Oil extraction from medicinal plants by *Pawra* tribe of Nandurbar district (Maharashtra): Value addition and sustainable utilization with the aid of Ayurved

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Medicinal oils for topical applications are commonly used by the tribes for treatment of various ailments like headache, muscular spasms and local inflammation. Objective of present paper was to describe the traditional methods for extracting oils either from seeds or whole plants used by the *Pawra* community in Nandurbar district. Interestingly, the methods of extraction of oils described in *Ayurvedic* literatures are similar to these methods as well as the medicinal uses except using fish oil in skin diseases. Value addition in the extracted oil resulted in additional economic benefit. Plants used for oil extraction are being conserved in forests as well as cultivated in farm.

**Keywords:** Medicinal plants, Oil extraction, *Pawra* tribe, Traditional process, *Ayurved*  
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India has the second largest tribal population in the world after Africa. There are over 55 million tribal people in India belonging to more than 500 communities and more than 200 ethnic groups. They inhabit about 5000 forested villages or lead to a nomadic life in the forests. These tribal populations have a rich heritage of traditional knowledge about the plants available in their surroundings with their medicinal usages. Over the past few decades, the traditional knowledge on the use of medicinally important plants has been widely acknowledged and valued across the world. This knowledge is commonly inherited through oral communication from generation to generation mostly in a script-less form. According to the World Health Organization (WHO) as many as 80% of world’s population depends upon traditional medicine for their primary health-care needs. As per the 2001 census of India, the total tribal population is 8% of country’s population out of which Maharashtra has 47 Scheduled tribal communities comprising of 9.27% of state population. There are several remote areas in Maharashtra state with a pool of knowledge, most of it is scientifically unexplored and awaits validation. These tribal communities have their own wisdom of medicinal plants growing in the nearby forests, and they specifically use these plants for preparing the extracts and formulations in a very cryptic and traditional ways. The aim of the present study was to evaluate some unique medicinal uses of the plants utilized by the *Pawra* tribe and encourage preservation of their culture, traditional knowledge with conservation and sustainable utilization of the plant wealth observed in the study area. The present investigation reports traditional methods for extraction of oils, which are highly important in ethno-medicinal uses in the treatment of different ailments by the *Pawra* tribe of Nandurbar district of Maharashtra, India.

**Methodology**

**Study area**

The study area, Nandurbar district, lies near the tri-junction of the boundaries of Gujarat, Madhya Pradesh and Maharashtra state (Fig. 1). Nandurbar district lies between 21° 14’ to 22° 02’ N latitude and 73° 59’ to 75° 12’ E longitude. It comprises of four talukas, namely Akrani, Taloda, Akkalkua and Shahada. The district occupies an area of 5034 km²

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and has a population of 1,311,709 of which 15.45% is urban (as of 2001). Nandurbar district, which adjoins Dhule district on its South and South-east side, towards the West and North, is the state of Gujarat, and to the North and North-east, is the state of Madhya Pradesh. The great Narmada river defines the northern boundary of the district. The climate of the study area is mainly dry, and the area receives an annual rainfall of nearly 860 mm. The main river basins in this area are of Narmada and Tapi.

As much as 80% of the population of the study area is dominated by several tribal communities. There are four main tribes Bhilla, Pawra, Padvi and Naik that reside in Nandurbar district, of which Pawra is the third dominant tribe, distributed in Satpuda ranges of Nandurbar district. They are mainly dependent on forest and agricultural produce. They usually reside in remote areas of the forests of Satpuda ranges and are indiscriminately scattered in small villages known as padas. As this tribe usually resides in the interior and hilly regions, they are disconnected from the modern medicine and healthcare systems. Moreover, accessibility to health-centre in some areas is also difficult. Despite that the tribes are generally free from common non communicable diseases such as diabetes, CVD, asthma, arthritis, etc. This is probably because of their unpolluted surroundings, low calorie food, dynamic life-style and use of the traditional herbal medicines.

Frequent visits to 73 tribal villages belonged to all four Talukas in the forests of Nandurbar and its adjacent area were made during 2008-2010. A close association was made with the local people, especially Vaidus (local healthcare providers) to understand their indigenous knowledge regarding medicinal plants and preparation of various formulations. A total of 157 tribal Vaidus were frequently interviewed with their prior consent as per the CBD guidelines and their medicinal procedures were minutely observed and documented. In the study, it was observed that the Vaidus use a variety of oils extracted from the local plants and fishes for their routine health practices. There exist a range of processes by which the oil was extracted from the plants like seeds of Celastrus paniculatus Willd., Terminalia bellirica (Gaertn.) Roxb., whole plant of Lavandula bipinnata O. Ktze. var. bipinnata and from fresh water fish and utilized in medicines.

