



Sweets as traditional medicine in winter season: An ethnobotanical study in Udaipur city, India

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Research

Abstract

Background: Food as medicine has been part of ancient civilizations and shared among generations as dietary health practices. Sweets are one of the important constituents of meals in India. Many plants are used to prepare sweets. In Udaipur city, Rajasthan, India, some specific sweets are consumed during winter season prepared from plants. No scientific study has been carried out to document the traditional botanical knowledge associated with winter sweets in Udaipur city. Hence, the present study was undertaken.

Methods: Ethnobotanical surveys were carried out at 11 most popular sweet shops of Udaipur city from October to January, 2018. Semi-structured interviews were conducted with shopkeepers about ingredients, preparation technique of sweets etc. and with the consumers about reasons of purchasing winter sweets.

Results: In total, 36 plants belonging to 21 angiosperm families were found to be used in preparation of winter sweets. The major traditional winter sweets consumed for health benefits were various kinds of *Laddu*, *Halwa* and Milk sweets. These were different from each other in shape, taste, shelf life and plant ingredients. All the consumers unanimously affirmed role of some of the winter sweets as traditional medicine.

Conclusions: The present study has first time documented different plant species used to prepare winter sweets in Udaipur city. Nutritional and pharmacological potential of some of the plants indirectly supports traditional wisdom behind their use in winter sweets for increasing immunity, treatment of joint pain, arthritis, asthma etc. However, clinical studies are required to recommend the winter sweets as dietary nutraceutical products for the claimed health benefits.

Keywords: Health tradition, Laddu, Barfi, Nutraceutical, Jaggery, Almond

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Background

Food is an integral part of human life. Many of the food items in a diet are included for health purpose and some due to good taste. In India, sweets possess an essential role in diet mostly due to good taste and considered not only for sharing happy moments but also used as traditional offerings to various deities in the country. They are an important part of different festivals and socio-cultural ceremonies (Singh & Pandey 1998). Some sweets are specifically prepared on a particular festival for example, *Gujjya* on *Holi*, *Sattu* on *Shravani Teej*, *Rabdi* and *Malpua* on *Hariyali Amavasya* etc. A wide variability among sweets depicts rich cultural heritage and food diversity spread among several districts in various states of India. Recipe of every sweet is different from each other either through difference in ingredients or method of preparation. These variations are inculcated traditionally among local people.

Plants and various plant parts are used for preparing many sweets. For example, fruits of *Cucurbita moschata* Duchesne are used to prepare *Petha* (Singh & Pandey 1998) and fruits of *Madhuca longifolia* var. *latifolia* A. Chev. are used as sweetener for offerings on Tinchhat festival in eastern Uttar Pradesh, India (Singh & Srivastava

2014). Similarly, an Indian traditional sweet '*Jalebi*' is prepared from fermented batter of refined Wheat flour (*Triticum aestivum*) which is poured in hot oil to make a shape of concentric ring and after frying, it is made sweet by soaking in sugar syrup (Chakkaravarthi *et al.* 2013). Likewise, there are many sweets having plants as ingredients but there is still no organized scientific documentation of the diversity of sweets and their plant ingredients.

Plants possess important roles in traditional medicinal systems for their medicinal efficacy as well as in modern medicine for development of novel drug molecules. Recently, there has been an increasing interest in finding out some dietary products as a nutraceutical by providing nutrition and health benefits together to combat with ever increasing varied type of diseases (Srivastava 2018, Spoorthi *et al.* 2018). Interestingly, there are some sweets having plant ingredients which are being consumed for preserving health by indigenous communities. For example, tubers of *Asparagus racemosus* are charred in mustard oil and the oil is used to prepare a sweet dish '*Halwa*' to be consumed during winter season by rural people of Shekhawati region, Rajasthan. It is considered good for treatment of joint pains in rheumatoid arthritis (Katewa & Jain 2006). In this regard, documentation of traditional health foods can give leads for development of a cheap and safe dietary nutraceutical product.

Winter season is a harsh environmental condition for living. But in Udaipur (Rajasthan), India; a tribal dominated district, winter is considered as a season of building immunity and yearlong strength through dietary modifications by local people. Being a resident of Udaipur city for more than 35 years, author has observed that every year some specific sweets are consumed here during winters for their health benefits and still no scientific documentation of traditional knowledge regarding those winter sweets is available. In view of this, ethnobotanical surveys were carried out for the first time to note down the types of sweets consumed during winter season as well as the plant species being utilized to prepare those sweets in Udaipur city. Traditional knowledge associated with sweets including consumers' perspectives about utilizing those sweets was also recorded.

Materials and Methods

Study area

Udaipur district is situated between 23°49' and 25°28' N latitudes and 73°01' and 75°49' E longitudes in South Rajasthan (India). It has 49.7% of Scheduled Tribe (ST) population out of total ST

population (13.5%) of Rajasthan. Udaipur district covers an area of 11,724 square kilometers and divided into 11 tehsils and the study area Udaipur city, also known as 'City of Lakes' is situated in Girwa tehsil (Fig. 1). Urban population of Udaipur district is 608426 whereas population of Udaipur metropolitan region is 474531 (District census handbook 2011). Winters are one of the major seasons in Udaipur which lasts about four months starting from October till the end of January (FES 2006). The lowest minimum temperature can reach between 5-10°C in the peak winter months of December and January and sometimes as low as 1°C (Singh *et al.* 2013). Ethnomedicinal knowledge of the indigenous communities of Udaipur has been documented in some studies (Katewa & Jain 2006) but traditional use of various plants for preparing sweets remained undocumented.

Data collection

Ethnobotanical surveys were carried out during winter season from October to January, 2018. For this purpose, 11 sweets selling shops of Udaipur city covering all directions except South (Table 1) were surveyed once in a fortnight leading to a total of 88 visits during the study period. These shops are very popular in Udaipur city as branded sweet shops. Semi-structured interviews were taken from shopkeepers considering them as qualified informants. They were asked questions regarding ingredients of winter sweets, local names of ingredients, preparation method, daily consumption quantity, selling rates and any associated therapeutic benefits.

Besides, semi-structured interviews were also conducted with 44 consumers (two from each shop every fortnight in December) who were willing to participate in the study irrespective of gender, caste, religion and literacy levels. Mainly, following information was obtained from consumers:

- a) Reasons for purchasing any particular sweet in winter season from sweet shops: good taste/health benefit/any other
- b) Availability and purchasing of those winter sweets in other seasons
- c) Perception about difference between their uses in various seasons if any
- d) Which types of traditional winter sweets are prepared at homes
- e) Which winter sweets are purchased from shops
- f) Affirmation of health benefits by consuming the winter sweets, if any.

