Pharmaceutico-Analytical Standardization of Yava Kshar

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Abstract- This study presents a pharmaceutical-analytical investigation of Yava Kshar (YK), a plant-based Kshar (alkali) preparation with the ability to mobilize and remove deformed body tissues. Ksharana is the property of this dravya, which is an alkaline substance derived from the ashes of medicinal plants. The study focuses on the validation of the standard operative procedure used in the preparation of YK by conducting three sequential procedures, including the preparation of ash, Kshar jala and evaporation of Kshar jala. The validation process involves scientific data collection and analysis at the level of each unit operation. The nomenclature, synonyms, properties, and therapeutic uses of YK in various diseases are also discussed. The study concludes that the process used in Kshar kalpana is validated by the results obtained from the three batches of YK prepared by the same method.

Keywords: Yava Kshar, Kshar Kalpana, Therapeutic Indication, Standardization, Analytical validation

Introduction:
Ayurved is the most sacred science of life with the holistic approach to maintain the physical and mental health of people as well as cure the disease from root level1,2. To achieve this target Ayurvedic scholars have prepared different Kalpana’s to get quick therapeutic action with a small dose without producing any undesired effects if used properly. The process of making such formulations involved crude extraction, dependent upon the nature and solubility of active components from plants to achieve desired action.

Kshar Kalpana (white colored residue obtained after evaporation of filtrate of plant ash dissolved in water) is mainly prepared to get inorganic, alkali dominant material. Kshar is one, which possesses the Ksarana (corrosive) property3. It is the alkaline substance of the plants obtained by processing the ash (Whitish Gray colored formulation prepared through incomplete oxidation) of drugs. Kshar is significant among Sastra (sharp instruments)- amusastra (accessory instruments) since it is useful in case of surgical contraindications and to cure the disease4. According to the source of origin there are three types Kshar- khanija (mineral origin), pranija (animal origin), vanaspatik (herbal origin). On the basis of use, paniya (internal administration) and pratissarinya (external application); types are also mentioned in Samhitas5. These are further divided on the basis of potency – Mrdha (Mild), Madhyam (Moderate), and Tikshna (High) Kshar6. YK is mentioned in Kshardvyas, Kshartriya, Ksharpanchak and Ksharashhtka7. The preparation of Kshar in this study used three sequential procedural i.e., 1) Preparation of Ash 2) Preparation of Kshar Jala (water soluble inorganic component of plant ash) 3) Evaporation of Kshar Jala. The concepts of standard operating procedures (SOPs) are written procedures for any process or system that is followed during the operation of any system or equipment. The purpose of this study is to make SOPs for the preparation of Yava Kshar and standardize it by testing it on pharmaceutical and physico-chemical parameters according to Rasa Tarangini.

Literary Review:
Yava Kshar, alkali preparation made with whole plant of Barley (Hordeum vulgare Linn. Syn.). Jou plant is grown in the plains as well as in hilly regions of Himalaya’s up to an altitude of 14,000 ft. It is a common cereal crop under extensive agro-practices in country, especially plains. An annual, erect, s, Tikshna, Kalpana's, SBMN Ayurvedic College, Rohtak-124021, Haryana, India
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Nomenclature – Pakya9,11,13, Kshar9,11, Yavakshar9,11, Yavshuk9,11,13, Yavagraj9,11,12,13, Yavlayas9, Tikshnaras9, Yava9,13, Yavnalaj9,10,13, Yavah9,10,13, Shukpak10, Shukaj10, Yavya pak10, Yavachak12, Yavapatya12,13, Yavshuka13, Yavya13

Vernacular Name14;
Chemical Constituents:
It consists mainly Potassium chloride, Potassium sulphate and Potassium Bicarbonate. It is a mixture of Potassium salts. Apart from this, Sodium, Iron and other elements are also intact in it.

