

Journal of Advanced Scientific Research

ISSN 0976-9595

Research Article

Available online through http://www.sciensage.info/jasr

STUDIES ON TOTAL LIPID CONTENT OF SOME WILDEDIBLE FRUITS USING CONVENTIONAL AND ULTRASOUND

Vaishali J. Khilari, P. P. Sharma*

Research Centre in Botany, Shri Muktanand College, Gangapur, 431109(MS), India *Corresponding author: drppsharma6848@gmail.com, vjkhilari2016@gmail.com

ABSTRACT

The present communication deals with the investigation of lipid contents of some wild fruits of *Diospyros melanoxylon, Pithecellobium dulce, Carrisa congesta, Lantena camera, opuntia and Aegle marmelis.* The total crude lipid determination was conducted using conventional and ultrasound assisted extraction technique using methanol, methanol-chloroform and petroleum ether as a solvent. It has been observed that ultrasound assisted extraction is superior in terms of time (1-2 hr) and yield of the crude lipids. As there is no detailed work done on lipid profile of nutritious wild fruits as such, present study focused on the food value and exploration of underutilized edible fruits in Maharashtra, India.

Keywords: Wild fruits, lipid profile, extraction, ultrasound, nutritional analysis

1. INTRODUCTION

Nutritive values of fruits make significant contribution to lifestyle and good health in human beings. Hence, there is need of identification and exploration of the other underutilized edible fruits in order to fulfil the scarcity of nutritionally potential diet for growing population [1, 2]. Since, wild fruits are found to be the most important source of nutritionally potential food and considering the fact that increasing demand of food with high nutritional supplements can be fulfilled by these fruits and, efforts must be focused on sustainable use of underutilized wild plants sources of nutrient supplements against enhancing food and nutrition problems. On the present issue researcher were studying the nutritional potential of various types of wild edible plants [3-4].

Huge Indian literature has evidence that several wild plant fruits are known as edible since ages, however, the use of wild fruits as a food has decreased due to improvement and hybridization in commercially cultivated fruit plants. On the other hand increase in urbanization and gradual exploitation of forests is resulting in disappearance of several wild species from the area where they were abundantly growing. Some people in rural areas are still using them as supplement to their basic food requirements. Some are preserved for use during periods of scarcity or some time sold in the urban market. Now a day, the popularity of these wild fruits has declined. Hence, special attention should be paid to maintain and popularise this important source of food supply. Therefore, there is need to achieve scientific and systematic knowledge of wild edible fruits for cultivation.

Hence, special attention is being on underutilized wild fruits for good nutritional content. Lipids are heterogeneous group of biomolecules that are sparingly soluble or insoluble in water but soluble in organic solvent having biological functions such as structural component of cell membrane, storage and transportation of metabolic fluid, cell recognition and tissue immunity [5]. It can provide energy and essential fatty acid for biological processes of living organisms. It has function as carrier of fat soluble vitamins and their absorption. Lipids are composition of fatty acids such as saturated and unsaturated fatty acids, short, medium and long chain fatty acids. The influence of dietary lipids on adipose tissue was extensively studied [6-7].

Now a days, ultrasound assisted extraction have found to be a most promising technique for the extraction of valuable natural products. The ultrasonic extractions involve mass transfer due to swelling and enlargement of pores of the cell wall and became effective interaction with the extracting solvent. When ultrasound passes through the liquid medium, lead to microbubbles. By absorption of energy from sound waves, bubbles will grow in size and implode. The potential energy of the expanded bubble transforms into kinetic energy in form of a liquid jet, which directly strikes on the nearby plant cell. This imparts the release of chemical constituents into the surrounding solvent [8, 9]. However, conventional extraction processes were time consuming and consumption of thermal energy for longer time was required. In addition, ultrasonic device is less expensive and much easier in practice than that of microwave- assisted extraction and supercritical fluid extraction methods [10, 11]. The application of ultrasound for extraction of different chemical components and natural products are well documented in literature [12-16]. In present article we have described the determination of lipid content of six wild edible fruit using conventional and ultrasonic irradiation method.

1.1. Plant Species

1.1.1. Diospyros melanoxylon Roxb. Family- Ebenaceae Family : Ebenaceae Genus:Diospyros

Vernacular names- Marathi: Temburini.