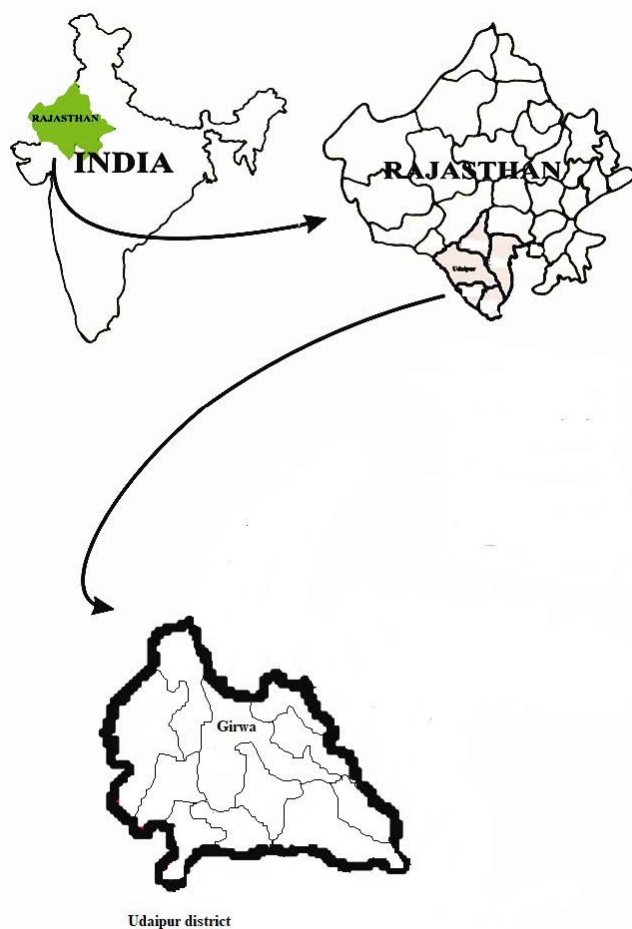


Figure 1. Location of the study area.

Table 1. List of traditional sweet shops surveyed in Udaipur city, India

Name of Sweet shop	Locality
Jagdish Misthan Bhandar	Surajpole
Indore Namkeen & Sweets	Panchwati
Shastri sweets	Shastri circle
Bikaner Misthan Bhandar	Ostwal plaza, Sunderwas
Jayesh Misthan Bhandar	Chetak circle
Jodhpur Misthan Bhandar	Bapu Bazar, Opposite Townhall
Jain Special Khakhra	Surya Marg, Jagdish Chowk
Arora sweets	Jagdish marg, Ghantaghar
Shree Balaji Bikaner Misthan Bhandar	Bedla road, Fatehpura
Jai Bharat Misthan Bhandar	Delhi gate circle
Ram ji Sweets	University Road

All the interviews were conducted in Hindi language after obtaining prior informed consent from the informants. Apart from these, keen personal observations were also made on sweets displayed in local fairs and various feasts organized during winter season such as marriages, house-warming ceremonies, birthday and New Year celebrations. Photographs of the sweets displayed in sweet shops and various feasts along with pictures of some of the sweets prepared at home were taken after obtaining prior consent and some of them are displayed in Figures 2-5. Various details about different types of

sweets consumed during winter season in Udaipur are presented in Table 2.

Identification of plants

Taxonomic identification of plants used in preparing winter sweets was carried out by consulting standard appropriate literature and given in Table 3 (Anonymous 1948-76, Jain & Jain 2018, Shetty & Singh 1987-93, The Plant List, Tiagi & Aery 2007).

Table 2. Types of winter sweets observed in Udaipur city, India

Name of Sweet	Description of sweet	Type of sweet	Plant based ingredients	Use quantity	Reasons / Benefits of use
Laddu	Round shaped ball	'Urd dal laddu'	<i>Vigna mungo</i> , <i>Acacia nilotica</i> / <i>Anogeissus latifolia</i> , <i>Prunus dulcis</i> , <i>Saccharum officinarum</i>	One piece of 60-70g once daily for a month	Increases endurance against cold
		'Methi ke laddu'	<i>Trigonella foenum-graecum</i> , <i>Triticum aestivum</i> , <i>Papaver somniferum</i> , <i>Prunus dulcis</i> , <i>Saccharum officinarum</i>	One piece 60-70g once daily for a month	To treat joint pain, back pain and arthritis
		'Gond ke laddu'	<i>Acacia nilotica</i> / <i>Anogeissus latifolia</i> , <i>Prunus dulcis</i> , <i>Triticum aestivum</i> , <i>Saccharum officinarum</i>	One piece of 60-70g once daily for a fortnight	To provide additional calories to body, good for physically weak persons especially for pregnant and lactating women
		'Dry fruit Laddu'	<i>Papaver somniferum</i> , <i>Phoenix dactylifera</i> , <i>Cocos nucifera</i> , <i>Elettaria cardamomum</i> , <i>Prunus dulcis</i> , <i>Saccharum officinarum</i> , <i>Triticum aestivum</i> , <i>Vitis vinifera</i>	One piece of 60-70g once daily for a fortnight	To keep body warm by giving additional calories
		'Tilli ke Laddu'	<i>Saccharum officinarum</i> , <i>Sesamum indicum</i>	One piece of 40-50g once daily for a fortnight	Good in taste and for bone health, specially consumed on 'Makar Sakranti festival' in middle of January
		'Amla laddu'	<i>Phyllanthus emblica</i> , <i>Piper nigrum</i> , <i>Saccharum officinarum</i>	One piece of 40-50g once daily for one or two months	For building immunity, general health and protection from cold and flu
		'Rajgira ke laddu'	<i>Amaranthus sp.</i> , <i>Saccharum officinarum</i>	One/two pieces of 30-40g during the days of fasting	To give instant energy
Halwa	Semi-solid consistency, rich in pure clarified butter fat	'Aate ka halwa'/'Gurh ka Halwa'	<i>Myristica fragrans</i> , <i>Elettaria cardamomum</i> , <i>Saccharum officinarum</i> , <i>Triticum aestivum</i>	About 100g daily for 15 days or intermittently during winter season	Good taste, to give energy and building body's immunity power
		'Moong Daal halwa'	<i>Elettaria cardamomum</i> , <i>Saccharum officinarum</i> , <i>Vigna radiata</i>	Same as above	Same as above
		'Badam halwa'	<i>Elettaria cardamomum</i> , <i>Saccharum officinarum</i> , <i>Prunus dulcis</i>	Same as above	Same as above
		'Akhrot halwa'	<i>Juglans regia</i> , <i>Saccharum officinarum</i> , <i>Elettaria cardamomum</i>	Same as above	Good taste and considered good for brain
		'Postadana Halwa'	<i>Papaver somniferum</i> , <i>Saccharum officinarum</i> , <i>Elettaria cardamomum</i>	100 g only for three days during intense cold	To tolerate intense cold temperature
		'Gajar ka Halwa'	<i>Daucus carota</i> , <i>Papaver somniferum</i> , <i>Saccharum officinarum</i> , <i>Elettaria cardamomum</i>	100 g daily for a week or intermittently during winters	Good taste and for improvement in eyesight
		'Lauki ka Halwa'	<i>Lagenaria siceraria</i> , <i>Saccharum officinarum</i> , <i>Elettaria cardamomum</i>	100 g during fasting days in 'Navratri' festival	To give calories for generating energy