Properties and Action:
Rasa (Taste): Katu (pungent)
Guna (Physical Property): Laghu (lightness), Snigdh (sliminess/unctuousness), Sukshma (minuteness/penetrating)
Virya (Potency): Usna (hotness)
Vipaka (Drug Metabolism): Katu (pungent)
Doshkarma (Pharmacological Action): KaphaVata Nashak (depleation of kapha and vata dosha)

Rogaghnta (Pharmacological Indications):
Hridya (cardio tonic)16,17,18,19,21, Pandu (anaemia)16,18,19, Grahan (derangement of agni situated in grahani)16,18,19, Pliha (spleenic disorders)16,17,18,19,21, Gal Grahal/ Kanth Roga (choking sensation in throat/disorders of throat)16,17,18,19,21, Kasa (Cough)16, Arsh (haemorrhoids)16,18,19, Aanah (barborygmus with distention)16,17,18,19,21, Gulum (palpable glandular enlargement in abdomen/abdominal lump)17,18,19,21, Opsargic Prameh (diabetes due to disease)17,21, Amlapitta (hyperacidity)17,21, Mutrakricch (dysuria)17,20,21, Phalakosh Nivaran (cure the scrotal swelling)17,21, Swed Pravartak (excessive sweating)17,21, Aadhman (abdominal distension)17, Udar roga (ascites)17,20,21, Agnideepak (stimulate digestive power)18,19, Aamodash (vitiated Aam)18, Shwas (breathlessness/difficult breathing)18,19, Shoola (colicky pain in the abdomen)18,19,20, Ashmri (urolithiasis)20, Vish dosh (poisoning disorder)20, Mutral (increase micturition)21

Dosage:
Mahoshadh Nighantu – 1-3 Masha22 (1-3 gm.)
Rasa Tarangini – 3-10 Ratti23 (375mg.-1250mg.)

Aamyik Prayog (Therapeutic Uses):

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Therapeutic Indication</th>
<th>Prayog (Therapeutic uses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Makkal Shoola (post-partum pain)</td>
<td>YK with lukewarm water or ghee</td>
</tr>
<tr>
<td>2.</td>
<td>Agnavardhak (stimulate digestive fire) &amp; Pachak (digestive)</td>
<td>YK with Trikatu powder + Jeerak (powder of Cuminum cyminum Linn.)</td>
</tr>
<tr>
<td>3.</td>
<td>Gulum (abdominal lump) &amp; Pliha Roga (splenic disorders)</td>
<td>YK with Rohitak churna (powder of Tecomella undulata G.Don) or Sarpunkha churna (powder of Tephrosia purpurea Linn.)</td>
</tr>
<tr>
<td>4.</td>
<td>Basti Shoola (Colicky pain in the urinary bladder)</td>
<td>YK with Marich (Piper nigrum Linn.) + Shunthi churna (powder of Zingiber officinale Rosc.) + Ushna jala (lukewarm water)</td>
</tr>
<tr>
<td>5.</td>
<td>Daha-Shoth yakt Mutrakricch (dysuria with burning and swelling)</td>
<td>YK with Ela beej churna (powder of seeds of Ellettaria cardamomum Linn.) + Khand (muscovado)</td>
</tr>
<tr>
<td>6.</td>
<td>Malavrodjhanya Mutrakricch (dysuria with constipation)</td>
<td>YK with Gokshur kwath (decoction of Tribulus terrestris Linn.)</td>
</tr>
<tr>
<td>7.</td>
<td>Tridoshjanya Udar shola (pain in abdomen due to tridosha)</td>
<td>YK with Shankh Bhasma + Trikatu churna + Sendhay lavan (rock salt) + Ushna jala (lukewarm water)</td>
</tr>
<tr>
<td>8.</td>
<td>Bahumutra (polyuria)</td>
<td>YK with Vasa swaras (juice of Adhatoda vasika Nees.)</td>
</tr>
<tr>
<td>9.</td>
<td>Parshva shola (flank pain), Hridya shola (pain in heart), Basti shola</td>
<td>YK with Sahijana kwath (decoction of Moringa oleifera Gaerth.) + Madhu (honey)</td>
</tr>
</tbody>
</table>
10. Jalayukta Urasotya (hydrothorax) | YK with Panarnava swaras (juice of Boerhavia diffusa Linn.)
11. Sujak (gonorrhoea) | YK with Sariva kwath (decocction of Hemidesmus indicus)
12. Mitravrodh (retention of urine) & Basti shola | YK with Tila Kshar + Nimbu swaras (juice of Citrus limon Linn.)
13. Mitrachhat (urinary retention) & Shukra-ashmari (uroolithiasis due to sukra) | YK with Petha swaras (juice of Benincasa hispida Thunb. Cogn.) + Guda (jaggery)
14. Ashmari (uroolithiasis) & Basti shola | YK with Varun (Crataeva nurvula), Gokshur and Pashanbhed kwath (decoction of Bergenia ligulate (wall.)
15. Gulum, Shoola, Hridya roga (heart disease), Kasa, Shwas | YK with Dashmoola kwath + Sendhav lavan (rock salt)

Pharmaceutical study:

Material and Method
Collection of Yava panchanga:
Fresh Panchang of Yava (whole plant of Hordeum vulgare Linn.) procured from surrounding of DSRRAU campus and authenticated by Quality control lab, DSRRAU, Jodhpur.

