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Physicochemical properties and elemental analysis of some non cultivated seed oils collected from Garhwal region, Uttarakhand (India)

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Abstract: The present study investigates the physico-chemical properties, elemental analysis and fatty acid profile of non cultivated seed oils of *Prunus armeniaca, Prunus persica, Hyptis suaveolens, Bischofia javanic* and *Datura metel*. The oil yields ranges between 14.72% to 44.3%.Crude protein content was in the range of 18.69% to 31.18%, carbohydrate between 15.61% to 51.22%. Iodine value of oils ranges between 102.0 to 178.3.Saponification value between 190 to 289.3. The main fatty acids were oleic acid, linoleic acid, linolenic acid ,and palmitic acids. The results obtained in present study showed that these non cultivated seed oils have very high nutritional and medicinal value and these can be used for edible and commercial purposes.
***Keywords*:** Non cultivated seeds, Garhwal region , elemental analysis, fatty acid profile, physico- chemical analysis.

INTRODUCTION

The use of plants and plant based products for treatment of diseases is as old as mankind, plant sources brings new natural products in food and pharmaceutical industry . Scientists throughout the world are trying to explore the precious assets of medicinal plants to help the suffering humanity (1).Likewise other plant parts as well as seeds have been used as natural drugs. Seeds are still widely used as herbal drugs either crude form or as preparations thereof, or as sources of medicinally active natural products to be used in traditional medicine. Plant seeds are important source of oil of nutritional, industrial and pharmaceutical importance. Fats and oils obtained from seeds are an important food source for man, and are supplying essential fatty acids.

Oils from seeds are both edible and non-edible depending on the type. These oils are often available as raw materials for chemical and industrial applications. Because of the high demand and economic importance of these oil seeds to the chemical industry, attention has therefore been focused on unutilized new seeds for possible development and use (2). So its necessary to invent the new sources of oils .The present study was therefore undertaken to explore their potential as possible sources of oil for domestic and industrial uses in different trades. Several species of non cultivated seed oils which have many medicinal, nutritional properties and can be used on commercial scale in different industries. In this study five non cultivated oil yielding seeds *Prunus armeniaca* (Rosaceae), *Datura metel* (Solanaceae), *Hyptis suaveolens* (Lamiaceae), *Bischofia javanica* (Euphorbiaceae), *Prunus persica* (Rosaceae) were selected.

MATERIALS AND METHODS:

Collection of seeds

The fruits of *Prunus armeniaca* , *prunus persica* (Village Kandai,Pauri Garhwal), *Hyptis suaveolens* (Kalagarh Road forest region), *Bischofia javanica*(Ramnagar near Kalagarh adjoining of Garhwal and Kumaun region **)**and *Datura metel* (Dugadda forest region near Kotdwara)collected from Garhwal region Uttarakhand, India. The seeds were identified and authenticated by Dr. H.B. Singh, National Institute of Science Communication and Information Resources, New Delhi, India. Seeds were separated from breaking the fruit into two parts..The seed samples were stored in airtight amber coloured glass bottles and kept in a refrigerator prior to analysis.

Extraction of seed oil

A known weight of the seeds were grounded into powder form and then oil was extracted with Petroleum ether (boiling point 40°C -60°C) by soxhlet method using soxhlet apparatus for 6 to 8 hrs. The extracted solvent was dried over anhydrous sodium sulphate and distilled off at 60°C by rotary evaporator to concentrate the oil. Oil content was calculated from weight of oil and weight of seed taken for extraction.Extracted oil collected and preserved in amber coloured glass bottle for the analysis.

Physico-chemical analysis of seed oil:

Moisture, % yield fat content ,crude protein, carbohydrates and crude fiber were estimated by AOAC method (3). Nitrogen content estimated by the Kjeldal method and was converted to protein content by using the conversion factor 6.25.Carbohydrates estimated by using Fehling solution. For oil analysis, a known weight of the seed were undergo size reduction and extracted with petroleum ether (boiling range 40-60°C) for 6-8 hours in a soxhlet apparatus.The extracted Petroleum ether was dried over anhydrous sodium sulphate and concentrared under reduced pressure by rotary evaporator .The oil percentage was calculated by weight difference . Density of extracted oil was determined picnometrically, Refractive index was determined at 25°C with Abbe refractrometer, viscosity was determined by Ostwald Method (4). The oil extracted from the seeds was analysed for various physico - chemical properties.

