Pharmacognostical and pharmaceutical analysis of *Triphala Kajjali* tablet—an ayurvedic herbomineral formulation for metabolic syndrome

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Received: 06 November 2020
Accepted: 19 December 2020

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**ABSTRACT**

**Background:** *Triphala* is one of the most easily available and commonly used medicine which contains fine powder of three fruits viz. *Terminalia chebula Retz.* (Haritaki), *Terminalia bellerica Roxb.* (Bibhitaki) and *Embilica officinalis* Gaertn. (Amalaki) and is indicated as one of the drugs for management of disorders of *Kapha and Meda*. Due to bitter and astringent taste of *Triphala* in the powder form is a major complaint of the patients. So, to discover that form of *Triphala*, which is easy to take, effective in low dose, has long shelf life and simple to dispense is the need. For assurance of quality of herbal compounds pharmacognostical and pharmaceutical analysis should be done.

**Methods:** *Triphala Kajjali* was subjected to microscopic evaluation for pharmacognostical, physiochemical analysis like hardness, weight variation, loss on drying, ash value, acid insoluble extract, pH value, water soluble extract, alcohol soluble extract and high-performance thin layer chromatography (HPTLC).

**Results:** Pharmacognostical study showed the presence of certain identifying characters of all of the ingredients of *Triphala Kajjali* that is Haritaki, Bibhitaki and Amalaki. In pharmaceutical study, preliminary physicochemical analysis showed that hardness of the tablet was 2.05 kg/cm², ash value 4.03% w/w, loss on drying 5.5% w/w, water soluble extract 5.89% w/w, alcohol soluble extract 25.96% w/w and HPTLC showed 7 spots in 254 nm and 7 spots in 366 nm.

**Conclusions:** Pharmacognostical and physico-chemical observations revealed the specific characters of all active constituents of *Triphala Kajjali* and confirmed the purity and genuinity of the drug.

**Keywords:** *Triphala kajjali*, Metabolic syndrome, Pharmacognosy, Pharmaceutical analysis

**INTRODUCTION**

*Triphala* is one of the most easily available and commonly used medicine which contains fine powder of three fruits viz. *Terminalia chebula Retz.* (Haritaki), *Terminalia bellerica Roxb.* (Bibhitaki) and *Embilica officinalis* Gaertn. (Amalaki) and is indicated as one of the drugs for management of disorders of *Kapha and Meda* (Fatty tissues). Pharmacological studies on *Triphala* indicate that it possesses properties like anti-oxidant, anti-hypercholesterolemia, anti-diabetic, anti-obesity, anti-inflammatory, immunomodulatory and cardio protective, and thus can play major role in the management of metabolic syndrome.

Though various dosage form of medicine is mentioned in the classic depending upon the drugs used in the preparation of formulation, but in present era, people prefer medicine that are palatable, have small dose, cost effective and that give immediate effect. Moreover, as per *Charaka Samhita*, that medicine is considered as appropriate which is effective in low dose (*Alpamatra*) and palatable.

Due to bitter and astringent taste of *Triphala* in the powder form is a major complaint of the patients. So, discover that form of *Triphala*, which is easy to take, effective in low dose, has long shelf life and simple to dispense is the need. *Kajjali* (combination of mercury and sulphur) possess
Yogavahi (increasing potency of formulation and not altering the pharmacological action of contents in combinations) property and is one of the main ingredients in about 80 formulations mentioned in the Ayurvedic formulary of India (AFI), which covers a wide range of therapeutic applicability. It is reported that when herbal powder is triturated with the Kajjali, the drug becomes potent and is effective in low dose. Such references can be traced in Rasataragini where various herbomineral preparations of Kajjali are used in different conditions. For example, Kajjali is given with Triphala Churna, Shuddha Guggulu triturated in oil of Eranda Taila (Ricinus communis L.) for the management of Vata Roga. These references indicate the need for research in doses form of Sukshma Aushadhi Kalpana effective in low dose, which can be applied for Ayurvedic classical drugs. Sukshma Aushadhi can be effectively used after assessing Hetu, Linga, Nidana causes of disease according to Ayurveda proper diagnosis, as also mentioned in symptoms Sukshma Aushadhi Kalpana.

