



“PHARMACEUTICAL DEVELOPMENT AND STANDARDIZATION OF SUGAR-FREE ASAVARISHTAS”

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ABSTRACT

Background and objectives:

Ayurveda pharmacology proposes numerous dosage forms as primary and secondary varieties. *Sandhana kalpana*^{6,7} is one of the secondary dosage forms aims to extract the phytochemicals in their optimum state of quality and is preserved in self-generated alcoholic end product. The process in the classics require sweetening agent as one of the essential factor. Though there are no contraindications to these dosage forms in any form, hesitation and ambiguity prevails in the minds of both the physicians and the people receiving the treatment with regards to the probable glucose load on the system and its hazards¹⁷. The previously standardized products like *arjunarishta*¹⁸ and *jambu asava*²⁰ were selected for the study and the same process of *Sandhana* was conducted and allowed to ferment with the help of other forms of carbohydrates as fermenting agents. Hence there is an attempt here to develop this concept of *Sandhana*²³ with other sources of carbohydrates rather than the sweetening agents as explained in classics.

Key words: Sugar free medicines, sugar free *Asavarishras*,

Introduction:

Ayurveda is a holistic medical science which has its roots in the Indian subcontinent. The principle of *Trisutra- Hetu, Linga* and *Aushadha*¹ where *Aushadha* which can be directly translated as Medicine, is explained as a tool with which one can treat the discomfort or diseases. *Rasashastra* and *Bhaishajya kalpana* are the specific and most essential parts in *Ayurveda* which deal with *Aushadha* and can be co-related to pharmacognosy and pharmaco-therapeutics. Among the dosage forms explained in *Ayurveda*, '*Sandhana kalpana*²' is a unique form in which acidic and alcoholic fermented formulations are prepared. Here, a chain of chemical reactions leads to alcoholic extraction of active principles of the organic compounds. Thus, these formulations have longer shelf life, quick absorption and action and excellent therapeutic efficacy as compared to other *Ayurvedic* herbal medicines.

*Asavarishtas*³ among the alcoholic extracts are prominently used for therapeutic use as against others being used as diet, luxury drink etc. *Asavas* and *Arishtas* are differentiated only by the liquid material which is used i.e, *Asavas* are made of juices of the raw drugs whereas the *Arishtas* are made out of decoctions of the dry drugs, although this principle does not hold good for all the *Asavas*³.

Review of literature:

Definition of *Sandhana Kalpana*:

Sandhana Kalpana is a process of fermentation where the *Drava dravya*, *Madhura Dravya*, *Prakshepaka Dravya* and *Sandhana Dravya* put together in an inert vessel sealed for a specified time period to facilitate the process of fermentation.

*ĀSAVA AND ARISTA*³

*Āsava*⁴ (आसव) refers to a medicated spirituous liquid. . *Āsava* is prepared using raw vegetables for fermentation, as opposed to *Ariṣṭa*⁵, which uses a decoction of drugs. *Āsava* (आसव) refers to a type of liqueur. *Ariṣṭa* (अरिष्ट) also refers to a type of fermented preparation and represents one of the various medicinal preparations and formulations in *Ayurveda*.

Classification of *Sandhana Kalpana*⁷:

<i>Madhya Kalpana</i>	<i>Shukta kalpana</i>
<p>1. <i>Sura</i></p> <ul style="list-style-type: none"> • <i>Prasanna</i> • <i>Kadambari</i> • <i>Jagala</i> • <i>Medaka</i> • <i>Surabija</i> <p>2. <i>Sidhu- Pakva and Apakva</i></p> <p>3. <i>Varuni</i></p> <p>4. <i>Asavarishta</i></p>	<p>5. <i>Shukta</i></p> <p>6. <i>Tushambu</i></p> <p>7. <i>Sauvira</i></p> <p>8. <i>Kanjika</i></p> <p>9. <i>Sandaki</i></p>

Regulatory referencesa) Existing national rules⁸

Department of AYUSH, Government of India, has laid down certain provisions under Schedule T (GMP norms for preparation), measures for quality and standard production of *Asava–Arishta*. And under rule 161 of drugs and cosmetics rule, 1945, for packing and maximum permissible limit of self-generated ethyl alcohol in medicine is directed. The upper limit of alcohol as a self-generated alcohol should not exceed 12%v/v except those that are otherwise to be notified by the central government from time to time.

