RESEARCH ARTICLE

Analytical Substantiation of an Antidiabetic Ayurvedic Formulation Eladi Churna through Fourier Transmission Infrared

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Abstract

Aim: This study aims to evaluate possible functional group and phytoconstituents present in all the ingredients of Eladi Churna as well as in final dosage form (Eladi Churna). **Materials and Methods:** For infrared (IR) spectroscopy, all the samples were mixed with KBr in moisture free environment in a ratio of 1:100, then, pellets were prepared and processed for scanning. **Results and Discussions:** Different absorbance peaks in Fourier transmission IR (FTIR) spectrum indicates the presence of phytoconstituents such as phenols, polyphenols, tannins, carbohydrates, and glycosides. **Conclusion:** By the usage of FTIR different bonding interactions and presence of phytoconstituents has been evaluated in separate ingredients as well as in final formulation. FTIR, if used in a proper manner, can act as a boon in the analytical validation of herbal medicines which are a complex mixture of phytoconstituents.

Key words: Diabetes mellitus, Eladi Churna, fourier transmission infrared

INTRODUCTION

The word "diabetes" was first used by the Greek physician Aretaeus. The word diabetes means "siphon," which indicates excessive thirst and urination. In the 17th century, the meaning of word mellitus, i.e., "like honey," was added, when diabetic patients' urine was noticed to be sweet. However, the disease is not directly related to urine, but instead to the pancreas. The global prevalence (age-standardized) of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population. As per the WHO report, 108 million adults were diabetic in 1980, but in 2014, 422 million adults were found to be diabetic.[1] Ayurvedic medications, if taken regularly in a prescribed manner, causes less or no side effects and found to be beneficial to maintain health of the patients as well as shows drastic improvement in disease conditions, thus seeking more attraction of civilization toward these medications. Chronologically, primarily in greater triad (Charaka Samhita, Sushruta Samhita, Ashtanga Sangraha), and then, in lesser triad (Madhav Nidan, Sharangdhar Samhita, Bhavaprakasha), various medications in different dosage forms have been described for the eradication of Prameha (diabetes mellitus). Similarly, in the 15th century, the treatise "Vaidya Chintamani" given by "Acharya Vallabhacharya" has also given a huge description on ayurvedic formulations effective for Prameha (diabetes mellitus), among which Eladi Churna is the formulation which has been taken to study its effect on Prameha (diabetes mellitus). Eladi Churna is a herbomineral formulation consisting of Suksham Ela (Elettaria cardamomum), Pippali (Piper longum), Pashanbheda (Bergenia ligulata), and Shilajit (Mineral Pitch).[2]

For global acceptance of ayurvedic medications, its standards should be verified by different analytical procedures as per the PLIM protocols. Although the application of infrared (IR) spectroscopy in the analysis of herbals is still very limited compared to its applications in other areas such as food

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Received: 29-07-2017
Revised: 09-09-2017
Accepted: 22-09-2017

and beverage industry and microbiology.[3] However, the application of Fourier transmission IR (FTIR) spectroscopy is useful to gather information about the functional and structural properties of a compound with the help of characteristic peaks in FTIR spectrum, which indicates the presence or absence of functional groups and molecular skeleton. The IR region of the electromagnetic spectrum has dimension of wave numbers extending from 13,000 cm^{-1} to 10 cm^{-1}, with near IR, mid-IR, and far IR spanning from 13,000 cm^{-1} to 4000 cm^{-1}, from 4000 cm^{-1} to 400 cm^{-1}, and from 400 cm^{-1} to 10 cm^{-1} wave numbers, respectively.[4] The selective absorption (or emission) of IR radiation arises in the mutual vibrations of the atoms constituting the molecules. A molecule does not absorb radiation of all wavelengths, however, selects only a few narrow wavelength intervals known as absorption bands. The resulting absorption pattern is characteristic of the molecule which reflects elemental interactions and chemical diversity in the sample.[5] In this present study, Eladi Churna including its ingredients has been evaluated through FTIR for its scientific validation.

MATERIALS AND METHODS

All the ingredients [Table 1] of Eladi Churna[6,7] were completely dried to make them moisture free and then made into fine powder through passing through mess no 80. All the powdered ingredients and final dosage form (Eladi Churna) were taken to evaluate about their functional group and phytoconstituents present on the basis of spectral peak. This experiment was performed in Ayurvedic Pharmacy Lab, RGSC, Banaras Hindu University. During the procedure, it was ensured to protect the sample from moisture as KBr used in the process is known to be highly hygroscopic. All the samples were mixed with KBr in proportion to 1:100 ratios and made pellet by press pellet technique using hydraulic pressure.[8] IR spectroscopy (Varian 640 IR Spectrophotometer) was first calibrated with polystyrene film, and then, the pellet made from samples were scanned.