		'Shakarkand ka Halwa'	<i>Ipomoea batatas, Elettaria cardamomum</i>	100 g on fasting days	To provide carbohydrates for generating energy
Hot milk	Liquid	'Cream rich milk'	<i>Saccharum officinarum</i>	250 ml during peak winter for 7 days	To tolerate cold
		'Kesar ka dudh'	<i>Crocus sativus, Elettaria cardamomum, Saccharum officinarum</i>	250 ml during peak winter for 3 days or intermittently	Good taste and to tolerate excess cold
		'Khajur milk'	<i>Phoenix dactylifera</i>	A full cup is consumed in winter nights for a fortnight	To create heat in the body and also to combat with various respiratory infections such as asthma
		'Dry fruit milk'	<i>Anacardium occidentale, Ficus carica, Prunus dulcis, Saccharum officinarum, Phoenix dactylifera, Vitis vinifera</i>	Half cup three days in a week	To build immunity power to fight against various infections
'Kheer'	Semi-liquid consistency	'Chawal ki kheer'	<i>Oryza sativa, Buchanania cochinchinesis, Elettaria cardamomum, Papaver somniferum, Saccharum officinarum, Phoenix dactylifera</i>	One bowl	Good in taste, specially prepared on 'Sharad Poonima' as an old tradition
		'Makhane ki kheer'	<i>Euryale ferox, Saccharum officinarum</i>	One bowl during fasting days	Good for treatment of arthritis
'Kheech'	Semi-liquid consistency	'Dudh ka Kheech'	<i>Triticum aestivum, Elettaria cardamomum, Vitis vinifera, Saccharum officinarum</i>	One bowl	As a tradition on 'Makar sakranti' festival in January
'Jalebi'	Concentric ringed, crispy texture	'Dudh-Jalebi'	<i>Crocus sativus, Triticum aestivum, Saccharum officinarum</i>	50/100g Jalebi in one bowl of hot milk	Good taste, usually during feast in winter season
'Imarti'	Concentric ringed, crispy texture	'Imarti'	<i>Vigna mungo, Saccharum officinarum</i>	One or two (50 g)	Good taste and satiating capacity
'Taarfini'	Concentric ringed, soft & brittle, very light weight	'Taarfini'	<i>Triticum aestivum, Saccharum officinarum</i>	One piece	Good taste and satiating capacity
Barfi/Chakki	Square or diamond shaped solid pieces	'Kaju barfi' and 'Kaju Khajur barfi'	<i>Anacardium occidentale, Phoenix dactylifera, Saccharum officinarum</i>	25/50g intermittently during winters	Good taste and for giving energy
		'Kardhaan paak'	<i>Acacia nilotica / Anogeissus latifolia, Cocos nucifera, Cucumis melo, Elettaria cardamomum, Euryale ferox, Papaver somniferum, Phoenix dactylifera, Prunus dulcis, Vitis vinifera, Saccharum officinarum, Zingiber officinale</i>	One piece of 25-30g daily for 15 days	Good taste and for building immunity power

		'Saunth ki barfi'	<i>Acacia nilotica / Anogeissus latifolia, Saccharum officinarum, Triticum aestivum, Zingiber officinale</i>	One piece of 25-30g daily for 15 days	To treat back pain, joint pains and arthritis
		'Anjeer barfi'	<i>Ficus carica, Saccharum officinarum</i>	One piece of 25-30g intermittently	Good taste and for giving energy
		'Bhutte ki barfi'	<i>Zea mays, Saccharum officinarum</i>	One/two pieces of 25-30g during early winter season	Good taste and giving strength to body
		'Lilve ki barfi' and 'Lilve ka Jaajriya'	<i>Cicer arietinum, Elettaria cardamomum, Myristica fragrans, Saccharum officinarum</i>	One/two pieces of 25-30g in a day	Good taste and giving strength to body
'Mawe ki Kachori'	Round puffed ball fried in clarified butter, dipped in sugar syrup	'Mawe ki Kachori'	<i>Triticum aestivum, Saccharum officinarum, Elettaria cardamomum, Pistacia vera</i>	One piece of about 120-150 g	Excellent taste
'Ghewar'	Circular disc	'Ghewar'	<i>Saccharum officinarum, Triticum aestivum</i>	One small piece of 50 g	Good taste and satiating capacity
'Lapsi'	Solid granules	'Gud ki Lapsi'	<i>Saccharum officinarum, Triticum aestivum, Cocos nucifera</i>	One bowl	Cooked on auspicious occasions at home
'Gulabjamun'	Round soft ball	'Gulabjamun'	<i>Amomum subulatum, Pistacia vera, Triticum aestivum, Saccharum officinarum</i>	One/two pieces of 20-30 g	Good taste, enjoyed in all seasons
'Chikki'	Golden brown colored, square or round shaped solid pieces	'Moongphali Chikki'	<i>Arachis hypogaea, Piper nigrum, Saccharum officinarum</i>	20-30g	As a snack to give instant energy
		'Moongphali Chapda'	<i>Arachis hypogaea, Saccharum officinarum</i>	50g	As a snack to give instant energy
'Gajhak'	Solid fragile pieces	'Gajhak'	<i>Saccharum officinarum, Sesamum indicum</i>	25-50g during winter season	As sweet tasty snack and to build immunity
'Rewri'	Solid circular pieces	'Rewri'	<i>Saccharum officinarum, Sesamum indicum</i>	20-30g	As sweet tasty snack and to build immunity
'Til papdi'	Thin delicate sheets	'Til papdi'	<i>Sesamum indicum, Saccharum officinarum</i>	One thin sheet	Good taste

Results

Winter sweets were diverse not only in their ingredients, tastes, names, consistency and methods of preparation but also in their shapes. Some of the most common shapes observed were

square/diamond/triangle shaped '*Barfi*' or '*Chakki*' and round balls specifically '*Laddu*'. Other shapes were cylinder shaped '*Kaju-roll*', oblong-oval shaped '*Chamcham*', concentric rings of '*Jalebi*' and '*Imarti*', a circular disc of '*Ghewar*' etc. (Fig. 2, Table 2).