Locality- Distributed in Ratanwadi, Bhandardara, Tal- Akole, Dist- Ahmednagar, Maharashtra State, India.

It has been found in dry tropical and sub-tropical forests with black or dark brown bark and woody. Leaves are thick pale green and hairy. Fruits are yellowish and fleshy with enlarged calyx like brinjal. Leaf fall has been observed during March to April, flowering and fruiting observed during April to June. Fruits of temburni are useful against diarrhea, dry cough and hypertension. Leaves contain flavones and triterpenes [17, 18].

1.1.2. Pithecellobium dulce(Roxb.) Bth.

Family- leguminosae(fabaceae)

Vernacular name-Marathi- Vilayati chinch.

Occurrence- India

Locality- Distributed in Ratanwadi, Bhandardara, Tal- Akole, Dist- Ahmednagar, Maharashtra State, India.

The genus pithecellobium contains approximately 100 to 200 species of shrubs and small trees. The fruits are in the form of pod, which turns pink when ripe and opens to expose an edible pulp. It has medicinal applications against convulsions. It contains carotene, phenylalanine, tryptophan, saponine a sterol glucoside and ascorbic acid [19, 20].

1.1.3. Lantena camara L. var.aculeata (L.)Moldenke Family-Verbenaceae

Vernacular name- Marathi: Tantani and Ghaneri.

Locality- Distributed in Ratanwadi, Bhandardara, Tal- Akole, Dist- Ahmednagar, Maharashtra State, India.

It is the most extensive species of this genus growing in tropical sub-tropical & temperate regions. It is being a large scrambling evergreen strong smelling shrub. The fruit are fleashy berries in cluster, shiny globular in shape. Ripened fruits are black in colour consisting caryophyllene, 1-alpha phellandrene, lantadene A, lantadene, quinine and Lantanine. It has various medicinal properties viz. vulneary, diaphoretic, carminative, antispasmodic and tonic wounds, ulcers, swelling, tumors and rheumatism. Fruit are known to have antibacterial, antifungal, anti-inflammatory and anti-fertility activity [21-25].

1.1.4. Carissa congesta

Family- Apocynaceae

Genus- Carissa

Species- congesta

Vernacular names-Marathi- Karvand

Locality- Distributed in Ratanwadi, Bhandardara, Tal- Akole, Dist- Ahmednagar, Maharashtra State, India.

This species belongs to rank growing strategy, woody, climbing shrub with evergreen leaves. Leaves are opposite oval or elliptic, 1 to 3 inch long and dark green in colour. The

flowers are fragrant, tabular with hairy lobes, twisted to the left in the bud. Fruits are developed at terminal clusters, broad ovoid or round, dark purple or nearly black when ripe and bitter [26-28].

1.1.5. Opuntia stricta(Haw.)Haw.

Family- Cactaceae

Genus- Opuntia

Species- Ficus-indica

Vernacular names-Marathi- Nivdung

Locality- Distributed in Ratanwadi, Bhandardara, Tal- Akole, Dist- Ahmednagar, Maharashtra State, India.

It is spread in the form of large colonies can be used as ornamental plant in gardens and later on it has been used as a natural agricultural fencing. Fruits are oval elongated berry with a thick receptacle and jucy pericap Fruit and stem have been traditionally used as medicine in several countries [29-31].

1.1.6. Aegle marmelo(L.)Corr.

Family- rutaceae

Vernacular names-Marathi- Beal

Locality- Distributed in Ratanwadi, Bhandardara, Tal- Akole, Dist- Ahmednagar, Maharashtra State, India.

It has great mytological significance for Hindus. Fruit is being used for breakfast as a mixture pulp and palm sugar or in the form of syrup. The syrup has therapeutic agent and relives diarrhoea and dysentery. It is rich in minerals and vitamin content, coumarins, alkaloids, sterols and essential oil [32-36].

2. MATERIALS AND METHODS

2.1. Fruit Sampling

Wild fruits of of Diospyros melanoxylon Roxb., Pithecellobium dulc (Roxb.)Bth., Carissa congesta Wight., Lantana camara L. var aculeate(L.)Moldenke., opuntia stricta (Haw.)Haw. and Aegle marmeos (L.) Corr. were collected from Ratanwadi, Bhandardara, Tal-Akole, Dist-Ahmednagar(MS), India in month of March 2015. The raw and ripened fruit samples were collected and dried under shade.

