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DRUG COLLECTION AND STORAGE PRACTICES: AN AYURVEDIC PERSPECTIVE

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ABSTRACT

In the recent years, there is an exponential growth in demand for herbal drugs across the globe. The market for herbal drugs is rapidly growing and expanding at a faster pace. However, the ever increasing demand for herbal drugs in market, has led to many consequences such as over-exploitation and unscientific use of medicinal plants, bio-piracy along with lack of regulation and infrastructure for proper cultivation and collection of medicinal plants etc. This tremendous growth of the herbal sector has revealed the need for improved quality control in cultivation and collection of herbal raw material. The guidelines released by WHO on "Good agricultural and collection practices (GACP) for medicinal plants," addresses the issues related to cultivation as well as provides recommendations on cultivation and collection techniques along with their practical implications. The seers of Ayurveda were well-versed with the various harvesting, collection and storage techniques of medicinal plants to get optimum therapeutic results. In Ayurveda literature, the practices related to drug collection and storage has been mentioned as per the different seasons, Nakshatras etc. to attain maximum therapeutic effect through the drug which has been properly harvested. The ancient concept of drug collection and storage shows its applicability & relevance in present era due to its close resemblance with the existing modern guidelines for drug cultivation and collection.

INTRODUCTION

The present market for herbal drugs is estimated about 40 billion and it is expected to increase by 16% in coming 3-4 year[1]. Despite of progress in modern medicinal system, the world is still lagging behind fulfilment of the commitment "Health to all". It is known fact that a major part of world population mainly in developing and underdeveloped countries does not have access to modern medicine. They are dependent on traditional or alternative or complementary systems of medicine. World Health Organization in 'WHO Traditional Medicine Strategy 2014–2023' has emphasised to integrate traditional and complementary medicine to promote universal healthcare and to ensure the quality, safety and effectiveness of such medicine. Around 75% of natural medicines available in the global market are the product of traditional medicinal knowledge. Around 70% of modern medicines are either derived from natural sources or synthetically modified from the naturally occurring phytochemicals. Due to a global increase in traditional and alternative healthcare systems, the demand for medicinal plants has increased in many folds. However, the availability of resources is limited. This all has led to loss of biodiversity, over-exploitation and unscientific use of medicinal plants, industrialization, bio-piracy, along with lack of regulation and infrastructure for proper cultivation and collection of medicinal plants.[2]

It has been found documented in Vedic era about the evidences of the knowledge and art to cultivate, harvest, collect and store medicinal plants. In Ayurveda classics, details related to collect a plant in order to get it in its most potent state has been well written. The specific part to be collected from the proper place at specific time with suitable methods has been elaborately described in our ancient texts. This was done with an aim to get a genuine drug having highest potency and therapeutic utility, which will be helpful in improving the quality of the formulations prepared from them.

WHO has also developed a series of technical guidelines relating to the quality control of herbal medicines under the Heading of Good Agriculture and Collection Practices (GACP). The guidelines provide a detailed description of the techniques and measures required for the appropriate cultivation and collection of medicinal plants and for the recording and documentation of necessary data and information during their processing.

In the present study an attempt has been made to provide ancient knowledge of drug collection and storage techniques. Attempt has also been made to collate all the information

available in standards and authoritative guidelines (such as GACP-WHO) related to medicinal plants collection and storage.

Ayurvedic perspective of Drug Collection and Storage

1. Identification of Medicinal Plants

In Sushruta Samhita "Medicinal plants should be identified with the help of cowherds, hermits, huntsmen and others who roams in the forest as well as with the help of those who consumes the edible roots and fruits of the forests".[3]

According to the GACP guidelines of WHO, it has been given:

- It should be the same as that specified in the national pharmacopoeia or recommended by other authoritative national documents of the country.
- It should be identified and documented as described in traditional medicine of the original country.

In Ancient times for identification and authentication, a specific group of people served as authoritative identifiers, nowadays, the pharmacopeia's and national documents serves the purpose of identification.

2. Appropriate Habitat for Drug Collection

In Charak Samhita, medicinal plants, for producing excellent therapeutic effects, should be collected from places having following characteristics.[4]

- These are to be collected from *Sadharana desha* (forests of normal/tropical land) or *Jangala desha* (forests of dry land)
- Plants should have been exposed to seasonal cold, sun, wind and rain appropriately.
- Plants should have grown over plains and clean land surrounded by water reservoirs.
- Plants should not have been grown in crematorium, *Chaiyta* (sacred tombs), prayer ground, assembly ground, pits, parks, anthills and saline soil.
- The land should have enormous growth of *Kusha* and *Rohisa*
- The soil should be unctuous, black in colour and sweet in taste or golden in colour with sweet taste; and
- The land should not have been ploughed and there should not be other big tress in vicinity over-shadowing the medicinal plants.