In the case of internal administration of herbomineral drug, it should be safe, effective and free from adulteration, with appropriate quantity and ingredients. It is difficult to identify herbal drug in dry or powdered form. So, it is a need of time to set proper parameters for standardization of herbal drugs. Pharmacognostical studies reveals plant identification and sets parameters for standardization which can be done in the case of herbal traditional medicine. Generally, physiochemical analytical study of drugs help to interpret the pharmacokinetics and pharmacodynamics involved. With the help of physiochemical analytical studies, it is possible to standardize the drug and differentiate the adulterants. High performance liquid chromatography (HPLC) and thin-layer chromatography (TLC) are the conventional methods used in the analysis of secondary metabolites originating from plants. It is necessity of time in the field of Ayurveda to go for quality control of the raw drugs as well as final products using modern parameters which provides credibility to Ayurvedic medicines and also help in the globalization of Ayurveda. Hence to evaluate the Authenticity of Triphala Kajjali tablet through various pharmacognostical procedures, and to develop the pharmacognostical and phyto-chemical profile of Triphala Kajjali tablet, the present study was carried out.

METHODS

Collection, identification and authentication of raw drugs

The raw materials were procured from the pharmacy of Gujarat Ayurved university, Jamnagar. and the raw drugs were identified and authenticated in the pharmacognosy laboratory of Institute for post graduate teaching and research in Ayurveda, Gujarat Ayurved university, Jamnagar.

The ingredients and part used of the Triphala Kajjali tablet are given in Table 1.

Table 1: Ingredients of Triphala Kajjali tablet.

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Latin name</th>
<th>Part used</th>
<th>Proportion (%)</th>
<th>Form of the drug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haritaki</td>
<td>Terminalia Chebula Retz.</td>
<td>Phala</td>
<td>30</td>
<td>Powder</td>
</tr>
<tr>
<td>Amalaki</td>
<td>Emblica officinalis Gaertn.</td>
<td>Phala</td>
<td>30</td>
<td>Powder</td>
</tr>
<tr>
<td>Bibhitaki</td>
<td>Terminalia Bellerica Roxb.</td>
<td>Phala</td>
<td>30</td>
<td>Powder</td>
</tr>
<tr>
<td>Kajjali</td>
<td>Mercury Sulphide (HgS)</td>
<td>-</td>
<td>10</td>
<td>-</td>
</tr>
</tbody>
</table>

Preparation of drug

Fine powder of Haritaki, Bibhitaki and Amalaki was prepared. Then fine powder of Triphala was triturated along with Kajjali. Water was added till the mixture completely mixed with it and trituration was carried out till the mixture got semisolid form and after it was dried in the oven and granules were made. Then granules were mixed with slight amount of starch and kept in tablet punching machine. Then tablet of 250 mg was prepared and stored in bottles under hygienic condition.

Pharmacognostical study

The pharmacognostical study was divided in to organoleptic study and microscopic study of the finished product.

Organoletic study

The genuinity of the polyherbal formulation can be fined with organoleptical characters of the given sample. Organoleptic parameters comprise taste, color, odor and touch of Triphala Kajjali which was scientifically studied as per the standard references.

Microscopic study

Triphala Kajjali was powdered and dissolved with water and microscopy of the sample was done without stain and after staining with phloroglucinol and HCl. Microphotographs of Triphala Kajjali were also taken under Corl-zeissstrinocular microscope.

