

# Sensory Analysis – A contemporary Quality Control tool for *Asava-Arishta*

## Research Article

Mehul Mehta<sup>1\*</sup>, Saloni Ambasana<sup>2</sup>, Shukla VJ<sup>3</sup>, Prajapati PK<sup>4</sup>

1. Head, Quality Control Department, Indian Institute of Ayurvedic Pharmaceutical Sciences, Gujarat Ayurved University, Jamnagar, Gujarat, India.
2. Senior Officer – R & D, Vasu Research Centre, Makarpura GIDC, Makarpura, Vadodara, Gujarat, India.
3. Head, Pharmaceutical Chemistry, IPGT&RA, Gujarat Ayurved University, Jamnagar, Gujarat, India.
4. Professor and Head, Ras shastra and Bhaishajya Kalpa, All India Institute of Ayurveda, New Delhi.

## Abstract

Quality control of Ayurvedic medicines though being the need of the hour, is an arduous task. As Ayurveda encompasses the use of drug as a whole which leads to generation of a complex matrix. In such a scenario, selective and sensitive sophisticated analytical tools alone cannot serve the purpose. Besides, the ancient science of medicine is sensory driven. A number of sensory based quality standards in form of quality-attributes for drugs as well as critical end point for pharmaceutical operations are mentioned in the classics of Ayurveda. It is thus advisable to employ sensory based analytical methods for Quality control of Ayurvedic medicines. Henceforth, in the present study an attempt was made to develop a sensory based Quality control tool for discrimination of the market samples of *Arjunarishtha* with regards to In-house prepared (Reference control) sample on the basis of smell and taste. Among the sensory methods available, Duo-Trio method was adopted. 40 pre-trained assessors were asked to identify the blindly coded sample analogous to Reference control. The results were analysed using Receiver Operating Characteristics (ROC) curve, Area Under Curve (AUC) and d-prime ( $d'$ ) with the help of sensR package in R-studio ver. 1.0.143. In both the sample sets, Reference control sample was correctly identified with a significance level of  $P < 0.001$  and Area Under Curve of 0.999 and 0.994 for each set respectively. Thus, it can be concluded that Sensory analysis method efficiently discriminated the *Arjunarishtha* samples and thus can serve as a cost-effective routine quality control tool.

**Key Words:** *Arjunarishtha, Ayurveda, Cost-effective, Duo-trio, Market samples, sensR.*

## Introduction

With the herbal wave sweeping over the entire society a rising call for return towards the ancient tradition has been observed. The increasing urbanization and thus to meet the global needs, Ayurvedic medicines are now being manufactured at large scale in pharma companies. However, it is very much essential to maintain the quality of the medicines thus manufactured.

Routinely the quality of Ayurvedic medicines is determined by Physico-chemical parameters, Toxicological study, Microbiological study and Shelf-life. However, due to the complex matrix of Ayurvedic medicines, its Quality control and Standardization is like harnessing the wild horses. Thus, there arises a need to develop multi-disciplinary approach for its efficacious Quality control and Standardization.

Though a number of sophisticated instrumentation techniques are available, which are sensitive and selective for the target analyte. But, as per the fundamental principles of Ayurveda, it encompasses the use of drug as a whole. Henceforth, the disparity between the modern instrumental methods and Ayurveda does not make the grade for effective Quality control of the latter.

Besides, the classical Ayurveda is sensory driven. In the classics of Ayurveda, a number of sensory based quality standards for drugs in form of desired characteristics have been mentioned (1-3). Likewise, the critical end point determination of any pharmaceutical operation is also determined through Sensory analysis (4-5). These analysis were primarily undertaken through "*Panchendriya pariksha*" which comprises of *Shabda* (sound), *Sparsh* (touch), *Roopa* (appearance), *Rasa* (taste) and *Gandha* (smell). These were not only used to identify the genuineness, but also were employed to evaluate the quality of the drug. In such a state-of-affair, it is the need of time to employ Sensory based analytical methods for the Quality control of Ayurvedic medicines.

Sensory analysis are widely used in food industry along with the medical field. It is a quantitative science in which the numerical data are collected to establish lawful and specific relationships between product characteristics and human perception. The

### \* Corresponding Author:

#### Mehul Mehta

Head, Quality Control Department,  
Indian Institute of Ayurvedic Pharmaceutical Sciences,  
Gujarat Ayurved University, Jamnagar 361008,  
Gujarat, India  
Email Id: [mehul\\_0016@yahoo.co.in](mailto:mehul_0016@yahoo.co.in)

method provides useful information about the human perception to product changes due to ingredients, processing, packaging or shelf-life. It is the science of measurement and like any other analytical method, Sensory analysis is concerned with precision, accuracy, sensitivity and avoiding false positive results.

