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Macroscopic evaluation of genuine and market samples of Ashwagandha (*Withania somnifera* (Linn.) Dunal) in Kerala

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Abstract

Withania somnifera (Linn.) Dunal (Solanaceae) is a very important ayurvedic herb used from time immemorial. The Ayurvedic Pharmacopoeia of India (API) mentions root of *Withania somnifera* (Linn.) Dunal as the officinal part of Ashwagandha. In Kerala, it is used in a variety of formulations either as single or in combinations. But there is a huge difference between its demand and availability. So the study was undertaken to assess the genuineness of Ashwagandha available in herbal raw drug markets of Kerala. For this purpose, 28 commercial samples (one from urban and one from rural) of Ashwagandha was collected from each of 14 districts of Kerala and its characters were compared with the root collected from the genuine source plant of Ashwagandha [*Withania somnifera* (Linn.) Dunal] and also with the standards mentioned for Ashwagandha in API. There was great difficulty in procuring original Ashwagandha because it is not cultivated in Kerala. So it was collected from Bhopal in Madhyapradesh where the best variety of Ashwagandha is obtained, which is called 'Nagori Ashwagandha'. Comparisons were done with the aid of macroscopic evaluation which is a part of Pharmacognostical evaluation. The result got from each of these matched with that of genuine sample and the standards given in API. So the samples got from each of the 14 districts of Kerala are thus found to be genuine.

Keywords: Ashwagandha, *Withania somnifera* (Linn.) Dunal, Macroscopical evaluation

1. Introduction

The adulteration and substitution of herbal drugs is the burning problem in herbal industry and it has caused a major effect in the commercial use of natural products. It is one of the greatest drawbacks in promotion of herbal drugs. It is invariably found that majority of adverse events related to the use of herbal products are not usually due to the intended herb but due to the presence of an unintended herb. WHO reports various adverse events may arise from the use of products contaminated with potentially hazardous substances, such as toxic metals, pathogenic microorganisms and agrochemical residues ^[1].

The quality control of herbal crude drugs and their bioconstituents is of paramount importance in ensuring its therapeutic efficiency. Hence every single drug needs to be quality checked to ascertain that it confirms to quality requirement and delivers the properties consistently. The present study assessed the genuineness of Ashwagandha (*Withania somnifera* (Linn.) Dunal) available in raw drug market of kerala with the aid of macroscopical study which is a part of pharmacognosy. Ashwagandha [*Withania somnifera* (Linn.) Dunal] is not commonly cultivated in Kerala, but it grows as a weed on road side and waste lands. The annual demand of Ashwagandha is 9127.5 tons per annum in the year 2005 ^[2]. Based on the current trend the current production would be 8429 tons and demand of Ashwagandha per annum would be around 12500 tons ^[3, 4] which shows a huge discrepancy. So in order to assess the genuineness with the aid of Macroscopical study, the root of genuine Ashwagandha [*Withania somnifera* (Linn.) Dunal] as well as market samples of Ashwagandha were collected.

2. Materials and Method

Macroscopic evaluation is the technique of evaluation of identity based on the study of morphological and sensory profiles of whole drug. It refers to evaluation of a drug by colour, odour, size, shape, taste, and special features including touch, fracture and texture.

a) Aims

To evaluate the organoleptic characters of the genuine samples.

To compare the organoleptic characters of various market samples with the genuine one.

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i) Collection of genuine sample

The genuine sample of Ashwagandha [*Withania somnifera* (Linn.) Dunal] was collected from the Bhopal in Madhya pradesh and authenticated by pharmacognosy unit, Ayurveda Research Institute, Poojappura.

ii) Collection of market samples

Two market samples of Ashwagandha were collected from each of fourteen districts of Kerala, one from rural and one from urban area of each district. Thus a total of twenty eight market samples were collected for the study. The sample from the urban and rural areas of the same district were named as sample A and sample B respectively. They were stored in air tight polythene bags.

b) Materials

Magnifying lens and dissecting microscope were used for the purpose.
Size of pieces –length of root, dimensions- length, breadth, thickness, surface- surface condition, colour, cork(fissure, ridges etc), fracture-smooth, powdery, short, fibrous, granular etc, odour- Any specific smell (pleasant, nauseating etc),taste- Any specific taste like acrid or bitter when put on tongue.
The above mentioned characters of the genuine samples and the market samples were done separately and then these characters of the market samples were compared with those of the genuine.