A



B



C



D



E



F

Figure 2. Traditional Indian sweets in various shapes A– Triangle shaped Barfi, B– Diamond shaped Barfi C– Round balls of Laddu, D– Oblong-oval shaped Chamcham, E– Concentric rings of Jalebi, F– Circular disc of Ghewar

**A****B****C****D****E****F**

Figure 3. Various kinds of Laddu available in sweet shops at Udaipur, India. A– Urd dal Laddu, B– Methi ke Laddu C- Dry fruit Laddu, D– Tilli ke Laddu, E– Besan ke Laddu (Top left) and Bundi ke Laddu (Top right), F– Amla Laddu



A



B



C



D



E



F

Figure 4. Other traditional Indian sweets. A– Rajgira ke Laddu (shown by red arrow), B– Dudh Laddu C– Akhrot Halwa, D– Gajar ka Halwa, E– Jalebi, F– Dudh ka Kheech



A



B



C



D



E



F

Figure 5. A– Lilve ki Barfi, B– Lilve ka Jaajriya C– Chikki (Indicated with red arrow), D– Chapda, E– Different types of Gajak, F– Modern sweet : Brownie topped with Ice-cream

Plants as ingredients in Sweets

The present study reveals 36 plant species (wild, cultivated and imported) belonging to 21 Angiosperm families which were being used to prepare various winter sweets in Udaipur city. Leguminosae family dominates the list having six plants, followed by Poaceae with four and Anacardiaceae and Zingiberaceae each with three plant species. Out of

these plants, 26 were dicotyledonous and rest ten was monocotyledon. Among the 36 plants, 23 were observed to be cultivated and rest 13 (Black Pepper, Cashew nut, Coconut, Foxnut, Saffron, Nutmeg, Mace, Pistachio, Almond, Raisin, Walnut, Figs, Small and Greater Cardamom) were imported from outside the state (Table 3).

Table 3. List of plant species used to prepare various winter sweets in Udaipur city

Botanical name	Family	Local name	Common name	Plant part used
<i>Acacia nilotica</i> (L.) Delile	Leguminosae	<i>Babul</i>	Gum Arabic	Gum
<i>Amaranthus sp.</i>	Amaranthaceae	<i>Rajgira</i>	Amaranth grain	Seeds
<i>Amomum subulatum</i> Roxb.	Zingiberaceae	<i>Bari Ilaaichi</i>	Greater Cardamom	Seeds
<i>Anacardium occidentale</i> L.	Anacardiaceae	<i>Kaju</i>	Cashew nut	False fruit
<i>Anogeissus latifolia</i> Wall. ex Guillem & Perr.	Combretaceae	<i>Dhawara</i>	Axle wood	Gum
<i>Arachis hypogaea</i> L.	Leguminosae	<i>Moongphali</i>	Groundnut	Seed
<i>Buchanania cochinchinesis</i> (Lour.) M.R.Almeida	Anacardiaceae	<i>Chironji, Charoli</i>	Cuddapah Almond	Seed
<i>Cicer arietinum</i> L.	Leguminosae	<i>Besan, Lilwa</i>	Bengal Gram flour & Green gram	Seed
<i>Cocos nucifera</i> L.	Arecaceae	<i>Khopra</i>	Coconut	Dried endosperm
<i>Crocus sativus</i> L.	Iridaceae	<i>Kesar</i>	Saffron	Dried style
<i>Cucumis melo</i> L.	Cucurbitaceae	<i>Kharbuj</i>	Muskmelon	Seed
<i>Daucus carota</i> L.	Apiaceae	<i>Gajar</i>	Carrot	Root
<i>Elettaria cardamomum</i> (L.) Maton	Zingiberaceae	<i>Ilaaychi</i>	Green Cardamom	Seed
<i>Euryale ferox</i> Salisb.	Nympheaceae	<i>Makhana</i>	Fox nut	Seed
<i>Ficus carica</i> L.	Moraceae	<i>Anjeer</i>	Fig	Fruit
<i>Ipomoea batatas</i> Lam.	Convolvulaceae	<i>Shakarkand</i>	Sweet Potato	Tuberous root
<i>Juglans regia</i> L.	Juglandaceae	<i>Akhrot</i>	Walnut	Seed
<i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae	<i>Lauki</i>	Bottle Gourd	Fruit
<i>Myristica fragrans</i> Houtt.	Myristicaceae	<i>Jaiphal and Javitri</i>	Nutmeg & Mace	Seed and aril
<i>Oryza sativa</i> L.	Poaceae	<i>Chawal</i>	Rice	Seed
<i>Papaver somniferum</i> L.	Papavaraceae	<i>Khas-khas, Postadana</i>	Opium Poppy	Seed
<i>Phoenix dactylifera</i> L.	Arecaceae	<i>Pind-Khajur, Chuaaraa</i>	Date Palm	Fruit
<i>Phyllanthus emblica</i> L.	Phyllanthaceae	<i>Amla</i>	Indian Gooseberry	Fruit
<i>Piper nigrum</i> L.	Piperaceae	<i>Kali mirch</i>	Black Pepper	Fruit
<i>Pistacia vera</i> L.	Anacardiaceae	<i>Pista</i>	Pistachio	Seed
<i>Prunus dulcis</i> (Miller) D.A. Webb	Rosaceae	<i>Badam</i>	Almond	Seed
<i>Rosa spp.</i>	Rosaceae	<i>Desi gulab</i>	Rose	Petals
<i>Saccharum officinarum</i> L.	Poaceae	<i>Gurh</i> <i>Shakkar</i>	Jaggery Sugar	Processed stem juice
<i>Sesamum indicum</i> L.	Pedaliaceae	<i>Til</i>	Sesame	Seed
<i>Trigonella foenum-graecum</i> L.	Leguminosae	<i>Methi</i>	Fenugreek	Seed
<i>Triticum aestivum</i> L.	Poaceae	<i>Aataa, Gaihun ka kheech, Maida, Daliya</i>	Wheat flour, Refined flour	Seed Split seeds
<i>Vigna mungo</i> (L.) Hepper	Leguminosae	<i>Urd daal</i>	Black Gram	Split seed
<i>Vigna radiata</i> (L.) R.Wilczek	Leguminosae	<i>Moong daal</i>	Green Gram	Split seed
<i>Vitis vinifera</i> L.	Vitaceae	<i>Daakh, Munnaka</i>	Raisin	Fruit
<i>Zingiber officinale</i> Roscoe.	Zingiberaceae	<i>Saunth</i>	Dry Ginger	Rhizome
<i>Zea mays</i> L.	Poaceae	<i>Bhutta</i>	Corn	Seed

Analysis of plant parts revealed that seeds (54%) were the most frequently utilized part followed by fruits (19%) and roots and gum (5% each). Seeds were mostly utilized by making powder and some of the seeds were directly employed like Cuddaph Almond, Greater Cardamom, Muskmelon, Sesame etc. (Table 3).