The Institute of Food technology, defines Sensory analysis as, “A scientific method to evoke, measure, analyse and interpret those responses to products as perceived through the senses of sight, smell, touch, taste and hearing.” It is widely used in industries at different stages viz. Product development, Product matching, Product improvement, Process change, Cost reduction, Raw material selection, Quality control, Product grading/ rating, Consumer acceptance, Consumer preference, Panel selection/ training and for Subjective/ objective correlation.

Henceforth, in the present study an attempt was made to develop a Sensory based Quality control tool for differentiation of different market samples of *Arjunarishta* on the basis of Sensory attributes.

**Aim**

The purpose of this study was to evaluate the efficacy of the Duo-Trio sensory method in differentiating the market samples of *Arjunarishta* from each other. In addition, the aim was also to determine if any difference exists between the market samples with regards to Smell and taste.

**Material and Methods**

The study was primarily initiated to develop a Sensory based analytical method for discrimination of the market samples of *Arjunarishta* on the basis of sensory attributes. Amongst the various sensory methods, ‘Duo-trio test’ is one of the most powerful and sensitive difference test which is employed to determine whether a difference exists between the two samples. The difference can involve one or several sensory attributes and can be used when one of the products is an existing standard or reference (6). Hence, in the present study Duo-trio test was employed for the discrimination of the market samples of *Arjunarishta*.

**Experimental Design**

**Procurement of Market Samples**

Considering the diversity in the climate and geographical variation in India, the market samples of *Arjunarishta* manufactured in different parts of the country were procured for the present study. The samples were coded as shown in Table 1.

**Table 1: Sample codes of market samples.**

S. Number	Region of Procurement	Code
1	North	A1
2	West	B2
3	South	C3
4	South	D4
5	West	E5

**Reference Control Sample**

For comparative analysis, an in-house *Arjunarishta* sample was prepared as per the standard procedure and composition mentioned in the Ayurvedic Formulary of India, Part- I (7). The sample thus prepared for treated as Reference control sample.

**Preliminary Screening**

A ‘Sensory panel’ was employed consisting of six experts within the institute in order to screen the market samples for immediacy with the Reference control sample. According to the evaluation by the learned panel, samples A-1 and D-4 were found to be alike with the Reference control sample on the basis of smell and taste. Henceforth, the above mentioned samples were further evaluated for discrimination by Duo-trio test method.

**Questionnaire**

Special proforma was adopted for Duo-trio test as per Sensory Analysis of Foods, Australian Standards for discrimination of the samples thus selected.

**Attributes Selected**

Smell and Taste.

**Training of Assessors**

40 volunteers were pre-trained on the attributed, depending on the test objective for about 2 h with three time exposure of the Standard (viz. Reference control) sample.

**Sample Coding**

The samples chosen from the preliminary screening viz. Samples A-1 and D-4 along with Reference control sample were divided into two sets viz. Set-1 and Set-2 and blindly coded as shown in Table 2.

**Table 2: Sample coding for Sensory analysis.**

S. Number	Code	Code
Set 1	101 (Reference control)	102 (D-4)
Set 2	201 (A-1)	202 (Reference control)

**Assessing Samples**

Each assessor was at first presented with Set-1 followed by Set-2 samples. The assessor

was asked to encircle the coded sample which matches with the standard from each set in the proforma with respect to Smell and Taste. All the assessors were given enough time for each Set. The number of correct responses and the total number of responses were calculated.

**Data Analysis**

Receiver Operating Characteristic (ROC) curve, Area Under Curve (AUC) and d-prime (*d'*) statistical calculations were used to analyse the Sensory analysis results with the help of sensR package in R-studio ver. 1.0.143 (8, 9).

## Results

The panel for Sensory analysis consisted of 40 assessors. Each assessor was asked to identify the sample analogous to standard on the basis of smell and taste. In case of Set-1, out of total 40 responses, 39 responses and in Set-2, 37 responses were correctly identified respectively.

In both the sample sets, Reference control sample was correctly identified with a significance level of  $P < 0.001$ . While, the results of  $d'$  for Set-1 and Set-2 are as shown in Table 3.