Sustainable utilization of the products was worked out in two steps—Awareness about plants and Value addition as explained below:

A time bound plan was carried out to increase awareness about the plants among the tribal people. First year was spent on identifying the proper representative person and documenting few vital points for generating awareness among tribes. Persons selected include the Vaidus, Dais, school students and prominent villagers who expressed their interest. They were trained theoretically as well as practically for cultivation, sustainable utilization of resources for scientific harvesting and processing and preserving raw drugs. They were also demonstrated for non-destructive harvesting methods (Figs. 2-4).

The traditional methods used by the tribes to produce the end products were optimized with the help of Ayurved expert targeted to increase shelf-life. This includes storage of raw material and packaging in bottles, labeling, storage and handling of the packaged products (Fig. 4b). They were also trained to calculate estimated costs of such products.

Results

The processes of extraction of oil are described below in detail:

Extraction of Malkangni and Behada oil

Malkangni (Celastrus paniculatus Willd.) oil is used mostly for topical application as massage oil for muscular, joint problems and for minor injuries. Mature fruits of Malkangni are collected usually in
the month of October-November whereas the oil is extracted preferably during summer season. The seeds separated can be stored for about 2 yrs after collection. Seeds are separated from seed coat and steamed in an assembly of a metal pot with narrow opening (Fig. 2a), a basket of bamboo that fits perfectly on the opening of this metal pot and a lid. The metal pot is filled with water and heated on fire (Fig. 2b). A bamboo basket containing seeds is placed and covered with a lid. The seeds are steamed for about 45 min till it is properly cooked. The seeds are then taken in a cloth and squeezed/pressed hard between wooden plates (Fig. 2c). Red colored oil flows out, which can be stored for one year. From one kg of Malkangni seeds, as much as 300 gm of oil can be extracted. The cake that remains behind in the cloth is used to treat patients with paralysis. Similar method is used for extracting oil from seeds of Behada (Terminalia bellirica (Gaertn.) Roxb) that is commonly used for the treatment of hair and skin. It is supposed to prevent premature graying of hair (Table 1).

Extraction of fish oil
Freshly collected fishes are kept on teak leaves and heated on a shallow metal plate on fire. The fat of these fishes is melted due to the heat and accumulates on the middle of metal plate. The teak leaf is than removed and the oil left behind is collected and bottled (Figs. 3a, b & c). From one kilogram of fish, about 50 ml of oil can be obtained. It is used for skin diseases like eczema, proriasis, non healing wounds, etc. as a topical application (Table 1). Most commonly used fish for extraction of oil are Garra mullya and Rasbora daniconias.

Balm oil
Balm oil is extracted from Gayanda (Lavandula bipinnata O. Ktze. var. bipinnata). It is used as topical application for headache. Twigs of Gayanda, which bears flowers and fruits, are collected and dried in sunlight. This material is crushed in to small pieces and mixed with water. Care must be taken that some part must remain above the water level in an earthen or aluminium vessel. In the traditional method of
distillation, sundried aerial part of *Gayanda* is heated in an earthen or aluminium vessel, covered with a lid. A small (5 cm diameter) hole is made on the top of the vessel. A hollow bamboo pipe is inserted through this hole, which remains connected to another small container that is partially submerged in water stream for condensation. Local sealing material like mud and cloth is used to reduce evaporation. The bamboo pipe is also covered by wet cloth and obtained oil is collected in small pot. In this pot, the proportion of obtained oil and water (1: 4) is taken. Then, water is removed and only oil is collected. It can be stored for 1-2 yrs (Table 1, Fig. 4a).

In the traditional practice of medicine, several plant based drugs, formulations are regularly utilized for treating various ailments, supplement for nutrition and healthy life style. Majority of the plant based drugs that are discovered have been used traditionally for medicinal purpose, showing a clear correlation between the documented traditional usages and their current applications. The strategy used for discovery of *de-novo* drugs used on the screening of plants having medicinal uses relevant to the therapy of a particular disease or ailment is known as ethno-pharmacological screening. Many of the traditional knowledge are concurrent to our traditional Ayurvedic system of medicine.

Medicinal oil is one of the important and most commonly practiced dosage forms in Ayurved. Variety of plants and animal sources of drugs are being mentioned for such type of medicinal applications like Sesame, Flax, *Semecarpus anacardium*, etc. and animal fats like from Pig, Goat, etc. The medicinal properties of these particular oils vary based on the base drug with an added potential of stability, permeability and better acceptability by the patients. This kind of dosage forms are being used via an internal as well as external route like massage, enema, topical application, etc.