RESULTS AND DISCUSSIONS

Different spectrum of ingredients of Eladi Churna [Figures 1–4] and final dosage form [Figure 5] was analyzed and absorbance peaks were also noticed for the same. On the basis of the spectrum and absorbance peaks, possible functional group and phytoconstituents were tried to evaluate.

Absorbance peaks observed in case of Ela (Elettaria cardamomum) are 3418, 2927, 1650, 1430, and 1050. Peaks in case of Pippali (Piper longum) are 3449, 2933, 1650, 1446, and 1058. In case of Pashanbheda (Bergenia ligulata) peaks are 3416, 2927, 1619, 1450, 1370, and 1236. Peaks of Shilajit (Asphaltum punjabinum) are 3424, 2827, 2859, 1650, 1573, and 1414. In the final formulation, i.e., Eladi Churna, the peaks observed are 3424, 2928, 1635, 1447, 1251, and 1054. Absorbance peaks in the range of 3000–4000 are 3418, 3449, 3416, and 3424; this depicts the presence of hydroxyl group either in H bonding or free state. Broad peak around 3424 indicates the presence of tannins, phenols, and polyphenols. Peaks in the range of 2000–3000 are 2933, 2927, 2827, and 2928 indicates the presence of alkane stretching vibrations, asymmetric stretching vibrations in C-H which is due to the presence of carbohydrate tail in the formulation. Peaks in the range of 1500–2000 are 1650, 1619, and 1635. These correspond to carboxyl derived NH2 (amide) bond. Peaks in the range of 1000–1500 are 1446, 1058, 1450, 1370, 1236, 1414, 1251, and 1054. Among these, peaks around 1446 and 1450 depict CH2 and CH3 deformation or alpha CH2 bending vibration; this is due to the presence of glycosides and carbohydrates, etc. Peak around 1370 shows the acidic content of plant extract. Peaks of 1236 and 1251 correspond to C-O bonding vibration and indicate the presence of polyphenols and phenols. Peak of 1054 has OH-CH stretching in sugar and polysaccharides. The data shows that the absorbance peaks of Eladi Churna are almost similar to the individual ingredient thus depicting the presence of near around similar phytoconstituents along with the functional groups.[9] As herbal drugs are a complex mixture of phytoconstituents and evaluation of each constituent is not a simple task. FTIR can be helpful to a certain extent for the analytical validation of the complex dosage forms of traditional system of medicine. Furthermore, studies and research work are required to analyze the herbal formulations on the basis of FTIR which can act as a step toward the scientific validation of traditional medicines, which are the demand of the era.

CONCLUSION

Eladi Churna, consisting of four ingredients, was prepared by powder processing technique. As it is a polyherbal formulation, hence exhibits complex phytoconstituent interaction. Its evaluation can be better done with the help of

Table 1: Ingredients of Eladi Churna

Name of drug	Family	Latin name/English name	Part used in formulation
Suksham ela	Zingiberaceae	Elettaria cardamomum	Fruit
Pippali	Piperaceae	Piper longum	Fruit
Pashanbheda	Saxifragaceae	Bergenia ligulata	Root
Shilajit (Asphaltum punjabinum)	-	Mineral pitch/rock exudate	Whole

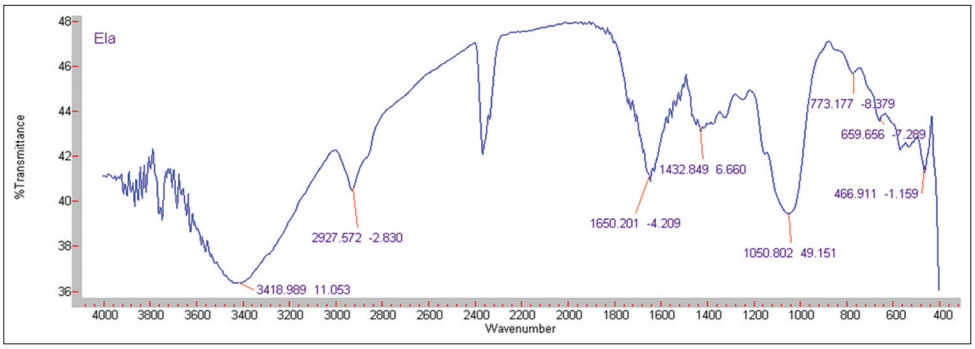

Figure 1: Absorbance peaks of Ela (Elettaria cardamomum)

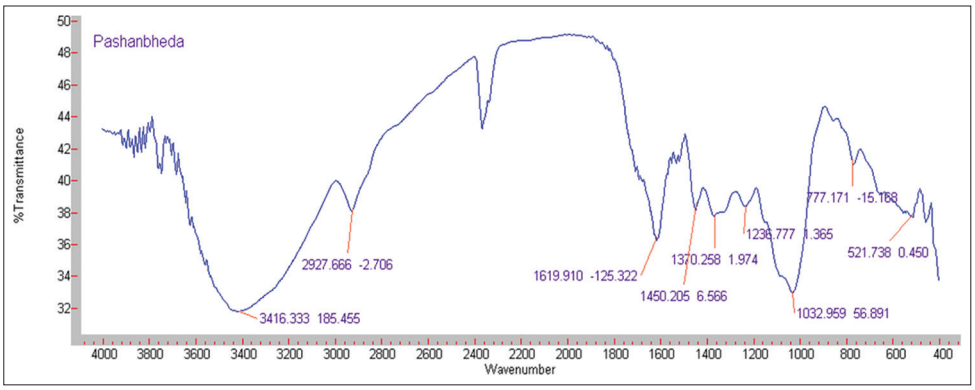

Figure 2: Absorbance peaks of Pippali (Piper longum)