**Table 3: Results of  $d'$  for Set-1 and Set-2.**

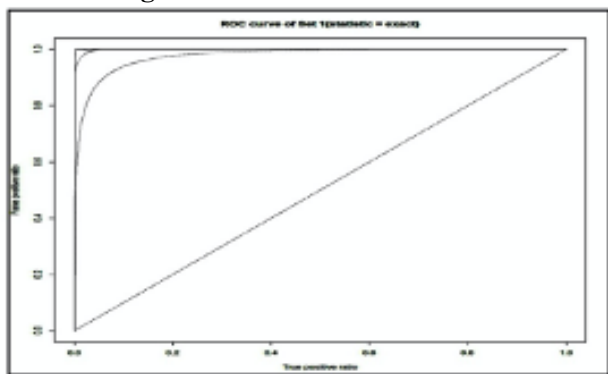
Sample Set	Set-1	Set-2
Total responses	40	40
Correct responses	39	37
Estimate	4.814	3.609
Standard Error	1.011	0.652
Lower	2.919	2.327
Upper	7.896	5.274

From the results of  $d'$ , ROC curve was generated (Figure 1 and Figure 2) and AUC was calculated. The results of AUC are as shown in Table 4.

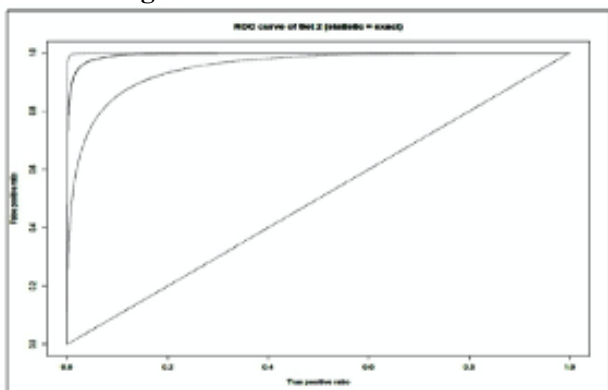
**Table 4: Results of AUC for Set-1 and Set-2.**

Sample Set	AUC
Set-1	0.999
Set-2	0.994

**Figure 1: ROC curve of Set-1.**



**Figure 2: ROC curve of Set-2.**



## Discussion

Evaluation of sensory attributes is an important measure of product quality and success (10). Sensory analysis involves the evaluation of product through organoleptic attributes *viz.* colour, odour, taste, touch and noise. These techniques involve a panel of human assessors, precise and controlled experimental protocols along with statistical techniques for processing the results (11).

Sensory analysis is routinely employed in the wine industry as a routine quality control tool. Likewise, *Asava-arishtha* in Ayurveda are self-generated alcoholic preparations. Henceforth, in the present study Sensory analysis was put to use in order to discriminate the market samples of *Arjunarishta* from each other.

The prime objective of the study was to determine whether a difference exists between the samples. Hence, duo-trio test was chosen, as it is generally applied to determine whether changes in ingredients, processing, packaging or storage result in differences between the products (6).

Among the various sensory attributes, smell and taste were chosen for assessment – a combination of olfactory and gustatory sensation perceived during tasting. All the samples being identical in colour, hence it was not incorporated as an evaluation attribute in the present study.

In both the sample sets *viz.* Set-1 and Set-2, Reference Control sample was correctly identified with a significance level of  $P < 0.001$ .  $d'$  or sensitivity index is a dimensionless statistic, it shows the discrimination between the two samples. If  $d'$  is low, then it means that there is low discriminability and vice-versa. Both the sample sets showed a higher  $d'$  value. Thus, indicating that the Reference Control sample can be competently differentiated from A-1 and D-4 by smell and taste respectively. However, in comparison to Set-1, a lower  $d'$  value in Set-2 indicates that sample A-1 shows similarity to Reference Control sample than sample D-4.

Further from the results of  $d'$ , ROC curve was generated and AUC was calculated. ROC curve is a graphical representation between false positive and true negative using an epidemiological language (12). While, a common method to represent ROC performance is to calculate the AUC. It measures the discrimination *i.e.* ability of the test to correctly classify the target class as follows:

- 0.90 – 1 : Excellent
- 0.80 – 0.90 : Good
- 0.70 – 0.80 : Fair
- 0.60 – 0.70 : Poor
- 0.50 – 0.60 : Fail

The AUC for Set-1 and Set-2 was 0.999 and 0.994 respectively.

## Conclusion

Henceforth, it can be concluded that Duo-Trio method can efficiently discriminate *Arjunarishta* samples on the basis of smell and taste. The method can be further validated by population study and thereby

can be used in routine Quality control analysis. Thus, study also directs to the fact that Sensory Analysis can turn out to be a cost-effective quality control tool for the routine analysis of Ayurvedic drugs and formulations.

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