Sl no	Name of the formulation	Maximum content of alcohol
1	<i>Mritha sanjeevini Sura</i>	16%
2	<i>Maha drakshasava</i>	16%

General Method of Preparation of *Sandhana Kalpana*⁹

Asava–Arishta preparation which includes important constituents like

- Liquids-*Kashayas/Swarasa*
- Medicinal drugs (as main ingredient of formulation)
- sweet substances/ *madhura dravya*
- *prakshepa dravya* (additional medicinal/palatable substances) as there.

Anukta Mana of Asavarishtha⁹

<i>Dravadravya</i>	1 <i>drona</i> (12.288kgs)
<i>Guda</i>	1 <i>tula</i> (4.8 kgs)
<i>Madhu</i>	½ <i>tula</i> (2.4 kgs)
<i>Prakshepaka Dravya</i>	1/10 of <i>Guda</i> (0.48kgs)

Asava samanya guna¹⁰:

- *Mano bala*- improves psychological strength
- *Shareera bala*- improves physical strength
- *Agni bala*-improves *agni*
- Cures *shoka, nidranasha and aruchi*
- The efficacy and indications depends on the drugs used in the formulation

Arishta samanya guna¹⁰:

- *Laghu paki*-easily assimilable than *asava*
- Better than all types of *sandhana kalpanas*

Sura Guna¹¹:

- *Guru guna*-heavy for digestion and assimilation
- *Tikshna* and *Grahi guna*
- Causes *ojanasha* when used non judiciously

Concept of fermentation:

The science of fermentation is known as **Zymology¹²**. **Fermentation** is a metabolic process that produces chemical changes in organic substrates through the action of enzymes. In biochemistry, it is narrowly defined as the extraction of energy from carbohydrates in the absence of oxygen. In food production, it may more broadly refer to any process in which the activity of microorganisms brings about a desirable change to a foodstuff or beverage.

Products of fermentation¹³

- **Ethanol¹³**- one glucose molecule is converted into two ethanol molecules and two carbon dioxide molecules.
- **Lactic Acid¹⁴: Homolactic fermentation** (producing only lactic acid) is the simplest type of fermentation. Pyruvate from glycolysis undergoes a simple redox reaction, forming lactic acid.
- **Hydrogen gas¹⁵**: Hydrogen gas is produced in many types of fermentation as a way to regenerate NAD⁺ from NADH.
- **Other types¹⁶** -Other types of fermentation include mixed acid fermentation, butane diol fermentation, butyrate fermentation, caproate fermentation, acetone–butanol–ethanol fermentation, and glyoxylate fermentation.

Industrial Fermentation¹⁷

Most industrial fermentation uses batch or fed-batch procedures, although continuous fermentation can be more economical if various challenges, particularly the difficulty of maintaining sterility, can be met.

Aims of the study:

1. To innovate a fermenting agent other than *Guda, madhu, sharkara* and develop a generalised method to produce Sugarfree *Asavarishtas*
2. To standardize the method of preparation of sugarfree *asavarishtas* and physical and chemical parameters

Objectives of the study:

1. To prepare classically explained *Arjunarishta¹⁸*
2. To prepare sugar-free *Arjunarishta* with alternating fermenting agent other than sweetening agents.
3. To prepare classically mentioned *Jambu asava²⁰*.
4. To prepare sugarfree *Jambu asava* with alternative fermenting agent other than sweetening agents

Materials and Methods: The previously standardized products like *arjunarishta¹⁸* and *jambu asava²⁰* are selected for the study and the same process of *sandhana* was conducted and allowed to ferment with the help of other forms of carbohydrates as fermenting agents. Here *Godhuma* and *Rakta shali⁶* were considered as they could form the alternating fermenting agents having more fibres and starch as their main composition. The method of preparation of *Kustaghni Sura* mentioned in *Bheshaja sangraha* is adopted.

Drug source:

- Raw materials are procured from Amruth kesari depot.
- Authentication is done from the department of *Dravya Guna Vijnana*, Sri SriCollege of Ayurvedic Science and Research, Bengaluru.

Pharmaceutical source:

The preparations are carried out at teaching pharmacy of department of *Rasa Shastra* and *Bhaishajya Kalpana*, Sri Sri College of Ayurvedic Science and Research, Bengaluru

Pharmaceutical Study-Pilot studies were conducted to know the exact method of preparation of sugar free *Asavarishtas* with *Godhuma* as a fermenting material.