In Sushruta Samhita, features of land from which medicinal plants can be collected are given as follows[5]:

- The ground should not be uneven by the presence of ditches, gravel and stones,
- It should not disfigured by ant-hills
- The land should not be used for the purposes of cremation or execution,
- It should not come under the provinces of temples
- It should be favourable for the cultivation of medicinal plants.
- The land should not contain alkaline soil and the one which is uncultivated
- It should be supplied with water source
- It should possess soil which is unctuous, soft, firm and black, yellowish or red in colour.
- It should be favourable to the growth of vegetation for the cultivation of medicinal plants.

According to the GACP guidelines of WHO, it has been given:

a. Site selection for plant

- Risks of contamination as a result of pollution of the soil, air or water by hazardous chemicals should be avoided.
- The impact of past land uses on the cultivation site, including the planting of previous crops and any applications of plant protection products.

b. Ecological environment and social impact

- The introduction of non-indigenous medicinal plant species into cultivation may have a detrimental impact on the biological and ecological balance of the region.

c. Climate

- Length of day, rainfall (water supply) and field temperature, duration of sunlight, average rainfall, average temperature, including daytime and night-time temperature differences.

d. Soil

- The soil should contain appropriate amounts of nutrients, organic matter, soil type, drainage, moisture retention, fertility and ph.

e. Irrigation and drainage

- The quality of water used for irrigation purposes comply with local, regional and/or national standards.

- The plants under cultivation should neither over- nor under-watered.

f. Plant maintenance and protection

- The measures such as topping, bud nipping, pruning and shading should be timely adopted form proper development and growth of plant.
- The use of pesticides and herbicides should be applied at the minimum effective level and should comply with maximum pesticide and herbicide residue limits, as per authority's rules and regulations.
- Consultation on pesticides use should be made with International agreements such as the International Plant Protection Convention and Codex Alimentarius etc.

3. Appropriate time and method of drug collection

Drug should be collected in the appropriate season when they have attained maturity in respect of their size, taste, potency and smell.[6]

Characteristics of plant to be selected

Their smell, colour, taste, touch and *prabhava* (specific action) should have remained unaffected by *kala*, excessive exposure to sun-rays, fire, water, wind and by parasites. They should be endowed with all attributes. They should be collected from the northern side.[7]

Vagbhatta has mentioned following things to be considered while collecting plants[8] are:

- The drug should possess their normal colour, taste and other qualities.
- Should not be attacked by insects,
- Should not be burnt by forest conflagrations
- Should not be affected by abnormal atmospheric elements
- They should be well tendered by shade, sunshine, water, etc. in the appropriate seasons,
- They should have deep-seated roots in the soil and the roots should be stout, belonging to the northern direction.

According to the GACP guidelines of WHO, it has been given

- Medicinal plants should not be collected in or near areas where high levels of pesticides or other possible contaminants are used or found, such as roadsides, drainage ditches, mine tailings, garbage dumps and industrial facilities which may produce toxic emissions. In addition, the collection of medicinal plants in and around active pastures, including

riverbanks downstream from pastures, should be avoided in order to avoid microbial contamination from animal waste.

4. Appropriate season for collection of specific part of plant

Pryojyanga	**Charaka Samhita[9]**	**Sushruta Samhita[10]**	**Ashtang Hridya[11]**	**Raja Nighantu[12]**
Moola	*Grishma,Shishira*	*Pravritta*	*Grishma*	*Shishira*
Patra	*Varsha, Vasanta*	*Varsha*	*Varsha, Vasanta*	*Shishira*
Shakha	*Varsha, Vasanta*	-	*Varsha, Vasanta*	-
Pushpa	As per season	*Grishma*	As per season	*Vasanta*
Phala	As per season	*Grishma*	A per season	*Vasanta*
Sara	*Hemanta*	*Vasanta*	*Hemanta*	-
Twaka	*Sharad*	*Sharad*	*Sharad*	-
Kanda	*Sharad*	-	*Sharada*	*Hemanta*
Kshira	*Sharad*	*Hemanta*	*Sharad*	-
Panchanga	-	-	-	*Sharad*

5. Appropriate method to collect the drug[13]

One should collect the various parts of these plants while facing towards the east or north after performing auspicious rites in a spirit of compassion, while living a pure life, wearing white dress, after offering prayers to the gods, Ashvinis, cows and Brahmins and observing the fast.

