Dar, M. S.(2014). Production of wine from over ripe guava (*Psidium guajava* L Cv. Safada) and *ber* (*Ziziphus mauritiana* L Cv. Umran) fruits using *Saccharomyces cerevisiae* Var. HAU 1. *Journal of Environmental Science, Toxicology and Food Technology, 8*(1):93-96.

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