- **Practical I**-Drakshasava
- **Practical II**-Pilot study-Parthadyarishta/Arjunarishta- 4 samples
- **Practical III**-Pilot study-Jambu Asava- based on Kushtaghni Sura¹⁶¹
- **Practical IV**-Jambu asava- 3 samples
- **Practical V**-Parthadyarishta/Arjunarishta- 3 samples-WITH SHALI

Practical I

Materials Required: *Chullika*, *Mrith patra*, iron rod, Kora cloth

Ingredients: Fresh *Draksha Phala*

Sl no	Sanskrit name	Botanical name	Part used	Quantity
1	<i>Draksha Phala</i>	Vitis Vinifera	Fresh fruits	3 kgs

Table 1. Ingredients of Practical I

Procedure:

Purva karma: *Dhoopana samskaara* was done to the previously washed and thoroughly dries *mrith patra*. Two holes were made for the provision to hang the *pottali* of *godhuma* with the help of iron rod. Iron rod was also washed and dried and also subjected to fumigation. A *sharava* was also prepared by giving *dhoopa* which was used for *Sandhibandhana*. 2000 g of black grapes (with seeds) was bought from authentic sources, washed thoroughly.

Pradhana Karma: The juice was extracted from the 2 kgs of black grapes with the help of grinder-1680 ml was the yield. 350g of *godhuma churna* was taken and made into dough with the help of required quantity of water and made into bolus form. The bolus was tied with a Kora cloth and made into *pottali*. With the help of the iron rod, it is hung inside the earthen pot in which the extracted juice is taken. Then the *sharava* is kept attached to the mouth of the earthen pot and *sandhibandhana* was done.

Note: 12.60 parts of *drava dravya* is added with 4 parts of *guda*. With this measurement as reference the dough prepared with wheat flour is taken according to this principle as equivalent to jaggery.

Paschat karma: The sample was tested for onset of fermentation and for onset of frothing. Fire test was done once in a week to check the completion of fermentation.

Practical II

Name of the Practical: Pilot study-Parthadyarishta/Arjunarishta¹⁸- 3 samples-

1. *Arjunarishta* as in classics with *Guda*-2 L
2. *Arjunarishta* with *godhuma* in *pottali*-2 L
3. *Arjunarishta* in *godhuma* cereals-1 L

4. *Arjunarishta* in *godhuma* powder-1 L

Materials Required: *Chullika*, *Mrith patra* and *sharava*, steel vessels, kora cloth, Porcelain Jars, *Dhoopana churna*, *Khalva yantra*

Ingredients: for 8 L of *Kashaya*

Sl no	Sanskrit name	Botanical name	Part used	Quantity
1	<i>Arjuna</i>	<i>Terminalia Arjuna</i> (Roxb) Wight & Arn	Bark	1200 g
2	<i>Draksha</i>	<i>Vitis Vinifera</i> L	Dried fruit	600 g
3	<i>Madhuka</i>	<i>Madhuca longifolia</i> (J Konig) J.F. Macbr	Flowers	480 g
4	Guda	<i>Saccharum Officinarum</i>	Extract	1200 g
5	Water			32 L
6	Dhataki	<i>Woodfordia Fruticosa</i> (L) Kurz	Flowers	480 g
7	Godhuma	<i>Triticum Aestivum</i> L	<i>Churna</i> <i>Cereals</i>	350 g 150 g

Table 2. Ingredients of *Arjunarishta*

Procedure:

Purva karma: same as above practical

Pradhana Karma: The soaked grapes were grinded to form a thick paste. Other ingredients (*Kashaya dravyas*) were added to the *patra* (steel vessel) which is chosen for the preparation of *Kashaya* and kept over the *chullika* and *Kashaya* of 8 litres was prepared over a period of 3 hrs 20 mins. 350 g of *godhuma churna* was taken and made into dough with the help of required quantity of water and made into bolus form. The bolus if tied with a kora cloth and made into *pottali*. Jaggery/ *guda* is made into course powder with the help of *Khalva yantra*. The three samples of *Arjuna Kwatha* as mentioned above was kept for fermentation. Then the *sharava* is kept attached to the mouth of the earthen pot and *sandhi bandhana* is done.