Determination of Elemental compositions:

The metal composition Zinc, Iron, Copper of the seed samples were determined using an Atomic Absorption Spectrophotometer (Model no. –Varian 240FS+GTA120), after acid digestion. Calcium and magnesium was determined by complexometric titration with 0.1M EDTA using Erichome black T indicator and calculated. Phosphorus was determined by the precipitation and then titration method using the reagent ammonium molybdate and after filtration precipitate dissolved in 0.1M NaoH and titrate with 0.1M HCl by using indicator Phenolphthalien. Sodium and potassium was determined by flame Photometer(model No. ESICO 1381) by using the reference standard (Merck) and calculated on the basis of reading and dilution of the sample.

Determination of fatty acid profile:

The Fatty acids were derivatized by using the boron trifluoride method as described by Hisil (5). Samples were injected as 2 µl into a Nucon model 5700 equipped with 10% DEGS (Diethylene Glycol Succinate) + 1% H_3PO_4 constant phase, a flame ionization detector (FID) and chromosorb G (100/120 mesh) support matter, internal diameter (2mm) and stainless steel (190 cm) column. Column temperature was programmed from 70°C to 200°C with the increasing rate of temperature 6°C/Minute. Injector and detector temperatures were set at 225°C. Nitrogen (N_2) (35 ml/min) was used as the carrier gas. Hydrogen (40ml/min) and Air (60ml/min) were used as burnt and dry gas respectively. Fatty acid methyl esters were identified by comparison with fatty acid internal standards, Individual fatty acid concentration was expressed as percent.

RESULT AND DISCUSSION:

From table No. 1 oil yield of *prunus armeniaca* is (44.3%), (36.5%) in *prunus persica* and (20.4 %) in *Bischofia javanica* that's comparable to the yield of some commercial seed oils groundnut(40.1%), mustard(39.7%), linseed(37.1%), Almond(58.9%), Sunflower(52.1%) and coconut oil(39.0%) given in Nutritive value of Indian Food (6). Many of the physico- chemical properties of the seeds oil studied have close similarity with other commercial seed oils. Specific gravity of extracted seed oil are lies in the range of (0.8919- 0.9172) that's are comparable to other conventional seed oil(2).

Table-1 Physico and phyto –Chemical properties of oil yielding seeds

Chemical test of seeds	*Prunus armeniaca*	*Datura metel*	*Hyptis suaveolens*	*Bischofia javanica*	*Prunus persica*
Yield, %	44.3	14.72	17.44	20.1	36.5
Moisture Content, %	6.86	4.63	7.93	5.93	7.32
Ash content , %	2.05	5.14	9.63	6.83	2.14
Carbohydrates Content, %	15.61	51.22	15.86	18.91	19.2
Protein Content,%	31.18	20.73	19.84	18.69	28.36
Fiber Content %	1.94	7.35	19.21	5.32	1.81
Total Phenolics%	0.27	0.35	0.98	0.59	0.25
Total tannin %	6.47	0.69	2.36	9.65	7.89
Total alkaloids %	0.22	3.56	0.31	0.22	0.35

Table-2 Elemental composition of oil yielding seeds

Metals (mg/100gm)	*Prunus armeniaca*	*Datura metel*	*Hyptis suaveolens*	*Bischofia javanica*	*Prunus persica*
Calcium (Ca)	330.0	174.0	670.0	710	498.0
Phosphorous (P)	472.0	690.0	238.1	391.4	428.0
Potassium(K)	0.017	0.50	2.4	1.25	0.036
Sodium (Na)	0.034	0.085	3.16	0.08	0.038
Iron (Fe)	3.6	16.8	1.63	2.33	1.3
Zinc (Zn)	3.79	2.63	1.78	1.40	4.62
Copper (Cu)	1.56	6.9	1.70	2.43	2.4
Magnesium (Mg)	370.0	390.0	1120.0	610.0	426

Table-3 Physico –Chemical properties of extracted oil.