Plant species were used as a major ingredient of sweet and/or for garnish or flavoring purpose. Cane sugar (powdered/sugar syrup) and jaggery obtained from the plant *Saccharum officinarum* was the main ingredient responsible for the sweet taste of all winter sweets observed in the study. Besides, Cane sugar, Wheat was one of the major ingredients in many of the winter sweets. Almonds and Cardamom powder were other maximally used ingredients (Table 2). Cardamom was mainly used as flavoring agent and also for proper digestion of sweets. Shopkeepers informed about using gum of either *Acacia nilotica* or *Anogeissus latifolia* depending on availability but usually preferred *A. latifolia* for getting more health-benefits.

Reasons for consuming winter sweets

Survey revealed that people consumed some specific sweets in winter for getting some health benefits either for prophylactic or curative or for both purposes. These sweets were *Methi Ke Laddu*, *Gond ke Laddu*, *Urd Dal Laddu*, *Tilli Laddu*, *Dry Fruit Laddu*, *Amla Laddu*, *Gajhak*, *Rewri*, *Kardhan paak*, *Kaju-Khajur Barfi*, *Saunth ki Barfi*, *Badam Halwa*, *Akhrot Halwa*, *Gajar Halwa*, *Lilve ki Barfi*, *Lilve ka Jaajriya*, *Khajur milk*, *Kesar milk* and *dry fruit milk*. Interestingly, some of these sweets not only provide health benefits but also delicious in taste which further increases their acceptability (Table 2). Sellers informed that demand for these specific winter sweets decreases in other months of the year and they are usually available in markets during winters only. All the consumers affirmatively confirmed the health benefits of the above-mentioned sweets. Rest of the winter sweets was being consumed mainly due to good taste and some were cooked as a tradition.

Some of the sweets such as *Besan barfi* and *Besan Laddu* (made from Bengal Gram flour), *Anjeer barfi* (made from Figs), *Bundi ke Laddu* (having Bengal Gram flour, Rose petals, Muskmelon seeds), *Dudh-Jalebi* are available throughout the year and consumers told that consumption of these sweets during winter season is better than other seasons as it is easy to digest these high calorie sweets in winter season. *Dudh ke laddu* (having Bengal Gram flour, Rose petals, Muskmelon seeds), *Alwarpaak* (made from condensed milk and Pistachio), *Taarfini* (made from Wheat), *Imarti* (made from Black Gram),

Ghewar (made from Wheat and Pistachio) are some of the sweets which are available throughout the year but preferred in winter season due to their good taste and satiating capacity.

Besides good taste and prophylactic and/or curative health benefits, different reasons were recorded for purchasing the sweets from sweet shops. Purchasing sweets from shops indicated higher financial status and preparing sweets at homes as lower financial status and this was one of the reasons which compelled consumers to purchase sweets from shops. Other reasons behind purchasing were difficulty of preparing sweets at home, lack of time for making sweets or sweet as a specialty of the particular shop in terms of taste and quality.

Survey also revealed that there were diverse reasons behind purchasing any specific sweet from a particular shop. These included personal preferences for cost, purity, taste, freshness, shelf-life and appearance of sweets or for fulfilling demand of a family member or extraordinarily good taste which could not be created at home.

Homemade sweets

Some winter sweets were exclusively prepared in homes or at sweet shops or in feasts and some were prepared at both homes and sweet shops as well as in feasts. For example, *Lapsi*, *Lilve ka Jaajriya*, *Khajur milk*, *Dry fruit milk*, *Gurh (Aate) ka halwa*, *Lauki ka Halwa*, *Shakarkand ka halwa*, *Dudh ka kheech*, *Kheer*, *Makhane ki Kheer* are types of sweets which were exclusively prepared at homes.

Some sweets such as *Bhutte ki barfi*, *Akhrot ka halwa*, *Anjeer barfi*, *Kaju khajur barfi*, *Dudh ke laddu*, *Bundi ke laddu*, *Alwarpaak*, *Taarfini*, *Imarti*, *Ghewar*, *Mawe ki kachori* were served in sweet shops as well as in feasts and not made in Homes. *Gajhak*, *Rewri* and *Rajgira ke laddu* were exclusively available at sweet shops (Table 2). Rest of the sweets were prepared at homes and also observed at sweet shops and feasts.

Discussion

India is one of the leading countries having a variety of sweets along with variations in their preparation methods. In urban societies, there is a trend of consuming sweets in the form of a dessert at the end of meal. This practice differs from family to family depending on their financial status as due to high cost, poor people cannot afford sweets on a daily basis and hence, sweets could be considered as 'Luxury food item'. The dessert could be any traditional sweet or modern era's dishes like cakes, pastry, brownie (Fig. 5 F), ice-cream etc. These modern sweets are cosmopolitan in nature while

traditional sweets are part of India's endemic cultural heritage.

A rich traditional knowledge associated with plants exists among local communities. Plants are an important part of diet and various healthy recipes are prepared using various plant parts. There are many plant species which are employed for preparing sweet dishes for example, seeds of *Perilla frutescens* Britton for preparing sweet dish in Arunachal Pradesh in North-East India (Srivastava & Adi community 2009) and a sweet candy known as 'Mufar' prepared from leaves of *Cannabis sativa*, is relished by rural population of South Rajasthan (Jain 2016). Due to urbanization and modernization, there is a rapid loss in traditional knowledge and in absence of proper documentation; existence of many health traditions will be jeopardized (Jain & Jain 2017, Posey 1999).

Ethnobotanical knowledge related to plant based health foods is scattered among various communities of India and should be documented at the earliest in order to prevent untimely loss. Moreover, specific trends in dietary practices endemic to a particular region etc. could also be studied in further objective-oriented ethnobotanical studies. In this regard, present study is an important initiative documenting traditional knowledge about winter sweets in Udaipur, India for the first time.