Paschath karma: Same as above practical SOP

Practical III

Name of the Practical: Pilot study-Jambu Asava- based on Kushtaghni Sura¹⁹

Materials Required: *Chullika*, Plastic vessel, steel vessels, chora cloth, *Dhoopanachurna*, Grinder

Ingredients:

Sl no	Sanskrit name	Botanical name	Part used	Quantity
1	<i>Jambu Phala</i>	<i>Syzygiumcumini(L)</i> Skeels	Fruit	1.5 kg
2	Water			6 litres
3	<i>Rakta Shali-Red rice</i>	<i>Oryza Longistaminata</i>	Bark	175 gms
	<i>Shali Churna</i>			475 gms

Table 3. Ingredients of Practical III**Procedure:**

Purva karma: same as above and also the Jambu Phala was washed and dried in sufficient quantity of plain water.

Pradhana Karma: Clean and dry *Jambu phala* was grinded to form a thick paste

This coarse paste was added with 6 litres of water and was kept on *Mandagni* for preparation of *Kashaya*. After the preparation of *Kashaya*, the liquid was filtered and collected. 175 gms of *shali* was taken and soaked in the *kashaya* which was collected for 3-4 hrs until the *shali* becomes soft and ready to form paste. Then it is grounded and made into paste. Then 475 grams of *Shali* is made into coarse powder form and mixed with above mentioned paste which is made out of **Shali** thoroughly. This mixture is spread at the bottom of the container in the form of bed. above this bed of *Kinva* the *Kashaya* which is already prepared is slowly put over the *Kinva* without disturbing the bed

Note: This method of preparation is as per *Kushtagni Sura*¹⁹

Paschath karma-Same as above practicals. Fire test was done as on mentioned dates to check the completion of fermentation.

Practical IV-*Jambu asava*²⁰ - 3 samples

1. Sample JC-classical method with Madhu
2. Sample JG-with *Godhuma*
3. Sample JS- with *shali*

Materials Required: *Chullika, Mrith patra* and *sharava, steel vessels, chora cloth, Porcelain Jars, plastic containers as sandhana patra Dhoopana churna, Khalva yantra*

Ingredients: for 1 sample

Sl No	Sanskrit name	Botanical name	Part Used	Quantity
1	<i>Jambu twak</i>	<i>Syzygium cumini(L)</i> Skeels	Bark	1750 g
2	<i>Jambugutali/beeja</i>	<i>Syzygium cumini(L)</i> Skeels	Seeds	350 g
3	<i>Madhuka pushpa</i>	<i>Madhuca longifolia(JKonig)</i> J.F.Macbr	Flowers	60 g
4	<i>Dhataki flowers</i>	<i>Woodfordia Fruticosa</i>	Flowers	75 g
5	<i>Lodhra</i>	<i>Symplococcus Racemosa Roxb.</i>	Bark	37.7 g
6	<i>Mocharasa</i>	<i>Bombax Malbaricum DC</i>	Resin	37.5 g

7	<i>Twak</i>	Cinnamomum Verum J.Presi	Bark	37.5 g
8	<i>Ela</i>	Elettaria Cardamomum (L)Maton	Seeds	37.5 g
9	<i>Guduchi</i>	Tinisporea Cardifolia (Thumb)Miers	Stem	37.5 g
10	<i>Gudamara</i>	Gymnema Sylvestre R.Br	Leaves	37.5 g
11	<i>Rakta shali</i>	Oryza Longistaminata	Cereals	175g+475 g
12	<i>Godhuma</i>	Triticum Aestivum L	Cereals	175g+475 g
13	<i>Madhu</i>	Honey		200 ml

Table 4. Ingredients of Jambu Asava

Procedure: Purva karma: same as above. The Patra which was selected were plastic containers and a porcelain container for classical sample.

Pradhana Karma:

- The ingredients (*Kashaya dravyas*) were added to the *patra* (steel vessel) which is chosen for the preparation of *Kashaya* and kept over the *chullika* and *Kashaya* of 6.5 L was prepared over a period of 3 hrs 45 mins

Preparation of *Kinva pishti*

- *Kinva pishti*- both cereals were used rice or wheat (*shali/godhuma*) for their respective samples
- Rice/wheat-1/8 th part of one of *Kashaya dravya* is soaked in *kashaya* for 3-4 hrs until the cereal become soft.
- Rice flour/wheat flour-3/4 th part of one of *kashaya dravya* is ground into paste and added with rice/wheat flour (freshly powdered)
- The consistency obtained was convenient to form *pishta* (ball)
- This is spread beneath the vessels used for fermentation to form the bed of *Kinva* (*patra samskara* priorly done)
- The *kashaya* prepared is poured over the *kinva* (of *shali* and *godhuma* separately) without disturbing the bed of *kinva*
- *Prakshepaka dravyas* are added and kept undisturbed until the fermentation starts.