Parameters	*Prunus armeniaca*	*Datura metel*	*Hyptis suaveolens*	*Bischofia javanica*	*Prunus persica*
State (at RT)	Liquid	Liquid	Liquid	Slight viscous liquid	Liquid
Colour	Pale yellow	yellow	Pale yellow	yellow	Pale yellow
Odour	agreeable	agreeable	Agreeable	Agreeable	Agreeable
Refractive index (at 40°C)	1.4638	1.4511	1.4319	1.4863	1.4672
Specific gravity (at 25°C)	0.9172	0.8919	0.8966	0.9256	0.9178
Acid value (mgKOH/g)	4.05	4.10	3.3	6.59	4.78
Iodine value	102.0	112.0	115.8	178.3	106.0
Unsaonifiable Matter,%w/w	0.71	0.49	0.68	0.48	0.78
Saponification Value (mgKOH/G)	190	215.6	195.0	289.3	198.05

Table-4 Fatty acid profile

Profile	*Prunus armeniaca*	*Datura metel*	*Hyptis suaveolens*	*Bischofia Javanica*	*Prunus persica*
Palmitic acid (C16:0), %	3.37	15.31	8.09	16.58	5.25
Stearic acid (C18:0), %	2.68	2.72	2.23	20.048	1.76
Oleic acid (C18:1),%	73.58	25.97	13.59	12.623	75.74
Linoleic acid (C18:2,)%	19.26	54.25	76.08	48.925	17.249
Linolenic acid (C18:3) %	-	-	-	1.145	-
Palmitolic acid (C16:1),%	-	1.52	-	0.40	-
Myristic acid (C14:0),%	1.18	-	-	-	-

Table-5 Total saturates & Unsaturates profile

Profile	*Prunus armeniaca*	*Datura metel*	*Hyptis suaveolens*	*Bischofia Javanica*	*Prunus persica*
Saturated fatty acids, %	7.23	18.03	10.32	36.628	7.01
Mono-unsaturted Fatty acids, (MUFA)%	73.58	27.49	13.59	13.02	75.74
Poly –unsaturted fatty acids,(PUFA) %	19.26	54.25	76.08	50.06	17.249
Total Saturates ,%	7.23	18.03	10.32	36.628	7.01
Total Unsaturates, %	92.84	81.74	89.67	63.08	92.99

Table No. 3 shows physico-chemical properties of extracted oil, in which colour of extracted oil range from Pale yellow to yellow . Odour of oils are agreeable, liquid at room temperature except *Bischofia javanica* which is slightly viscous . Moisture content of oils in *Datura metel* is very lowest (4.63%) and highest in *Hyptis suaveolens* (7.93%), comparable with other edible and commercial used oils and results shows that can be stored for a long time. Acid value is used as an indication of edibility of oil and suitability for used in the paint industry and that are with in range of (4.05 to 6.59), falls within the recommended codex of 0.6 and 10 for virgin and non -virgin edible oils and fats (7) nearest to other conventional oils, which are already in use for edible and commercial industries. Non drying liquid oils have iodine values of approx. 80-120 , Drying oils have greater than 150 and Semi – drying oils have an iodine value in the range of 120-150. Iodine value of *prunus armeniaca ,Prunus persica, Datura metel, Hyptis suaveolens* (range102.0-115.8) lies in the category of non drying oils and , very closer to *mustard oil*(108), *cotton seed* oil (108) reported in Nutritive value of Indian food (8).The non-drying oils find a wide variety of industrial uses, they enter into soaps and cleansers, cosmetics, lubricants, leather dressings, and candles. They are also used in the processes of wool manufacture, especially carding; they are employed in making tin plate and in foundry work. Iodine value of *Bischofia javanica* is (178.3), that lies in drying oil. Drying oils are used mainly in paints, varnishes, lacquers, and printer's ink.