International Journal of Advances in Medicine | February 2021 | Vol 8 | Issue 2  Page 196
Physico-chemical analysis

With the help of various standard physico-chemical parameters, *Triphala Kajjali* tablet was analysed. The common parameters mentioned for Vati (tablet) Kalpana in Ayurvedic Pharmacopoeia of India, and CCRAS, guidelines are loss on drying, hardness, total Ash value, acid insoluble ash, pH value, water soluble extract, methanol soluble extra total ash and water and alcohol soluble extractives.\(^1\,^2\)

High performance thin layer chromatography\(^1\)

High performance thin layer chromatography (HPTLC) is a powerful analytical method suitable for the separation and quantitative determination of a considerable number of compounds even from complicated matrix. HPTLC is used for identification of active constituents, identification and determination of impurities and quantitative analysis of active constituents. Principle of HPTLC remains the same as of TLC i.e., adsorption. One or more compounds can be spotted in a thin layer of adsorbent coated on a chromatographic plate. The mobile phase solvent flows through because of capillary action against gravitational force. The component with more affinity towards stationary phase travels faster. Thus, the components are separated on a thin layer chromatographic plate based on the affinity of the components towards the stationary phase.

RESULTS

The initial purpose of the study was to confirm the authenticity the drugs used in preparation of *Triphala Kajjali* tablet. For this, coarse powder of all ingredients was subjected to organoleptic and microscopic evaluations separately to confirm the genuineness of all the raw drugs. Later after the preparation of formulation, pharmacognostical evaluation was carried out.

Organoleptic evaluation

organoleptic features like color; odor and taste of the *Triphala Kajjali* tablet were recorded and are placed in Table 2.

**Table 2: organoleptic characters of *Triphala kajjali* tablet.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Dark brownish black</td>
</tr>
<tr>
<td>Odor</td>
<td>Irritant</td>
</tr>
<tr>
<td>Test</td>
<td>Astringent</td>
</tr>
<tr>
<td>Consistency</td>
<td>Fine coarse powder</td>
</tr>
</tbody>
</table>

Microscopic evaluation

Microscopic evaluation was conducted by dissolving powder of *Triphala Kajjali* tablet in the distilled water and studied under microscope for the presence of characteristics of ingredient drugs. The diagnostic characters are black debris of *Kajjali* (Figure 1 A), starch grains of *Haritaki* (Figure 1 B), groups of sclereids of *Bibhitaki* overlapped with *Kajjali* (Figure 1 C), scleroids of *Amalaki* coated with *Kajjali* (Figure 1 D), trichome of *Bibhitaki* (Figure 1 E), stone cell of *Bibhitaki* covered with *Kajjali* (Figure 1 F), silica deposition of *Amalaki* (Figure 1 G), stone cell of *Haritaki* (Figure 1 H), fibers of *Amalaki* (Figure 1 I), tannin content of *Haritaki* (Figure 1 J), group of scleroids (Figure 1 K), lignified stone cell of *Haritaki* (Figure 1 L), lignified scleroids of *Bibhitaki* coated with *Kajjali* (Figure 1 N), epicarp cell coated with *Kajjali* (Figure 1 O).

Physico-chemical parameters

Physico-chemical parameters like loss on drying, pH values were found within the normal range. Methanol and water-soluble extractive values of *Triphala Kajjali* were found to be 25.9% and 5.9% respectively. Details is shown in the Table 3.

**Table 3: Physico-chemical analysis of *Triphala Kajjali* tablet.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss on drying (w/w)</td>
<td>5.5</td>
</tr>
<tr>
<td>Ash value (w/w)</td>
<td>4.03</td>
</tr>
<tr>
<td>Water soluble extract (w/w)</td>
<td>5.89</td>
</tr>
<tr>
<td>Methanol soluble extract (w/w)</td>
<td>25.96</td>
</tr>
<tr>
<td>pH (by pH indicator paper)</td>
<td>4.5</td>
</tr>
<tr>
<td>Weight variation of tablet (gm)</td>
<td>Average weight 0.270, Highest weight 0.307, Lowest weight 0.243</td>
</tr>
<tr>
<td>Hardness of tablet (kg/cm(^2))</td>
<td>2.05</td>
</tr>
</tbody>
</table>