Paschath karma-same as above

Practical V

Name of the Practical -*Parthadyarishta/Arjunarishta*- 3 samples-WITH SHALI

1. A1-with *shali* as *kinva pishta*
2. A2- with *shali* as *kinva pishta*
3. A3- with *shali* as *kinva pishta*

Date of commencement: November 10th 2021

Date of completion: January 19th 2021

Materials Required: *Chullika*, steel vessels, kora cloth, Porcelain Jar, Plastic Jars, *dhoopana churna*, *Khalva yantra*

Ingredients: includes the ingredients of *Arjunarishta* along with *sandhana dravya* as *Rakta shali* in the form of cereals in the quantity of 37.5g+225 g for *Kinva Pishta* preparation.

Procedure:

Purva karma:

- *Dhoopana samskaara* and *gritha lepana* was done to the previously washed thoroughly and dried.
- The dry black grapes (*draksha*) was soaked overnight in sufficient quantity of plain water.

Pradhana Karma:

The soaked grapes were grinded to form a thick paste. Other ingredients (*Kashaya dravyas*) were added to the *patra* (steel vessel) which is chosen for the preparation of *Kashaya* and kept over the *chullika* and *kashaya* of 6.25 litres was prepared over a period of 3 hrs 15 mins.

Preparation of Kinva pishti

Kinva pishti of rice (*shali*) was prepared. Rice was taken 1/8 th part of the main ingredient in *Kashaya dravya* is soaked in *kashaya* for 3-4 hrs until the cereal become soft. Rice flour was prepared with 3/4 th part the of *kashaya dravya* is mixed with the ground paste of the soaked rice. The consistency obtained was convenient to form *pishta* (ball) This is spread beneath the vessels used for fermentation to form the bed of *Kinva* (*patra samskara* priorly done) The *kashaya* prepared is poured over the *kinva* (of *shali* and *godhuma* separately) without disturbing the bed of *kinva* *Prakshepaka dravyas* are added and kept undisturbed until the fermentation starts.

Paschath karma-same as above- same as above

Practical VI

Name of the Practical – Jambu asava- 3 samples-WITH SHALI

4. J1- with *shali* as *kinva pishta*
5. J2- with *shali* as *kinva pishta*
6. J3- with *shali* as *kinva pishta*

Date of commencement: November 24th 2021

Date of completion: January 18th 2021

Materials Required: *Chullika*, steel vessels, chora cloth, Porcelain Jar, Plastic Jars, *Dhoopana churna*, *Khalva yantra*

Ingredients: for each sample includes the ingredients of *Jambu asava* along with *sandhana dravya* as *Rakta shali* in the form of cereals in the quantity of 175g+475 g for *Kinva Pishta* preparation

Procedure:

Purva karma: same as above

Pradhana Karma:

- The soaked grapes were grinded to form a thick paste
- Other ingredients (*Kashaya dravyas*) were added to the *patra* (steel vessel) which is chosen for the preparation of *Kashaya* and kept over the *chullika* and *kashaya* of 6.25 litres was prepared over a period of 3 hrs 25 mins

Preparation of *Kinva pishti*-as above

Paschath karma-same as above

Precautions during all the preparations:

- *Kashaya* was prepared on low flame
- *Dhoopana samskara* and *Patra samskaara* with *gritha* was thoroughly done
- *Sandhi bandhana* as done only after the onset of fermentation
- Onset of frothing and fermentation were carefully monitored
- Utmost care was taken during *dhoopana, patra samskara* and preparation of *Kinva* and subsequently all the samples regarding spillage and cleanliness

Observations

- Organoleptic -The juice extracted from jambu phala was light pinkish to blue color. The *Kashaya* extracted from bark of *jambu* and *Arjuna* was dark red in colour
- Onset of fermentation- was on the second day to third in all the samples
- Frothing- also started just before the onset of fermentation- we could only hear the frothing sound as we had done *Sandhi bandhana* in many samples. Whereas we could appreciate the frothing in plastic containers as they were transparent.
- Practical II-10 days the samples of *gudhuma* was found to have fungal growth and the *godhuma* was oozing out from the *pottali*. The *Kashaya* was completely absorbed by the cereals of *gudhuma* and was also found infested with fungal growth in case of the samples with *godhuma* directly put as cereals. Hence only one sample i.e, the sample with *Guda* and *Dhataki Kusuma* was obtained.
- The sample in porcelain jar took more duration for the completion of fermentation than the sugar free samples in Plastic containers
- yield was comparatively lesser in the sample out of porcelain jar than the other samples in plastic containers