Preparation of Yava Kshar
For validation of YK three pharmaceutical batches were prepared. The batches were labelled as YKN1, YKN2 and, YKN3. Whole process was divided into three phases; these are the preparation of Kshar Ash, the preparation of Kshar Jala, and the evaporation of Kshar Jala.

Preparation of Kshar Ash
For the preparation of Kshar Ash, matured whole plant of Yava (Hordeum vulgare Linn) was collected and carefully dried. The dried plants were burned in a cement tank, and after self-cooling, the resulting ash was collected. The ash obtained had specific characteristics such as a whitish grey color, characteristic salty taste, and a powder-like consistency. The weight of dry Yava panchanga and the percentage of ash obtained were recorded for each batch, along with the time required for burning and self-cooling. [Image-1 and Image-2]

Table No.3 Observations and results obtained during the preparation of YK ash

<table>
<thead>
<tr>
<th>Parameters</th>
<th>YKN1</th>
<th>YKN2</th>
<th>YKN3</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of Dry Yava panchanga</td>
<td>12 kg.</td>
<td>12 kg.</td>
<td>12 kg.</td>
<td>12 kg.</td>
</tr>
<tr>
<td>Weight of ash obtained</td>
<td>1,960 kg.</td>
<td>1,650 kg.</td>
<td>1,700 kg.</td>
<td>1,770 kg.</td>
</tr>
<tr>
<td>% Of ash obtained (w/w)</td>
<td>16.33 %</td>
<td>13.75 %</td>
<td>14.16 %</td>
<td>14.74 %</td>
</tr>
<tr>
<td>Time to burn</td>
<td>9 hr.</td>
<td>8.20 hr.</td>
<td>8 hr.</td>
<td>8.4 hr.</td>
</tr>
<tr>
<td>Self-cooling &amp; White-grey Ash</td>
<td>15 hr.</td>
<td>14 hr.</td>
<td>14 hr.</td>
<td>14.33 hr.</td>
</tr>
</tbody>
</table>

Preparation of Kshara Jala:
The next step involved the preparation of Kshar Jala. The ash obtained from the previous step was mixed with demineralized water in a specific ratio (1 Part Ash and 8 Part water) and thoroughly rubbed to ensure proper mixing. After allowing it to settle overnight, the clean supernatant liquid was decanted Seven times through two-three folded cotton cloth.
The resulting Kshar Jala was a yellowish-brown liquid with a characteristic odor and salty taste. The weight of ash taken, volume of water used, filtration cycle, and the amount of Kshar Jala obtained were measured for each batch. [Image-3 and Image-4]

Table No.4 Observations and results obtained during preparation of YK jala

<table>
<thead>
<tr>
<th>Parameters</th>
<th>YKN1</th>
<th>YKN2</th>
<th>YKN3</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of ash taken</td>
<td>1960 gm.</td>
<td>1650 gm.</td>
<td>1700 gm.</td>
<td>1770 gm.</td>
</tr>
<tr>
<td>Conc. of Ash (w/v)</td>
<td>12.5 %</td>
<td>12.5 %</td>
<td>12.5 %</td>
<td>12.5 %</td>
</tr>
<tr>
<td>Filtration Cycle</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Kshar Jala obtained</td>
<td>13,956 ml.</td>
<td>12,113 ml.</td>
<td>12,407 ml.</td>
<td>12,825 ml.</td>
</tr>
</tbody>
</table>
Evaporation of Kshar Jala:
Finally, the Kshar Jala was subjected to evaporation. The liquid was heated in stainless steel vessel over a Chullika yantra (earthen stove) until all the water had evaporated. The resulting light brown Kshar was obtained\(^2\). Then powdered and stored in an airtight glass container. The evaporation process involved specific observations and precautions to ensure the quality of the final product. [Image-5 and Image-6]