3. Result

The macroscopic characters of market samples of Ashwagandha were evaluated. Then the results were compared with the characters of *Withania somnifera* Linn. root mentioned in Ayurvedic Pharmacopoeia of India (API) and also with the root of genuine Ashwagandha [*Withania somnifera* (Linn.) Dunal] collected from the genuine source plant. For this purpose the roots were divided into 3 groups- large, medium and small. Characters observed were as follows:

Macroscopic evaluation of root of genuine Ashwagandha
Tables and Figures

Table 1: Organoleptic characters of genuine sample

Shape	All the pieces were cylindrical
Size	1cm diameter x 15cm length
External colour	Buff to grayish yellow
Internal colour	Starchy white
External surface	Almost smooth except very few longitudinal fissures
Fracture	Short, uneven and powdery
Texture	Smooth
Odour	Characteristic
Taste	Bitter and acrid



Fig 1: Fresh and dry roots of Ashwagandha [*Withania somnifera* (Linn.) Dunal]

Images of Samples from All Districts (Fig 2 to 29)

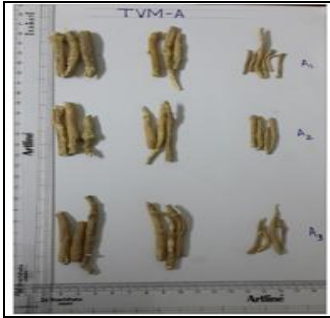


Fig 2: Trivandrum A



Fig 3: Trivandrum B



Fig 4: Kollam A



Fig 5: Kollam B



Fig 6: Alappuzha A



Fig 7: Alappuzha B



Fig 8: Ernakulam A



Fig 9: Ernakulam B



Fig 10: Pathanamthitta A



Fig 11: Pathanamthitta B



Fig 12: Kottayam A

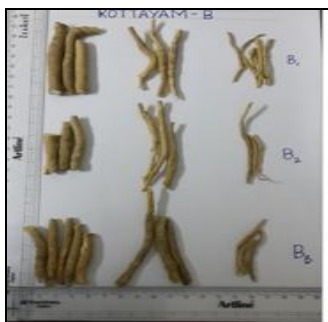


Fig 13: Kottayam B



Fig 22: Wyanad A



Fig 23: Wyanad B



Fig 14: Thrissur A



Fig 15: Thrissur B



Fig 24: Palakkad A



Fig 25: Palakkad B



Fig 16: Kozhikode A



Fig 17: Kozhikode B



Fig 26: IDUKKI A

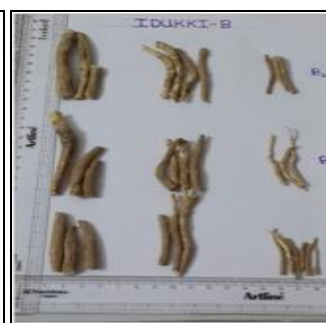


Fig 27: IDUKKI B



Fig 18: Kannur A



Fig 19: Kannur B



Fig 28: Kasargod A



Fig 29: Kasargod B



Fig 20: Malappuram A



Fig 21: Malappuram B

Macroscopic evaluation of market samples

The samples were evaluated macroscopically. On primary inspection of market samples it was clear that all the samples were very similar in their appearance except their sizes. The results are as charted below:

Table 2: Organoleptic evaluation of 28 market samples

Characteristics	Size of sample A	Size of sample B
Trivandrum	Large- 4 to 4.7 cm length 0.4 to 0.9 cm diameter Medium- 3.7 to 6.5 cm length 0.3 to 0.4 cm diameter Small- 1.7 to 5.4 cm length 0.1 to 0.3 cm diameter	Large- 3.5 to 4.9 cm length. 0.2 to 0.5 cm diameter. Medium- 3.5 to 6.9cm length 0.3 to 0.4 cm diameter Small- 2.4 to 5cm diameter 0.1 to 0.2 cm diameter
Kollam	Large- 4 to 11.9 cm length 0.3 to 0.9 cm diameter Medium- 6 to 8 cm length 0.1 to 0.5 cm diameter Small- 3.5 to 7.2 cm length 0.1 to 0.4 cm diameter	Large- 3.2 to 7.5 cm length 0.5 to 0.6 cm diameter Medium- 6 to 7 cm length 0.2 to 0.5 cm diameter Small- 2 to 4 cm length 0.1 to 0.2 cm diameter
Alappuzha	Large- 3 to 9.5 cm length 0.5 to 1 cm diameter Medium- 4.2 to 8.5 cm length 0.1 to 0.2 cm diameter Small- 2 to 3.6 cm length 0.1 to 0.2 cm diameter	Large- 2.5 to 10 cm diameter 0.5 to 1 cm diameter Medium- 6 to 5.5 cm length 0.2 to 0.3 cm diameter Small- 3 to 4.8 cm length 0.2 to 0.3 cm diameter
Ernakulam	Large- 4.5 to 10 cm length 0.3 to 0.5 cm diameter Medium- 5 to 11 cm length 0.1 to 0.5 cm diameter Small- 3 to 10 cm length 0.1 to 0.2 cm diameter	Large- 6 to 7 cm length 0.5 to 0.7 cm diameter Medium- 5 to 7.2 cm length 0.2 to 0.4 cm diameter Small- 2.2 to 6.5 cm length 0.2 to 0.3 cm diameter
Pathanamthitta	Large- 4 to 8 cm length 0.5 cm to 1.5 cm diameter Medium- 5.5 to 8.5 cm length 0.1 to 0.2 cm diameter Small- 2 to 4.4 cm length 0.1 to 0.2 cm diameter	Large- 6 to 9 cm length 0.2 to 0.3 cm diameter Medium- 5 to 6 cm length 0.1 to 0.2 cm diameter Small- 1.2 to 4.5 cm length 0.1 to 0.2 cm diameter
Kottayam	Large- 3.2 to 9.5 cm length 0.2 to 0.3 cm diameter Medium- 4.5 to 6.6 cm length 0.2 to 0.4 cm diameter Small- 1.5 to 3.7 cm length 0.1 to 0.2 cm diameter	Large-3.5 to 6.8 cm length 0.3 to 0.6 cm diameter Medium- 5.5 to 9.0 cm length 0.2 to 0.4 cm diameter. Small- 1.3 to 4.5 cm length 0.1 to 0.2 cm diameter
Thrissur	Large- 4 to 9.5 cm length 0.2 to 0.5 cm diameter Medium- 5.2 to 8 cm length 0.2 to 0.4 cm diameter Small-3.5 to 5.1 cm length 0.1 to 0.3 cm diameter	Large- 2.5 to 6.5 cm length 0.3 to 0.8 cm diameter Medium- 4 to 6.5 cm length 0.2 to 0.3 cm diameter Small- 2.5 to 6.5 cm length 0.1 to 0.2 cm diameter
Kozhikode	Large-3.7 to 12.4 cm length 0.5 to 0.6 cm diameter Medium- 5.5 to 8 cm length 0.2 to 0.3 cm diameter Small- 2.1 to 4.8 cm length 0.1 to 0.2 cm diameter	Large- 4 to 8 cm length 0.4 to 1 cm diameter Medium- 5 to 6.5 cm length 0.3 to 0.4 cm diameter Small- 1.9 to 4.8 cm length 0.1 to 0.2 cm diameter
Kannur	Large- 2.5 to 8.3 cm length 0.3 to 0.8 cm diameter Medium- 4.5 to 8.5 cm length 0.2 to 0.4 cm diameter Small- 3.5 to 6.5 cm length 0.2 to 0.3 cm diameter	Large- 3 to 5 cm length 0.5 to 0.6 cm diameter Medium- 4.4 to 5 cm length 0.1 to 0.3 cm diameter Small- 2 to 3.4 cm length 0.1 to 0.2 cm diameter
Malappuram	Large- 3 to 10.5 cm length 0.5 to 1 cm diameter Medium- 5 to 6.5 cm length 0.1 to 0.5 cm diameter Small- 2 to 7 cm length 0.1 to 0.2 cm diameter	Large- 1.9 to 4.1 cm length 0.3 to 0.5 cm diameter Medium- 2.4 to 7.5 cm length 0.2 to 0.3 cm diameter Small- 1.1 to 5.1 cm length 0.1 to 0.2 cm diameter
Wyanad	Large- 5.5 to 8.7 cm length 0.2 to 0.4 cm diameter Medium-6.0 to 10.5 cm length 0.1 to 0.3 cm diameter Small- 3.5 to 9.4 cm length 0.1 to 0.2 cm diameter	Large- 5.5 to 8 cm length 0.3 to 0.5 cm diameter Medium- 4.5 to 7 cm length 0.4 to 0.5 cm diameter Small- 2 to 6cm length 0.1 to 0.2 cm diameter
Palakkad	Large- 3.6 to 9 cm length 0.2 to 0.3 cm diameter Medium- 5 to 8 cm length	Large- 4.5 to 11 cm length 0.2 to 0.3 cm diameter Medium- 3.8 to 10 cm length