Date	Sample 1 (Classical <i>Arjunarishta</i> with <i>Guda</i>)	Sample 2 (<i>Arjunarishta</i> in <i>godhuma pisti</i> <i>pottali</i>)	Sample 3 (<i>Godhuma</i> <i>churna</i>)	Sample 4 (<i>Gudhuma</i> <i>cereals</i>)
5/2/2021	Intact	Spillage of dough out of <i>pottali</i> - partially fungus	Intact-quantity of <i>kashaya</i> was markedly reduced	fungus- <i>kashaya</i> was absorbed
8/2/2021	Intact-the smell of <i>guda</i> and other ingredients elicited	Fungus infestation progressed	Froathing +	Fungus- <i>Kashaya</i> dried up discarded
15/2/2021	Intact – typical smell of fermentation, floating of <i>dhataki pushpa</i> , <i>agni pareeksha</i> - the fire did put- off inside the pot	Fungal infestation hence discarded	Fungal infestation hence discarded	
30/2/2021	Intact-fire test- fire continued- typical strong smell of <i>sandhana</i> , taste of <i>guda</i> - reduced			
15/3/2021	Intact			
7/4/2021	Intact-yield 2650 ml			

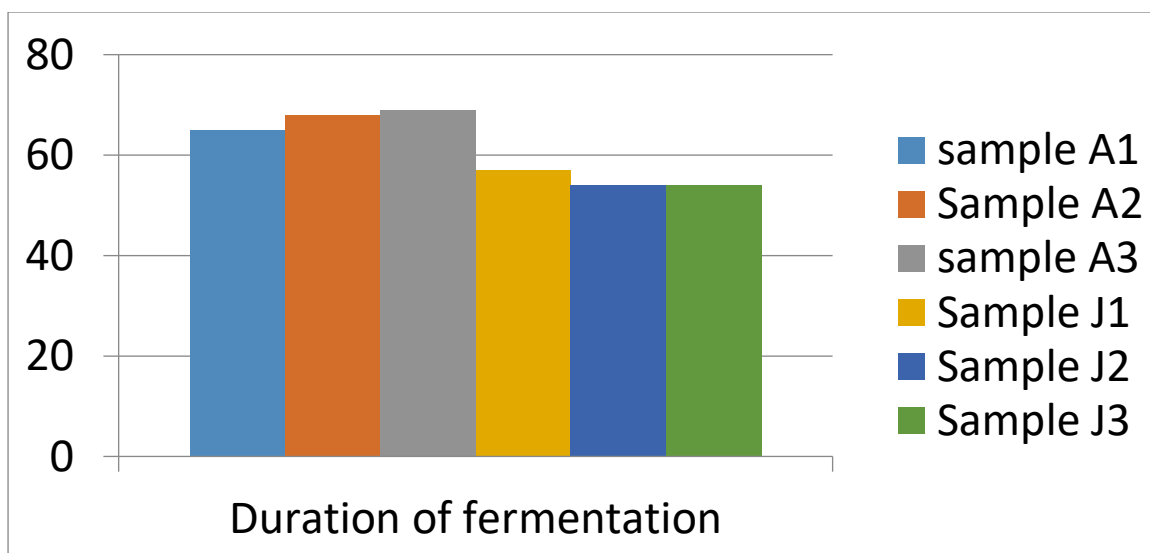
Table 5. Observations of Practical IV

Samples	Samples kept on	Fire test dates	Date of completion of fermentation	No of days taken for fermentation	Yield
Sample JC- classical <i>Jambu</i> <i>asava</i>	27/7/2021	13 th Aug, 24 th Aug, 18 th Sep, 31 st Sep, 5 th October, 15 th Oct, 25 th Oct	9/11/2021	106 days	860 ml
Sample JS- <i>Jambu</i> <i>Asava</i> with <i>Shali</i> as <i>Sandhana</i> <i>Dravya</i>	27/7/2021	13 th Aug 2021, 24 th Aug, 18 th Aug, 18 th Sep, 31 st Sep, 5 th October- negative for fire test	5/10/2021	71 days	1080 ml

Table 6. Observations of *Jambu Asava* classical and with *Shali* as *Sandhana dravya*