The plants like *Celastrus paniculatus* Willd. (*Jyotishmati*), *Terminalia belerica* (Gaertn.) Roxb. (*Bibhitaki*) have an important place in ethnic as well as traditional Ayurvedic medicinal system. The procedures used by the tribal for extraction of the medicinal oil from the drugs are quite similar to the method explained in various authentic texts of *Ayurvedic*. A detailed list of *Yantra* (assembly of equipments) for preparation of various formulations from plants can be found which is similar to the ones used by the tribal.

The oils thus extracted are used mainly for the external applications like *Celastrus paniculatus* Willd. for joint pain, enhancement of cognition, hair problems and *Terminalia belerica* (Gaertn.) Roxb. especially for hair and skin problems. A detailed reference for the use of fish oil in regards to its extraction and medicinal properties is not found yet it can be explained on the basis of fundamental *Ayurvedic* properties (Table 1). Even today, tribal communities rely on their traditional knowledge of herbal medicines to cure variety of ailments and disorders. These traditional systems and knowledge are kept in secrecy and are generally passed on to the next generations by the elders. Many of these herbal drugs prepared by this traditional ways by these tribal communities are concurrent to the Indian *Ayurvedic* system of medicine.

### Traditional conservation practices of plants adopted by tribes and Economics

Initially these products were used locally by the tribal people. After discussion with the experts, they initiated marketing of their products to visitors at very low cost. Proper and elaborated training resulted in to conservation of these plants; tribal people initiated cultivation of selected plants in their farm and their harvesting by using sustainable methods. These practices lowered the burden on forest and ultimately

<table>
<thead>
<tr>
<th>Source</th>
<th>Origin (Plant/Animal)</th>
<th>Used in/as</th>
<th>Ayurvedic relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behada</td>
<td>Plant; From seeds of <em>Terminalia bellirica</em> (Gaertn.) Roxb.</td>
<td>Hair growth, head massage for irritation of eyes</td>
<td>Oil is used in hair problem</td>
</tr>
<tr>
<td>Malkangni</td>
<td>Plant; From seeds without seed coat of <em>Celastrus paniculatus</em> Willd.</td>
<td>Fresh oil is applied locally for joint pain; older oil is used to treat paralysis; For muscle tone up</td>
<td>Similar in <em>Ayurvedic</em> texts; also used as nootropic drug and during hair loss</td>
</tr>
<tr>
<td>Gayanda</td>
<td>Plant; From whole plant or twigs with flowers and fruits <em>Lavandula bipinnata</em> O. Ktze. var. <em>bipinnata</em></td>
<td>In Headache the balm is applied locally</td>
<td>Used similarly but preparation method is different</td>
</tr>
<tr>
<td>Fish</td>
<td>Animal; Freshly collected fish</td>
<td>Used in Skin diseases</td>
<td>Not available</td>
</tr>
</tbody>
</table>
have led to conservation and sustainable utilization of natural resources. Scientific cultivation technique increased the availability of raw materials, training resulted in maintaining good quality of product and appropriate way of packaging eventually led to increase in the selling price of the product (Table 2) (Fig. 4b). For example, fish oil was initially sold at a very lower price (Rs. 500/-pre liter) and after scientific inputs local people could make a monetary benefit of Rs. 1000/-per liter. Thus, value addition resulted in the successful sustainable lively hood for the tribe. By routine practice, they are expert in cultivation and processing of plant. Proper training and marketing of these medicines is in turn helping in conservation of the forest wealth and for their economical up gradation. Economic status of these tribal people is comparatively very low and this difference in initial and current price made a major change in their livelihood.

**Conclusion**

Traditional knowledge is the basis of treatments of various ailments in many tribal communities. Some of them are concurrent to the standard Ayurvedic system. Scientific training will help them to prepare products according to standard parameter and sale them in local market as an additional source of income which will play a considerable role to raise their economical condition and conservation of forest wealth as well. Present study will be helpful to researcher to investigate and validate the application of these oils for particular ailments.

**Acknowledgement**

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**References**

6. [www. http://nandurbar.nic.in](http://nandurbar.nic.in)

Table 2—Difference in cost of product

<table>
<thead>
<tr>
<th>Product</th>
<th>Initial price</th>
<th>Current price</th>
<th>Benefit/liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malkangani oil</td>
<td>Rs. 400/lit.</td>
<td>Rs. 1200/lit.</td>
<td>Rs. 800/lit.</td>
</tr>
<tr>
<td>Behada oil</td>
<td>Rs. 200/lit.</td>
<td>Rs. 700/lit.</td>
<td>Rs. 500/lit.</td>
</tr>
<tr>
<td>Balm oil</td>
<td>Rs. 300/lit.</td>
<td>Rs. 1000/lit.</td>
<td>Rs. 700/lit.</td>
</tr>
<tr>
<td>Fish oil</td>
<td>Rs. 500/lit.</td>
<td>Rs. 1500/lit.</td>
<td>Rs. 1000/lit.</td>
</tr>
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