<table>
<thead>
<tr>
<th>Time</th>
<th>Temperature °C</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>38°C</td>
<td>Yellowish brown color liquid with characteristic smell and salty taste</td>
</tr>
<tr>
<td>0-30 min.</td>
<td>74°C</td>
<td>Aggregation and Vapor started</td>
</tr>
<tr>
<td>30-1 hr.</td>
<td>100°C</td>
<td>Creaking sound, Aggregation and Vapor increased</td>
</tr>
<tr>
<td>1-1.30 hr.</td>
<td>100°C</td>
<td>Slowly boiling started from central part</td>
</tr>
<tr>
<td>1.30 - 2 hr.</td>
<td>100°C</td>
<td>Vigorous boiling, Kshar started adherence to wall of the vessel</td>
</tr>
<tr>
<td>2 - 2.30 hr.</td>
<td>93°C</td>
<td>Vigorous boiling started sticking to wall of vessel. Color changes from yellow-brown to brown</td>
</tr>
<tr>
<td>2.30 - 3 hr.</td>
<td>75°C</td>
<td>Brownish semisolid mass</td>
</tr>
<tr>
<td>3 hr. – till Complete</td>
<td>57°C</td>
<td>Light Brown Kshar was obtained</td>
</tr>
</tbody>
</table>

Analytical Study-
Analysis was done at S.R. Labs, Jaipur (an Ayush approved (Ayush DTL/03) and ISO 9001:2015 certified laboratory). Sample quantity of drug was 25 gm. In this phase of study, physio-chemical analysis of YK was evaluated in different parameters.

Physio-chemical Evaluation:
Preliminary physicochemical parameters like pH, loss on drying at 110°C, ash value, acid insoluble ash value, Potassium content, Sodium content were carried out.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Batches</th>
</tr>
</thead>
<tbody>
<tr>
<td>YKN(_1)</td>
<td>YKN(_2)</td>
</tr>
<tr>
<td>Kshar Jala taken for evaporation</td>
<td>13956 ml.</td>
</tr>
<tr>
<td>Time required for evaporation of Kshar Jala</td>
<td>3.42 hr.</td>
</tr>
<tr>
<td>Kshar obtained</td>
<td>353.1 gm.</td>
</tr>
<tr>
<td>Kshar obtained (w/v)</td>
<td>0.0253 gm/ml</td>
</tr>
<tr>
<td>% Of Kshar obtained (w/v)</td>
<td>2.53 %</td>
</tr>
</tbody>
</table>

Results and Discussion:
Kshar is one, which possesses the Ksaranā and Kshalanā (Killing) property\(^3\); explained the word, Ksharanā “as one which mobilizes and removes the deformed flesh, skin etc. and also removes the vitiated Doshas from their location. It is the alkaline substance of the plants obtained by processing the water-soluble ashes of drugs\(^2\). Kshar has been told to be having the topmost place among all surgical and para-surgical measures in Ayurveda, due to its efficacy even in surgical measures though being considered as para-surgical one (Chhedya (excision), Bhedya (incision), & Lekhya Karanat (scrapping))\(^4\).
References of YK are found at many texts of Ayurveda. Detailed explanation regarding Kshar has been texted in Sushruta Samhita, but in Rasa Tarangini, there is systematic description of preparation and therapeutic uses of YK. YK, alkali prepared with whole plant of Barley (Hordeum vulgare). When the crop is ripe and ready to be harvested, before cutting the crop including the fruit, it is used to make YK.

Whole plant of Jow/Barley dried in sunlight and should be made into small pieces for better drying, burnt to open place for whitish-grey color ash due to maximum oxidation. It should be burnt by keeping it in a non-reactive vessel in an open place so that it can burn properly (maximum oxidation) and can be collected easily. Whole plant of Yava burn should be added little by little into the fire for proper burning. Panchang of Yava burn slowly when it was burn, Therefore, the time taken for the whole plant to burn and cool down to obtain whitish-grey ash was more. Maximum temperature during burning was 310°C. Average 14.74% (1770 gm.) whitish-grey ash was obtained in average twenty-three hours from twelve-kilogram whole plant of Jow. Because the organic part of in the plant material gets destroyed by burning, only the inorganic part and residue black carbons remains.