2.2. Preparation of the plant materials for chemical analysis

All fruit samples of Diospyros melanoxylon Roxb., Pithecellobium dulc (Roxb.)Bth., Carissa congesta Wight., Lantana camara L. var aculeate(L.)Moldenke., opuntia stricta (Haw.)Haw. and Aegle marmeos (L.) Corr. were dried in shade in order to remove residual moisture. The shade dried fruits were ground into powder using grinder, filtered and stored in polythene bags. The stored food powders were used as such for further lipid analysis.

2.3. Chemical Analysis

The experimental chemical analysis of all fruit samples were conducted in Research Laboratory, Department of Botany, Shri Muktanand College, Ganagapur, Dist-Aurangabad by conventional extraction process using Soxhlet extractor and Sonicator. The solvents used were ethanol and n-hexane.

2.4. Determination of crude lipid

2.4.1. Conventional method

The dried fruit powder (2 gm) was placed in a porous thimble of a Soxhlet extractor with cotton plug at its mouthed and thimble was placed in an extraction chamber which was suspended to previously weighed flask containing methanol, methanol-chloroform or petroleum ether. The whole assembly was adjusted and flask was heated using heating mental for 8-10 hrs to extract crude lipid. After the extraction, thimble was removed from the Soxhlet apparatus and the solvent was removed under reduced pressure to afford crude lipid. Furthermore, the flask containing lipid was placed in oven at 100°C for 30 minutes to remove residual solvent, cooled in a desiccator and weighed. The amount of crude lipid was calculated and expressed as percentage crude lipid content (AOAC. 1990). The results were summarized in Table 1.

2.4.2. Ultrasound assisted method

To a dried fruit powder (2 gm) in previously weighed round bottom flask with 50 ml capacity, methanol, methanolchloroform or petroleum ether (15 ml) was added. The above fruit suspention was placed in water bath and irradiated under sonication for 2 hrs. at ambient temperature. After each time interval as 30, 60, 90 and 120 minutes (Figure 1), the suspension was filtered evaporated and weighed to find out crude lipids. Irradiation was continued till constant weight of flask was recorded. The amount of crude lipid was calculated and expressed as percentage crude lipid content.

3. RESULTS AND DISCUSSION

In continuation to our ongoing research on applicability of wild fruits in India [37-39] the determination of total lipid content of six wild edible plant viz. Diospyros melanoxylon, Pithecellobium dulce, Carrisa congesta, Lantena camera, opuntia and Aegle marmelis was conducted using conventional method using Sohxlet extraction apparatus and sonications using different solvents and solvent system such as methanol, petroleum ether and methanol-chloroform. It has been found that methanolchloroform solvent system showed yield of crude lipids than methanol and petroleum ether. This is because methanolchloroform solvent system is a mixture of polar (methanol) and non-polar (chloroform) solvents, hence both neutral and polar lipids gets extracted (Haizhou Li et al 2004). However, only nonpolar lipids are soluble in non-polar solvent as petroleum ether. Although, petroleum ether gives lower yield but selectivity of lipid extraction is excellent as compared to methanol and methanol-petroleum ether solvent system. Because other chemical components like alkaloids also gets extracted in polar solvent system. Furthermore, the use of ultrasound has some advantages over traditional method in terms of time required for extraction and yield of crude lipids. The processes of cavitations in sonication method can accelerate the rate of extraction with in shorter period (2 hr). The results obtained by conventional method as well as ultrasound method were represented graphically in Fig. 2 and Fig.3.