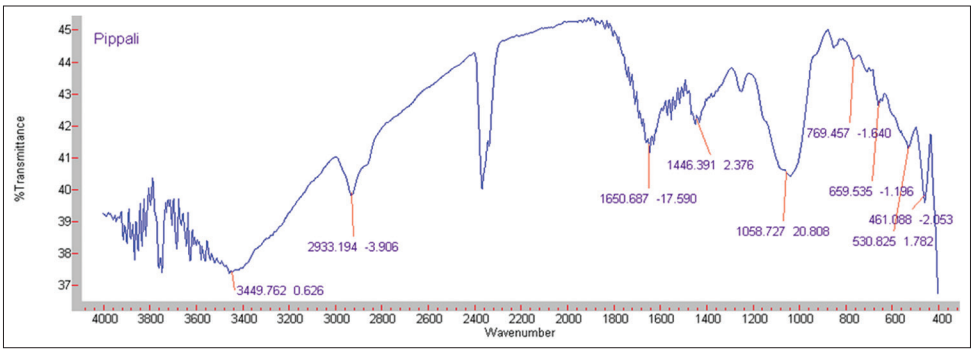

Figure 3: Absorbance peaks of Pashanbheda (Bergenia ligulata)

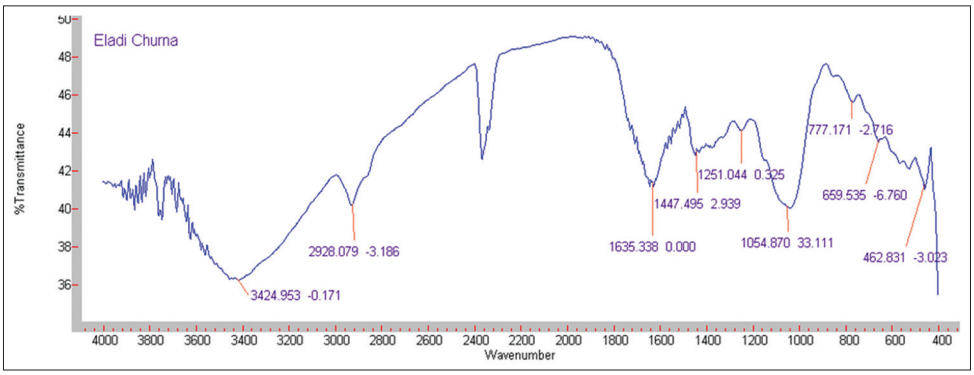

Figure 4: Absorbance peaks of Shilajit (Asphaltum punjabinum)

FTIR, which can act as a foremost tool in the field of herbal medicines. In this study, FTIR absorption peaks indicate the presence of many phytoconstituents such as tannins, phenols, polyphenols, glycosides, and carbohydrates. Peaks of individual drugs were came almost identical to the final drug indicating the same chemical nature of them.

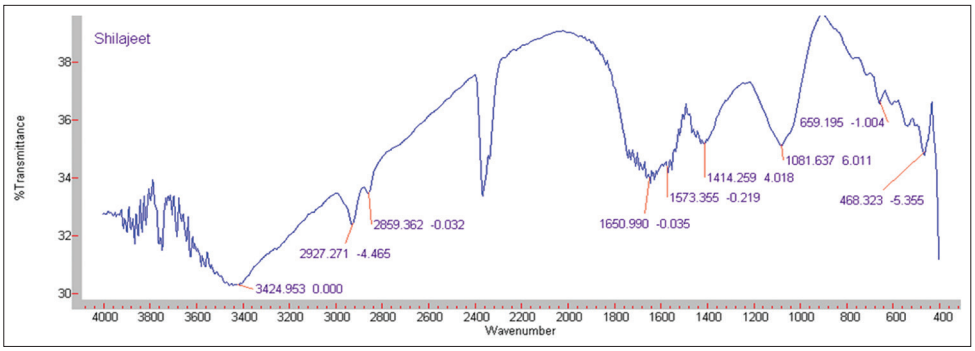

Figure 5: Absorbance peaks of Eladi Churna

ACKNOWLEDGMENT

The author is thankful to Dr. Narender Kumar Singh, Asst. Professor RGSC-BHU, who supported in the completion of this test.

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Source of Support: Nil. **Conflict of Interest:** Nil.