The ratio of water in ash is different according to Acharyas (Four-time, six time) but, according to Ras Tarangini for the preparation of Kshar Jala eight times of water needs to be added to obtained better solubility. Water is a chemically stable compound that can be used to dissolve a wide variety of compounds. De-mineralized water was used to avoid any interference. Ash should be rubbed well with water for proper mixing and then at least 3 hours for better absorption of alkaloids. Kshar is considering as a water-soluble ash, but all water-soluble content cannot be obtained within a single wash or filter; some of them may remain as residue. Different methods of filtering water have been told in the scriptures that it should be filtered 21 times with multi-folded cotton cloth or decant 7 times but ultimate aim is to make the carbon free clear liquid or Ksharjala. Average 12825 ml. Ksharjala was obtained from whitish-grey ash and loss observed was 1334 ml, it may be due to the soaking of water in ash material which cannot be separated. The color of Kshar Jala is yellowish brown and the taste is salty with a Characteristic odor.

After getting a clear liquid, it is heated moderate followed by mild flame. After the 2/3 parts of water evaporation on the fire, it changes its color to brown and starts stick to the vessel. At this time, it is cooked (Pakva) on low flame so that the Kshar does not burn and sticks less on the vessel. When the water content in the Kshar is reduced and it becomes semi-solid, it is taken out in another vessel or tray and dried in the sun light until it becomes solid powder form. Average 2.55% YK was obtained from the whole plant material. The color of YK was light brown. Color of Kshar depends on the nature of vessels and medium of agni. When wood and coal are used instead of LPF gas as fuel and iron vessel is used instead of steel-ness steel as the vessel, the color of Kshar is relatively dark.

The results of the study showed the quantity of YK ash and Kshar Jala obtained for each batch, as well as the percentage of ash and Kshar obtained. The time taken for the preparation and evaporation of Kshara jala was also recorded.

This pharmaceutical study highlights the importance of following standardized procedures and validation protocols to ensure the production of high-quality herbal medicines. By subjecting Indian Medicinal herbs to rigorous scientific testing and establishing modern standards, the Indian pharmaceutical industry can enhance the quality of its products and meet the demands of the global market.

Term Quality Control refers to the sum of all procedures undertaken to ensure the identity and purity of a particular pharmaceutical product. Analytical tests were performed on YK to assess the formulations against the standard parameters.

Organoleptic characters of YK were observed that the Kshar was fine powder in appearance with characteristic odor and salty in taste. The color of YK was Light brown.

The pH value of a sample expresses the degree of acidity or alkalinity of a sample. pH of YK is 9.69. High alkaline nature of Kshar or drug indicates the site of absorption and action of the drug. Loss of drying is a specific analytical technique removing not only water but all other volatile impurities from a sample. Moisture content in YK is 5.73% w/w.

Ash Value is useful in determining authenticity and purity of sample and also these values are important qualitative standards. Total Ash value of YK is 89.27% w/w while Acid Insoluble Ash value of YK is 8.80%. Total Ash is important and indicates to some extent the amount of care taken in the preparation of the drug.

In YK the quantity of Potassium Content is 36121.3 mg/100gm while the quantity of Sodium Content is 8021.2 mg/100gm. YK is the compound of Potassium and Sodium Salts. In our study the Kshar was rich in Potassium & Sodium content. Due to its laghu and sukshma guna, it’s use as an emergency medicine in practice. This Kshar have great potential to treat many diseases.

Conclusion-
To validate the standard operational procedure three batches of YK were prepared by the process mentioned in Rasa trangini (Preparation of Ash, Preparation of Kshar Jala, Evaporation of Kshar Jala) and all the possible Physico-chemical studies were done as mentioned in API. The average yield of YK from the whole plant was 2.55%. Pharmacuetic-analytical observations results from this study are helpful for further work and use as a reference. It can be a fore step for Standard Operative Procedure for the preparation of the YK on large scale.

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Conflicts of interest-
There are no conflicts of interest.
REFERENCES:


9. Indradeva Tripathi, Mahausadha Nighantu, Chaukhambha Bharti Academy Varanasi, Reprint 2015, Mahausadhari Varg (134) p.66.


17. Indradeva Tripathi, Mahausadha Nighantu, Chaukhambha Bharti Academy Varanasi, Reprint 2015, Mahausadhari Varg (136-138) p.66.


22. Indradeva Tripathi, Mahausadha Nighantu, Chaukhambha Bharti Academy Varanasi, Reprint 2015, Mahausadhari Varg, p.66.


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