Plant Name	Family	Common	Lipid Content (%)					
		Name	Conventional Method		Ultrasound Method		ethod	
			MeOH	MeOH-	Pet.	MeOH	MeOH-	Pet. Ether
			Extract	$CHCl_3$	Ether	Extract	CHCl ₃	Extract
				Extract	Extract		Extract	
Diospyros melanoxylon Roxb.	Ebenaceae	Tembhurni	1.2	1.8	0.80	1.5	1.68	0.82
Pithecellobium dulce	Fabaceae	Vilayati	1.35	1.70	0.40	1.32	1.90	0.55
(Roxb.)Bth.		Chinch						
Carissa congestaWight.	Apocynaceae	Karvand	3.6	4.2	2.35	3.25	4.34	2.40
Lantana camara L. var.	Verbenaceae	Ghaneri	0.80	1.7	0.66	1.40	2.3	0.80
Aculeate (L.)Moldenke								
Opuntia stricta (Haw.)Haw.	Cactaceae	Nivdung	1.6	2.8	0.80	1.80	3.65	0.79
Aegle marmelos (L.) Corr.	Rutaceae	Beal	2.30	3.5	1.60	2.42	3.81	1.70
	5				MeOH Extr	act		
	4.5 -				MeOH-CHC	I3Extract		
	<u>چ</u> 3.5 -				Pet. Ether E	xtract		
) spiq							
	en 2.5							
	O 1.5							
	1 -							
	0.5 -							

Table 1 Determination of crude lipid contents of some wild fruit samples using conventional method

90

30

120

140

Sonication time (min.) Fig.1: Effect of US time on the yield of lipid

Table 2.	Comparative	study	of total	lipids	of	commonly
consuma	able fruits and	wild fr	uits und	er inve	stiga	ation:

Common name of the fruit	Total fats (%)		
Rowal, raw	4		
Bananas, dehydrated, or banana powder	3		
Bananas, raw	1		
Cranberries, dried, sweetened 1	1		
Pomegranates, raw	5		
Sapodilla, raw	4		
Guavas, common, raw	2		
Figs, dried, uncooked	2		
Raspberries, raw	1		
Blueberries, frozen, unsweetened	2		
Blackberry juice, canned	2		
Blackberries, raw	1		
Grapefruit juice, white, frozen	2		
concentrate, unsweetened, undiluted			
Sapotes, (marmalade plum), raw	2		
Tamarinds, raw	1		
Custard-apple, (bullock's-heart), raw	1		
Apples, dehydrated (low moisture),	0		
sulfured, uncooked			
Prickly pears, raw	l		
Jackfruit, raw	1		
Lemon peel, raw	0		
Oranges, raw, with peel	1		
Strawberries, raw	1		
Tembhurni raw	1.8		
Vilayati Chinch raw	1.90		
Karvand raw	4.34		
Ghaneri raw	2.3		
Nivdung raw	3.65		
Beal raw	3.81		

^aTotal fat content data cited from

http://www.weightchart.com/nutrition/food-nutrient-highestlowest.aspx?nn=204&h=True&ct=Fruits%20and%20Fruit%20Juices



Fig. 2: Extraction of lipid using conventional method; A-Diospyrus melanoxylon; B- Pithecellobium dulce; C- Carrisa congesta; D-Lantena camera; E- Opuntia; F- Aegle marmelis



Fig. 3: Extraction of lipid using ultrasound method;

A-Diospyrus melanoxylon; B- Pithecellobium dulce; C- Carrisa congesta; D-Lantena camera; E- Opuntia; F- Aegle marmelis

4. CONCLUSION

Determination of lipid content of six wild edible fruit of Diospyros melanoxylon, Pithecellobium dulce, Carrisa congesta, Lantena camera, opuntia and Aegle marmelis was conducted using conventional and ultrasonic irradiation method. The extraction was carried out using methanol as polar solvent, methanolchloroform as polar-nonpolar solvent system and peteroleum ether as nonpolar solvent. The results obtained were suggested that ultrasound assisted extraction technique is more effective for lipid extraction in terms of lower extraction time and yield of residual lipids than conventional extraction technique. The total lipid content was further compared with some of the commonly consumable fruits (http://www.weightchart.com/nutrition/food-nutrient-highestlowest.aspx?nn=204&h=True&ct=Fruits%20and%20Fruit%20Juice s). The comparative results were represented in Table 2. This indicates the lipid potential wild fruits under investigation are higher. Hence it will be more beneficial than commonly consumable fruits when fat rich supplement was required.

5. ACKNOWLEDGEMENTS

Authors are thankful to tribal peoples, Ratanwadi, Bhandardara, Tal- Akole, Dist- Ahmednagar (MS) and Principal, Shri Muktanand College, Gangapur for providing necessary laboratory facilities.

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