	Froathing started	Fermentation started	Fire test positive	Fire test negative	Duration of fermentation	Yield
Sample A1	15 th November	16 th November	16 th 19 th , 29 th November and 6 th December 7 th January	17 th January	65 days	1450ml
Sample A2	15 th November	16 th November	16 th 19 th , 29 th November and 6 th December 7 th January	19 th January	68 days	1600ml
Sample A3	15 th November	16 th november	16 th 19 th , 29 th November and 6 th December 7 th January	19 th January	69 days	1700ml
Sample J1	25 th November	1 st December	6 th December, 7 th January, 21 st January	17 th January	57 days	850ml
Sample J2	25 th November	1 st December	6 th December, 7 th January, 24 th January	18 th January	54 days	980ml
Sample J3	25 th November	1 st December	6 th December, 7 th January, 24 th January	18 th January	54 days	960ml

Table.7. Observation of sugar free samples



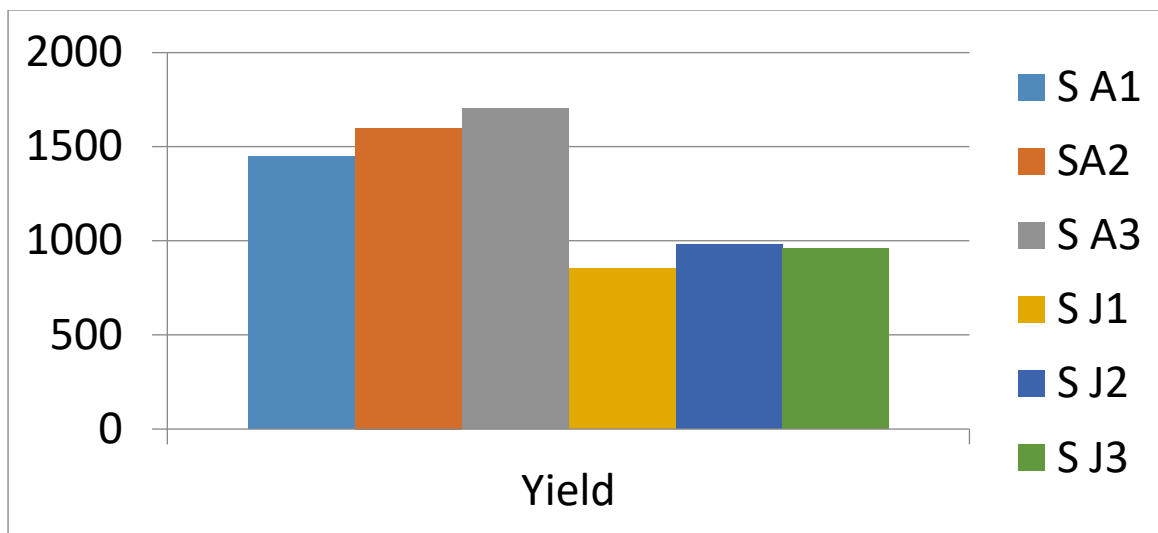


Fig.Graph Analysis duration of fermentation and yield of all the Sugarfree and Classical samples.

The samples thus obtained were subjected to physico-chemical Analysis with following parameters:

Analytical parameters²¹:

1) Organoleptic characters

These parameters were analysed through the 5 sensory organs to differentiate the taste, odour, colour etc..

2) Physico-chemical parameter

- Specific gravity
- pH value
- Total solid
- Refractive index
- Reducing sugar
- Total sugars
- Non-reducing Sugar
- Alcohol percentage
- Chromatography

Specific gravity²²:

Specific gravity, also known as relative gravity can be defined as the ratio of a density of a substance to that of water at a particular given temperature. The specific gravity of an object is the ratio between the densities of an object to a reference liquid. It has no units. The specific gravity of water is equal to 1. Specific gravity was measured using Hydrometer²³.

$$\text{Specific gravity} = \frac{\text{Density of substance}}{\text{Density of equal volume of water}}$$

pH value²⁴:

The full form of pH is potential of Hydrogen. pH is a quantitative measure of the acidity or basicity of aqueous or any liquid solutions. It is the value of the concentration of the hydrogen ion which ordinarily ranges between about 1 and 10^{-14} gram-equivalents per litre and into numbers between 0 and 14.