Potential health benefits of plant ingredients in sweets

Many of the plant species which are being utilized to prepare the winter sweets have shown to possess various health-beneficial pharmacological activities in scientific studies. This indirectly supports the consumers' affirmation about getting health benefits after consumption of the sweets. Notably, beneficial effects of some of these plant species have also been mentioned in Indian ethnomedicine. For example, seeds of *Trigonella foenum-graecum* have been recommended in ethnomedicine for their beneficial role in treatment of arthritis, back pain, rheumatism and joint pains (Jain & Jain 2016) and shown to possess anti-inflammatory, antioxidant, immuno-modulatory, antidiabetic, antihyperlipidemic, antiobesity, anticancer potential in scientific studies (Nagulapalli *et al.* 2017). Similarly, calcium rich seeds of *Sesamum indicum* used to prepare 'Tilli ke laddu' are recommended for treatment of gout and rheumatism in ethnomedicine (Jain & Jain 2016) and have demonstrated various activities such as antioxidant, anti-inflammatory, anti-diabetic, anticancer, anti-hyperlipidemic, gastro-protective and vasorelaxant in animal and human studies (Amoo *et al.* 2017).

Fruits of *Phoenix dactylifera*; chiefly consumed during winter as raw or after boiling in milk are recommended for treatment of asthma and cold in Indian ethnomedicine (Jain & Jain 2016). It has also demonstrated many pharmacological activities like anti-inflammatory, anti-diabetic, antioxidant, anti-tumor, hepato-protective, nephro-protective etc. (Rahmani *et al.* 2014). Seeds of *Papaver somniferum* have been recommended for treatment of asthma, cough and cold (Jain & Jain 2016). In this regard, their use during intense cold environment may help people both as a prophylactic and curative.

Likewise, scientific studies provide indirect evidences of using gum of *Acacia nilotica* and/or *Anogeissus latifolia* for treatment of weakness and pain (Rather *et al.* 2015, Singh *et al.* 2016). Rhizome of *Zingiber officinale* is a very important ingredient recommended for treatment of joint pains and arthritis and its anti-inflammatory potential serves as indirect evidence against these ailments (Al-Nahain *et al.* 2014). Fox nut is rich in calcium, magnesium, phosphorus, and iron and its use as 'Makhane ki kheer' is considered very good for treatment of arthritis (Jha *et al.* 2018).

Use of *Phyllanthus emblica* (*Amla*) fruits as a *laddu* was another interesting observation from Khadi Ghramodyog fair which was held during the month of December in Udaipur city. *Amla* is well known for its health beneficial activities such as anti-inflammatory, anti-hyperglycemic, anti-hyperlipidemic, antioxidant, anticoagulant, anti-platelet, anti-aging and a recent double blind, placebo controlled study in healthy volunteers has demonstrated significant improvement in endothelial functions and reduction in biomarkers of oxidative stress after 500mg per day consumption of *Amla* for 18 weeks (Kapoor *et al.* 2020, ShavezKhan *et al.* 2019). These vasodilator activities keep much importance during the winters and might prevent from incidences of cardiovascular diseases which tend to increase during winter seasons due to more vasoconstriction and changes in coagulation parameters (Fares 2013). All these properties supports role of 'Amla laddu' for increasing immunity and general health as described by informants in the present study.

Dried kernel of Coconut as an important part of dry fruits rich sweet 'Kardhan paak', has demonstrated antioxidant, antihypertensive, antidiabetic properties and Coconut oil has shown anti-thrombotic effect (Lima *et al.* 2015, Müller *et al.* 2003). Nutritious Mung beans used to prepare 'Moong daal halwa' have shown to possess antioxidant, anti-inflammatory, antidiabetic, antihypertensive and antitumor effects in various scientific studies (Tang *et al.* 2014).

Many of the spices which are being used in these sweets such as Small Cardamom, Black Pepper and Saffron have also shown multifarious pharmacological activities such as anti-inflammatory, antioxidant, antithrombotic, anti-proliferative, hypolipidemic, platelet aggregation inhibition and therefore, their consumption is considered advantageous for human health (Vasanthi & Parameswari 2010, Vázquez-Fresno *et al.* 2019).

It was observed that nuts such as Almonds, Cashew nuts, Peanuts, Pistachio and Walnuts are important part of winter sweets. Nutritional analysis of Almonds have shown to be rich in several minerals and vitamins such as calcium, magnesium, potassium, phosphorus, thiamine, riboflavin, niacin, and vitamin E along with healthy fatty acid composition of mono- and polyunsaturated fatty acids. Almonds have shown to decrease total cholesterol (TC), low density lipoprotein-cholesterol (LDL-C) and increase good cholesterol that is, high density lipoprotein-cholesterol (HDL-C) in persons having dyslipidemia which is one of the major causes behind cardiovascular diseases (Kalita *et al.* 2018). Walnuts have also shown antioxidant, hypotensive, anti-diabetic, hypolipidemic and liver protective activities (Delaviz *et al.* 2017).

Eight weeks consumption of mixed nuts having Almonds, Peanuts, Cashews, Brazil nuts, Macadamia nuts and single nut Pistachio has demonstrated significant reduction in TC, LDL-C, triglycerides, c-reactive protein and oxidative stress in a recent animal study (Hong *et al.* 2018). Kim *et al.* (2018) have also shown beneficial effect of nuts consumption on TC, LDL-C, endothelial function in various cardio-metabolic diseases. Besides improving cardiovascular risk factors, nuts have also shown to improve mental health and bone mineral density along with decrease in risk of obesity, metabolic syndrome and depression in various scientific studies (Rico *et al.* 2016).

In view of all of these beneficial properties, incorporation of nuts in traditional winter sweets is a reflection of the wisdom of ancient people. These dried nuts not only enhance taste but also improve health. Here, it should be mentioned that most of the sweets are rich in fat content as prepared from pure clarified butter (*'ghee'*) which may raise lipid parameters of body. As many of the nuts have shown lipid lowering potential, their use in sweets seems appropriate. Moreover, none of these nuts naturally grow in Rajasthan's climatic conditions and therefore, imported from other states for consumption. Their use in traditional sweet recipes indicates a long history of importing of dried fruits.

Many of the traditional winter sweets for example, *Tilli ke Laddu*, *Gajhak*, *Rewri*, *Chikki*, *Lapsi* and *Halwa* are sweetened using jaggery (*Gurh*) which is made from Sugarcane juice. It is a traditional nutritive sweetener mentioned in ancient texts such as *Rigveda* and healthier than refined sugar in terms of having 50 times more mineral content with many medicinal effects (Jaffe 2012, Kumar & Kumar 2018). In the present study, maximum use of cane sugar followed by jaggery was observed as a sweetening agent for preparing winter sweets.