High performance thin layer chromatography

Densitometry scanning of the HPTLC pattern showed 07 spots at corresponding Rf values 0.05, 0.11, 0.39, 0.58, 0.69, 0.77 and 0.81 in short wave UV 254 nm and 07 spots at corresponding Rf values 0.05, 0.18, 0.77; 0.81, 0.91, 0.92 and 0.96 obtained in long wave UV 366 nm (Table 4). Though it is not possible to identify particular chemical constituent from the spot obtained, the pattern may be used as a reference standard for further quality control researches.

**Table 4: R\(_f\) Values of *Triphala Kajjali* tablet.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>(R_f) value at 254 nm</th>
<th>(R_f) value at 366 nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPTLC</td>
<td>0.05, 0.11, 0.39, 0.58, 0.69, 0.77 and 0.81</td>
<td>0.05, 0.18, 0.77, 0.81, 0.91, 0.92 and 0.96</td>
</tr>
</tbody>
</table>
A: Black debris of Kajjali
B: Starch grains of Haritaki
C: Groups of sclereids of Bibhitaki overlapped with Kajjali
D: Scleroids of Amalaki coated with Kajjali
E: Trichome of Bibhitaki
F: Stone cell of Bibhitaki covered with Kajjali
G: Silica deposition of Amalaki
H: Stone cell of Haritaki
I: Fibers of Amalaki
J: Tannin content of Haritaki
K: Group of sclereids
L: Lignified stone cell of Haritaki
M: Lignified sclereids of Haritaki
N: Lignified sclereids of Bibhitaki coated with Kajjali
O: Epicarp cell coated with Kajjali

Figure 1: Microphotograph of Triphala Kajjali tablet.
DISCUSSION

Study on *Triphala Kajjali* tablet was a step towards pharmacognostical and pharmaceutical standardization of the drug. The pharmacognostical study revealed the presence of the diagnostic characters of *Triphala Kajjali* tablet like scleroids of *Amalaki*, trichomes of *Bibhitaki*, stone cell of *Haritaki* and *Bibhitaki*, black debris of *Kajjali*, fibers of *Amalaki*, lignified stone cell of *Haritaki*, lignified scleroids of *Haritaki*, lignified scleroids of *Bibhitaki* coated with *Kajjali* and tannin content of *Haritaki*.¹ This confirms the presence of all ingredients of raw drugs in the final product and there is no major change in the microscopic structure of raw drug during the pharmaceutical process of preparation of tablet, this showed the genuinity of the final product. The Physico-chemical parameters showed that the ash values are the criteria to identify the impurity of drugs. *Triphala Kajjali* tablet contained 4.03% w/w total ash. The results revealed that *Triphala Kajjali* tablet is free from unwanted organic compounds and production site was good enough keeping sample free from dust and other solid matters. The 5.89 w/w of water-soluble extractives and 25.96 % w/w methanol soluble extractives were present in *Triphala Kajjali* indicates that drug is having good solubility in water and methanol. In HPTLC study 7 spots at 254 nm and 7 spots at 366 nm were obtained, indicating its possible components of matrix which may possess its therapeutic effect.

CONCLUSION

The pharmacognostical and Physico chemical analysis of *Triphala Kajjali* tablet confirmed the purity and genuinity of the drug. As no standard fingerprint is available for this formulation, an attempt has been made to evolve pharmacognostical and physico-chemical profiles of *Triphala Kajjali* tablet. Information acquired from this study may be beneficial for further research work and can be used as a reference standard for quality control researches.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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**Cite this article as:** Garasia JS, Goyal M, Harisha CR, Shukla VJ. Pharmacognostical and pharmaceutical analysis of Triphala Kajjali tablet—an ayurvedic herbomineral formulation for metabolic syndrome. Int J Adv Med 2021;8:195-200.