Saponification value of *prunus armeniaca ,Prunus persica, Datura metel, Hyptis suaveolens* range 190-215.6 (table. 3) while *Bischofia javanica* seed oil was 289.3 vey highest, which suggests that the oils contain high molecular weight fatty acids and low level of impurities & unsaponifiable matter of oils are in range of (0.48 – 0.71) shows less impurities in oils ,so it can be used in soap making industry (9 -10). Fatty acid profile (table 4) shows that percentage of linoleic acid in *Hyptis suaveolens* seed oil is 76.08% ,*Datura metel* seed oil 54.25% *Bischofia javanica* seed oil 48.92% that is comparable with *sunflower* & *soyabean* seed oil. Total unsaturated fatty acid (Table 5) are in range of 63.08% - 92.99%. Mono-unsaturted Fatty acids,(MUFA)% range from 13.02% to 75.74 % while Poly –unsaturted fatty acids,(PUFA) % range from 17.2 to 76.08%. Unsaturated fatty acids (polyunsaturated) help to reduce cholesterol formation or deposition and hence to decrease the risks of atherosclerosis and other heart disease.

Elemental analysis of oil (table No.2) shows that oil seed is rich in phosphorous, calcium, magnesium, Iron and copper which give support for use of this oil as medicinal and edible purposes. These mineral elements are very important in human nutrition. *Hyptis suaveolens* (670.0mg/100gm), *Prunus armeniaca*(330.0mg/ 100gm), *Prunus persica* (498.0 mg/100gm) seed oils are very rich in Calcium. *Hyptis suaveolens* oil contain higher amount of Magnesium (1120.0 mg/100gm) Potassium (2.4mg/100gm), *Bischofia javanica* contains magnesium (610.0mg/100gm) and potassium (1.25mg/100gm) .Calcium, potassium and

magnesium are required for repair of worn out cells, strong bones and teeth in humans, building of red blood cells and for body mechanisms (11) . The biological roles for K and Ca are essential for disease prevention and control and may, therefore, contribute to some of the traditional medicinal influences of the plants.

Prunus persica (4.62mg/100gm) *& prunus armeniaca* (3.79 mg/100gm) seed oil contains higher amount of Zinc. Copper (6.9 mg/100gm) and Iron (16.8 mg/100gm) are higher in *Datura metel seed oil*. Datura metel contains high concentration of Phosphorous (690.0mg/100gm). Phosphorus in more widely distributed than calcium and also serves a variety of biological functions. While most of phosphorus is skeletal as hydroxyapatite, 15 % is distributed among extraskeletal sites like phosphoproteins, phospholipids, and nucleic acids. *Hyptis suaveolens* seed oil contains (3.16 mg/100gm) of sodium, which is higher than other oils. Trace elements such as manganese, iron and zinc are essential in enzymes metabolism. The concentrations of these elements in the plants are quiet important. Manganese is an important modulator of cells functions and play vital role in the control of diabetes mellitus (12).The importance of iron in maintaining the good health has been recognized (13).Iron plays an important role in biology, forming complexes with molecular oxygen in haemoglobin and myoglobin, these two compounds are common oxygen transport proteins in vertebrates. Iron is also the metal used at the active site of many important redox enzymes associated with cellular respiration and oxidation and reduction in plants and animals.

CONCLUSION:

Physico chemical properties of oils, % oil yield and fatty acid profile shows that these non cultivated seed oil can be used in commercial scale in many industries. The appreciable concentrations of minerals such as sodium, potassium, calcium and magnesium obtained in the plants seed oil are interesting. These findings provide quantitative estimation of the phytochemicals as well as mineral element analysis which are important in understanding the pharmacological and/or toxicological actions of these seed oil. The results obtained from this study could be used as baseline data to develop these non cultivated seed for both domestic and industrial purposes.

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