According to the GACP guidelines of WHO, it has been given:

a. Harvest

- It should be harvested during the optimal season or time period to ensure the production of medicinal plant materials.
- The time of harvest depends on the plant part to be used.
- Medicinal plants should be harvested under the best possible conditions, avoiding dew, rain or exceptionally high humidity.
- In the course of collection, efforts should be made to remove parts of the plant that are not required and foreign matter, in particular toxic weeds. Decomposed medicinal plant materials should be discarded.

b. Personnel

- They should have adequate knowledge of the medicinal plant.
- They should maintain appropriate personal hygiene and have received training regarding their hygiene responsibilities.

In GACP-WHO, specific description of collection under the heading of "Ecologically non-destructive systems of collection" has been mentioned

- While collecting roots of trees and bushes, the main roots should not be cut or dug up.
- Cutting of the taproot of trees and bushes should be avoided.
- When collecting species whose bark is the primary material to be used, the tree should not be girdled or completely stripped of its bark; longitudinal strips of bark along one side of the tree should be cut and collected.
- In general, the collected raw medicinal plant materials should not come into direct contact with the soil. If underground parts (such as the roots) are used, any adhering soil should be removed from the plants as soon as they are collected. Collected material should be placed in clean baskets, mesh bags, other well aerated containers or drop cloths that are free from foreign matter, including plant remnants from previous collecting activities.

6. Method of Storage of collected drugs[14]

- The collected plant product should be kept inappropriate containers well covered with a lid and hung on a swing.
- The store room should have doors facing towards the east or the north.
- The room should be immune to the wind or storm and there should be only one window for ventilation.
- Flower-offerings and sacrificial rituals should be performed in the store-room every day.
- It should be free from the hazards of fire, water, moisture, smoke, dust, mice and quadrupeds.
- It should be properly covered.
- It should be properly hanged to the roof with *Shikya*.

According to the GACP guidelines of WHO, it has been given:

- After collection, elimination of undesirable materials and contaminants, washing (to remove excess soil), sorting and cutting should be done appropriately.
- The collected medicinal plant materials should be protected from insects, rodents, birds and other pests, and from livestock and domestic animals.
- If more than one medicinal plant part is to be collected, the different plant species or plant materials should be gathered separately and transported in separate containers. Cross-contamination should be avoided at all times.

- All personnel must be protected from toxic and dermatitis-causing plants, poisonous animals and disease-carrying insects.
- Appropriate protective clothing, including gloves, should be worn when necessary.

Medicinal plant material handling areas

1. Floors should be of waterproof, non-absorbent, washable, nonslip and non-toxic material, without crevices, and should be easy to clean and disinfect.
2. Walls should be covered with waterproof, non-absorbent and washable materials, sealed and free from insects, and should be light coloured.
3. The wall should be smooth and without crevices, and should be easy to clean and disinfect.
4. Ceilings should be designed, constructed and finished so as to prevent the accumulation of dirt and minimize condensation, mould development and flaking, and should be easy to clean.
5. Windows and other openings should be constructed so as to avoid accumulation of dirt, and those that open should be fitted with insect-proof screens.
6. Doors should have smooth, non-absorbent surfaces and, where appropriate, be self-closing and close-fitting.
7. Stairs, lift cages and auxiliary structures such as platforms, ladders and chutes should be situated and constructed so as not to cause contamination to medicinal plant materials.

CONCLUSION

In Ayurvedic literature the description of collection and storage practices of medicinal plants are documented in detail and its applicability as well as relevance in present era is validated by its close relation or comparison with the existing modern guidelines of Good Agricultural and Collection Practices (GACP) by World Health Organisation (WHO) which indicates that scholars of Ayurveda were quite aware about such practices and were practicing them for cultivation and collection of herbs. These guidelines serve as tools for obtaining maximum quantity of active principles by proper cultivation and collection techniques. Therapeutic efficiency of medicines depends upon the quality and quantity of the medicinal plants, active principles and their secondary metabolites and which in turn are influenced by the method of collection. The details related to collection and storage practices in ancient times are equally important as the modern guidelines to achieve the desired therapeutic effect of medicinal plants.

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