'Rajgira ke laddu'; prepared from a gluten free pseudocereal Amaranth were being sold in sealed packets in the fair and also at five of the surveyed sweet shops (Fig. 4 A). As Amaranth is rich in proteins, essential amino acids, starch, fiber, vitamin A, K, C, E, B, B6 and minerals calcium, iron etc.; it is in fact a nutritious choice being adopted by people during fasting both in winters and in other seasons as well (Peter & Gandhi 2017). *Chikki*; containing mainly Peanuts has protein, fat, iron, calcium and folic acid and provides instant energy (Pallavi *et al.* 2014). Efforts are also being made to make it as a nutraceutical by fortifying with natural medicinal herbs (Ramakrishna *et al.* 2015).

'Gajar ka Halwa' (Fig. 4 D) is prepared with grated Carrots which are cooked in cream rich milk. As a rich source of Vitamin A, use of Carrots for improving eyesight is well known. More important here is the process of preparing its *Halwa* with fat rich milk which helps the fat soluble Vitamin A of Carrots to be readily absorbed in the body (Reboul 2013). This highlights the wisdom of those people who discovered the specific method of its preparation to get its maximum benefit.

Notably, consumers were not aware about the scientific evidences for health beneficial properties of ingredients of the traditional winter sweets. They told that they have heard from their elder family members that consumption of these sweets during winter season is good for health and for treatment of particular ailments as described in the present study (Table 2). Above-mentioned brief pharmacological profiles of these plant ingredients support observation of those elderly people and personal experiences of consumers. It also confirms the beneficial role of sweets consumption in winters and shows the significance of using food as a medicine in ancient cultures.

Nowadays, people have become more health conscious and opting for nutritive and healthy foods (Jain 2013). Detailed nutritional and clinical assessment of a winter sweet in its original form should be carried out for its claimed health benefits

and if positive results are obtained, scientific recommendations for utilization of these traditional sweets as dietary nutraceuticals could be made.

Potential economic benefits

Besides these health benefits, winter sweets could become a good source of income generation as many times the demand of plant ingredients could not be supplied with wild plant resources available in local area. Hence, cultivation of plant resources at large scale could help in economic enhancement of local communities. However, some of the plant ingredients are imported from outside as also observed in present study that 13 plant ingredients could not be cultivated in Rajasthan due to their specific climate requirements and were being imported (Shetty & Singh 1987-93, Tiagi & Aery 2007). Though, it helps in boosting economy of the state/country which is exporting the required plant ingredient.

Conclusions

Man has been utilizing plant resources growing in their vicinity for treatment of various ailments since time immemorial. Traditional health practices using plants as food for treatment of many ailments are immensely valuable treasure for development of nutraceuticals. Sweets are an integral part of diets in India and plants are one of their important ingredients. The present study is a first attempt to document various types of winter sweets and plant species being used in preparing those sweets in Udaipur city. Several of these plants possess various health benefits in terms of nutrition as well as medicinal effect and indirectly support their role as traditional medicine for treatment of joint pains, arthritis and building immunity power to prevent from cold and flu in winter season. Detailed clinical studies will be helpful to project these winter sweets as nutraceuticals in modern markets.

Declarations

List of abbreviations: Scheduled Tribe: ST; Total Cholesterol: TC; Low Density Lipoprotein-Cholesterol: LDL-C; High Density Lipoprotein-Cholesterol: HDL-C

Ethics approval and consent to participate: Before conducting interviews, prior informed consent was obtained from all participants. No further ethics approval was required.

Consent for publication: Not applicable

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Literature Cited

- Al-Nahain A, Jahan R, Rahmatullah M. 2014. *Zingiber officinale*: A potential plant against rheumatoid arthritis. *Arthritis*: 159089. doi: 10.1155/2014/159089
- Amoo SO, Okorogbona AOM, DuPlooy CP, Venter SL. 2017. Chapter 26 - *Sesamum indicum*. In *Medicinal Spices and Vegetables from Africa, Therapeutic potential against metabolic, inflammatory, infectious and systemic diseases*. Edited by V Kuete. Academic press, USA, Pp.549-579.
- Anonymous. 1948-76. *The Wealth of India, Raw Materials*, Vol. I-XI. Publications & Information Directorate, CSIR, New Delhi, India.
- Chakkaravarthi A, Kumar HNP, Bhattacharya S. 2013. Jilebi 2: Flowability, pourability and pH of batter as affected by fermentation. *Journal of Food Science Technology* 50:293-300.
- Delaviz H, Mohammadi J, Ghalamfarsa G, Mohammadi B, Farhadi N. 2017. A review study on phytochemistry and pharmacology applications of *Juglans regia* plant. *Pharmacognosy Reviews* 11:145-152.
- District census handbook. 2011. Census of India. Directorate of census operations, Rajasthan. Available online at: http://censusindia.gov.in/2011census/dchb/0832_P_ART_B_DCHB_UDAIPUR.pdf (Accessed December 2019).
- Fares A. 2013. Winter cardiovascular diseases phenomenon. *North American Journal of Medical Sciences* 5:266-279.
- FES. 2006. *Ecological Profile*. Udaipur, Rajasthan. Foundation for Ecological Security, Anand, Gujarat, India.
- Hong MY, Groven S, Marx A, Rasmussen C, Beidler J. 2018. Anti-inflammatory, antioxidant, and hypolipidemic effects of mixed nuts in atherogenic diet-fed rats. *Molecules* 23, 3126, doi:10.3390/molecules23123126
- Jaffe WR. 2012. Health effects of non-centrifugal sugar (NCS): a review. *Sugar Tech* 14:87-94.
- Jain SK, Jain V. 2017. *Methods and Approaches in Ethnobotany (Concepts, Practices and Prospects)*. Deep Publications, New Delhi, India.
- Jain V, Jain SK. 2016. *Compendium of Indian Folk Medicine and Ethnobotany (1991-2015)*, Deep Publications, New Delhi, India.
- Jain V, Jain SK. 2018. *Dictionary of Local-Botanical names in Indian Folk Life (Guide to over 26000 tribal and rural plant names documented in sixty years ethnobotanical field work)*, Scientific Publishers, Jodhpur, India.