	0.1 to 0.2 cm diameter Small- 1 to 6 cm length 0.1 to 0.2 cm diameter	0.2 to 0.3 cm diameter Small- 1 to 4 cm length 0.1 to 0.2 cm diameter
	Large- 4.3 to 9.5 cm length 0.2 to 0.3 cm diameter Medium- 4.5 to 9 cm length 0.2 to 0.3 cm diameter Small- 1 to 7 cm length 0.1 to 0.2 cm diameter	Large- 3.2 to 8 cm length 0.4 to 0.7 cm diameter Medium- 3 to 6 cm length 0.3 to 0.4 cm diameter Small- 1 to 4.2 cm length 0.1 to 0.2 cm diameter
Kasargod	Large- 6.5 to 19 cm length 0.2 to 0.6 cm diameter Medium- 6.5 to 10.5 cm length 0.2 to 0.4 cm diameter Small- 3 to 7 cm length 0.1 to 0.2 cm diameter	Large- 3.5 to 7.5 cm length 0.4 to 1 cm diameter Medium- 5 to 10 cm length 0.3 to 0.4 cm diameter Small- 3 to 6.2 cm length 0.1 to 0.2 cm diameter

Characteristics	Sample A of 14 districts	Sample B of 14 districts
Shape	Cylindrical	Cylindrical
External colour	Buff to grayish yellow	Buff to grayish yellow
Internal colour	Starchy white	Starchy white
External surface	Almost smooth except a very few shallow longitudinal fissures. Surface of thin root appears shrunken.	Almost smooth except a very few shallow longitudinal fissures. Surface of thin root appears shrunken.
Fracture	Short, uneven & powdery	Short, uneven & powdery
Texture	Smooth except very few shallow longitudinal fissures	Smooth except very few shallow longitudinal fissures
Odour	Characteristic	Characteristic
Taste	Bitter and acrid	Bitter and acrid

4. Discussion

Root of *Withania somnifera* (Linn.) Dunal is mentioned as the officinal part of drug Ashwagandha in API. So in order to assess its genuinity of the market samples, it was compared with genuine *Withania somnifera* (Linn.) Dunal. For this genuine *Withania somnifera* (Linn.) Dunal was collected from Bhopal in Madhya Pradesh where the best variety of Ashwagandha is obtained, which is called 'Nagori Ashwagandha'. Then two samples of Ashwagandha were collected from each of fourteen districts of Kerala thus making a total of 28 samples.

The price of raw drug purchased as Ashwagandha varied from market to market. The market price varied from 60 to 100 Rs per 200 gm. There are many factors which determine the price of a raw drug. It depends on the quality and extent of adulteration, the demand and supply discrepancy, the status and reputation of the trader and buyer, mode of payment (cash/credit) and quantity ordered also decide the price of species [5].

In Organoleptic evaluation, all the market samples showed similar characters except the size of the root. There were three sizes of roots. Large size having length of 4cm to 19 cm and diameter 0.2 to 0.5cm. Medium size having length of 5 to 8cm and diameter 0.2 to 0.4cm and small size having length of 3.5 to 5cm and diameter 0.1 to 0.3cm. Variation in diameter suggests pieces at different ages were present in the market samples. Genuine root sample matched with the length of large size root.

Foreign matter was comparatively high in market samples than genuine sample. It mainly consisted of visible moulds on the external surface. External surface in majority of market samples showed white patches due to mould attack (Fig 2 to 29). Unscientific drying, prolonged duration of storage and climatic conditions in Kerala where the average temperature and relative humidity are comparatively high may be the factors which favor association of microbes with stored product. Plant materials which are especially rich in carbohydrates and getting less attention in storage are more

prone to the attack of vulnerable moulds [6].

Herbal drugs should be made from stated part of the plant and be devoid of other parts of the same plant or other plants. They should be entirely free from moulds or insects, including excreta and visible contaminant such as sand and stones, poisonous and harmful foreign matter and chemical residues. Animal matter such as insects and "invisible" microbial contaminants, which can produce toxins, are also among the potential contaminants of all medicines (WHO, 2004, 2003; EMEA, 2002) [7]. Such drugs should be rejected even though the percentage of other foreign matter are less in them. Special care should be taken to avoid the formation of moulds, since they may produce aflatoxins as per the study of Roy *et al.* [8].

5. Conclusion

The macroscopic characters of the genuine sample matched with the standard features mentioned in API. All the macroscopic features were similar except the size of the samples. The majority of the pieces had white spots on its external surface (fig 2 to 29) suggesting the presence of moulds. Quality is the sum of all the factors which contribute directly or indirectly to the safety efficacy and acceptability of the product. So care should be taken in the storage of herbal drugs to avoid microbial contamination and also to get maximum concentration of active principles.

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