- Jain V. 2013. Traditional subsistence grains of the poor now health foods of the rich. *Ethnobotany* 25:109-114.
- Jain V. 2016. Candy of *Cannabis sativa* L.- A traditional intoxicant in Udaipur, Rajasthan. *Journal of Traditional and Folk Practices* 4:129-131.
- Jha V, Shalini R, Kumari A, Jha P, Sah NK. 2018. Aquacultural, nutritional and therapeutic biology of delicious seeds of *Euryale ferox* Salisb.: A minireview. *Current Pharmaceutical Biotechnology* 19:545-555.
- Kalita S, Khandelwal S, Madan J, Pandya H, Sesikeran B, Krishnaswamy K. 2018. Almonds and cardiovascular health: A review. *Nutrients* 10, 468. Doi:10.3390/nu10040468
- Kapoor MP, Suzuki K, Derek T, Makoto O, Okubo T. 2020. Clinical evaluation of *Embllica officinalis* Gaertn (Amla) in healthy human subjects: Health benefits and safety results from a randomized, double-blind, crossover placebo-controlled study. *Contemporary Clinical Trials Communications* 17:100499.
- Katewa SS, Jain A. 2006. Traditional Folk Herbal Medicines. Apex Publishing House, Udaipur, India.
- Kim Y, Keogh J, Clifton PM. 2018. Nuts and cardio-metabolic disease: A review of meta-analyses. *Nutrients* 10, 1935; doi:10.3390/nu10121935
- Kumar R, Kumar M. 2018. Upgradation of jaggery production and preservation technologies. *Renewable and Sustainable Energy Reviews* 96:167-180.
- Lima EBC, Sousa CNS, Meneses LN, Ximenes NC, Santos Júnior MA, Vasconcelos GS, Lima NB, Patrocínio MC, Macedo D, Vasconcelos SM. 2015. *Cocos nucifera* L. (Arecaceae): A phytochemical and pharmacological review. *Brazilian Journal of Medical and Biological Research* 48:953-964.
- Müller H, Lindman AS, Blomfeldt A, Seljeflot I, Pedersen JI. 2003. A diet rich in coconut oil reduces diurnal postprandial variations in circulating tissue plasminogen activator antigen and fasting lipoprotein(a) compared with a diet rich in unsaturated fat in women. *Journal of Nutrition* 133:3422-3427.
- Nagulapalli VKC, Swaroop A, Bagchi D, Bishayee A. 2017. A small plant with big benefits: Fenugreek (*Trigonella foenum-graecum* Linn.) for disease prevention and health promotion. *Molecular Nutrition & Food Research* 61(6). Doi: 10.1002/mnfr.201600950
- Pallavi BV, Chetana R, Reddy SY. 2014. Processing, physico-chemical, sensory and nutritional evaluation of protein, mineral and vitamin enriched peanut Chikki. *Journal of Food Science and Technology* 51:158-162.
- Peter K, Gandhi P. 2017. Rediscovering the therapeutic potential of *Amaranthus* species: A review. *Egyptian Journal of Basic and Applied Sciences* 4:196-205.
- Posey DA. 1999. Cultural and spiritual values of biodiversity. Intermediate Technology Publications, UK.
- Rahmani AH, Salah MA, Ali H, Babiker AY, Srikar S, Khan AA. 2014. Therapeutic effects of date fruits (*Phoenix dactylifera*) in the prevention of diseases via modulation of anti-inflammatory, anti-oxidant and anti-tumour activity. *International Journal of Clinical and Experimental Medicine* 7:483-491.
- Ramakrishna C, Pamisetty A, Reddy S, Reddy Y. 2015. Nutraceutical enriched Indian traditional chikki. *Journal of Food Science and Technology* 52:5138-5146.
- Rather LJ, Islam S, Mohammad F. 2015. *Acacia nilotica* (L.): A review of its traditional uses, phytochemistry, and pharmacology. *Sustainable Chemistry and Pharmacy* 2:12-30.
- Reboul E. 2013. Absorption of Vitamin A and Carotenoids by the Enterocyte: Focus on Transport Proteins. *Nutrients* 5:3563-3581.
- Rico R, Bulló M, Salas-Salvadó J. 2016. Nutritional composition of raw fresh cashew (*Anacardium occidentale* L.) kernels from different origin. *Food Science & Nutrition* 4:329-338.
- ShavezKhan M, Qais FA, Ahmad I. 2019. Chapter 8 - Indian berries and their active compounds: Therapeutic potential in cancer prevention. In *New Look to Phytomedicine. Advancements in Herbal Products as Novel Drug Leads*. Edited by Mohd. SA Khan, I Ahmad, D Chattopadhyay. Academic press, USA, Pp. 179-201.
- Shetty BV, Singh V. 1987-1993. Flora of Rajasthan. Vol. I-III. Botanical Survey of India, Howrah, India.
- Singh OP, Singh SS, Kumar S. 2013. Rainfall profile of Udaipur. *Meteorological Monograph: Hydrology* No. 15/2013. Meteorological Centre, Jaipur, India Meteorological Department, New Delhi, India.
- Singh D, Baghel US, Gautam A, Baghel DS, Yadav D, Malik J, Yadav R. 2016. The Genus *Anogeissus*: A Review on Ethnopharmacology, Phytochemistry and Pharmacology. *Journal of Ethnopharmacology* 194:30-56. Doi: 10.1016/j.jep.2016.08.025.
- Singh V, Pandey RP. 1998. *Ethnobotany of Rajasthan, India*. Scientific Publishers, Jodhpur, India.
- Singh V, Srivastava SK. 2014. Utilization of wild plants during Tinchhath festival in eastern Uttar Pradesh. *Ethnobotany* 26:103-105.
- Spoorthi BC, Gautham SA, More SS, Maiti AK. 2018. Nutraceuticals: Potential therapeutic agents for the treatment and prevention of cardiovascular

diseases. Journal of Pharmacy Research 12:231-242.

Srivastava RC, *Adi* community. 2009. Traditional knowledge of *Adi* tribe of Arunachal Pradesh on plants. Indian Journal of Traditional Knowledge 8:146-153.

Srivastava RK. 2018. Need of Nutraceuticals / Functional food products for health benefits to world-wide people. Journal of Biotechnology and Biomedical Science 1:1-13.

Tang D, Dong Y, Ren H, Li L, He C. 2014. A review of phytochemistry, metabolite changes, and medicinal uses of the common food mung bean and its sprouts (*Vigna radiata*). Chemistry Central Journal 8:4. Doi: 10.1186/1752-153X-8-4

The Plant List. (Webpage) <http://theplantlist.org/> (Accessed October 2019).

Tiagi YD, Aery NC. 2007. Flora of Rajasthan. South & South-east region. Himanshu Publications, Udaipur, Rajasthan, India.

Vasanthi HR, Parameswari RP. 2010. Indian spices for healthy heart-An overview. Current Cardiology Reviews 6:274-279.

Vázquez-Fresno R, Rosana ARR, Sajed T, Onokome-Okome T, Wishart NA, Wishart DS. 2019. Herbs and Spices- Biomarkers of intake based on human intervention studies - A systematic review. Genes & Nutrition 14:18. doi: 10.1186/s12263-019-0636-8