Total solids²⁵:

Total Dissolved solids (TDS) are the total amount of mobile charged ions including minerals, salts or metals dissolved in a given volume of solution. It expressed in units of mg per unit volume (mg/L). Total suspended solids (TSS) include all particles suspended in water which all not pass through a filter.

Formula

$$M_{\text{solids}} = (M_{\text{pan}} + M_{\text{solids}}) - M_{\text{pan}}$$

Refractive index²⁶:

Refractive index is defined as “The ratio of the speed of light in a vacuum to its speed in a specific medium”. Refractive index is also referred to as refraction index or index of refraction which is also the indicator of the optical density of a medium. The speed of light in a medium depends on the properties of the medium. In electromagnetic waves, the speed is dependent on the optical density of the medium.

Formula²⁶

The refractive index, represented by symbol n , is the velocity of light in vacuum divided by the velocity of light in a medium. The formula of the refractive index is as follows:

$$n = \frac{c}{v}$$

Where,

- n is the refractive index
- c is the velocity of light in a vacuum (3×10^8 m/s)
- v is the velocity of light in a substance

Reducing sugars²⁷:

A reducing sugar is any sugar that is capable of acting as a reducing agent. Reducing sugar is a type of sugar that consists of a free aldehyde group or a free ketone group, allowing the molecule to act as a reducing agent. Sugars that can be oxidised by mild oxidising agents are called reducing sugars. All monosaccharides are reducing sugars, and so are some disaccharides and oligosaccharides. The detection of reducing sugars in a sample can be done by one of the two methods; Fehling's reaction and Benedict's test.

Non-reducing sugar²⁷:

Non reducing sugar is a type of sugar that doesn't have a free aldehyde or ketone group, as a result of which the sugar cannot act as a reducing agent. All polysaccharides are non-reducing sugars, and so are most disaccharides and oligosaccharides. Non-reducing sugars are either dimers, trimers, or polymers, which are formed of many reducing monomeric units by the formation of a glycosidic bond and they do not generate any compounds with an aldehyde group in a basic aqueous solution.

Non-reducing sugar can be differentiated from reducing sugars through tests like Benedict's test and Fehling's test.

Alcohol percentage²⁸:

Alcohol by Volume (ABV) is the measure of alcohol content within a beverage. It is a standard measure that how much of alcohol (ethanol) is contained in a given volume of an alcohol beverage (expressed as a volume percent). It is defined as the number of millilitres (ml) of pure ethanol present in 100 ml of solution at 20°C (68°F).

Determination of alcohol percentage²⁸:

The alcohol percentage of all the samples was determined by using a Hydrometer with triple measurements.

Chromatography²⁹:

Chromatography is an important biophysical technique that enables the separation, identification, and purification of the components of a mixture for qualitative and quantitative analysis. Chromatography is based on the principle that molecules in mixture applied onto the surface or into the fluid stationary phase (stable phase) are separated from each other while moving with the aid of a mobile phase. The factors effective on this separation process include molecular characteristics related to adsorption (liquid-solid), partition (liquid-solid), and affinity or differences among their molecular weights. Because of these

differences, some components of the mixture stay longer in the stationary phase, and they move slowly in the chromatography system, while others pass rapidly into mobile phase, and leave the system faster²⁸.

The TLC plates with the samples loaded were kept in the medium for 3-4 hrs and Rf value is calculated.

Statistical analysis has been done using SPSS IBM software with Two way Anova to compare the samples between each of them and the classical preparation of both *Jambu asava* and *Arjunarishta*.

Results

The parameters were evaluated at Sri Sri Tatva and the vales obtained were as follows:

Sample	Specific gravity	pH	Total solids	Reducing sugars	Total Sugar	Non reducing sugar	Alcohol content (immediately after filtering)	Alcohol content (after 1 month)
AC	1.105	4.64	0.065	33.2%	34.2%	1%	5%	7.62%
JC	1.139	4.14	0.445	24.2%	24.8%	0.6%	4.2%	6.01%
A1	1.016	3.60	4.12	8.89%	9%	0.11%	1.093%	4.10%
A2	1.010	3.80	3.90	10.26%	10.56%	0.3%	2.86%	5.20%
A3	1.011	3.64	4.45	9.47%	9.77%	0.3%	2.63%	5.60%
J1	1.0316	4.54	7.52	12.83%	13.29%	0.46%	3.28%	6.50%
J2	1.030	4.03	6.43	10.73%	11.14%	0.41%	2.94%	5.98%
J3	1.028	4.45	10.89	12.42%	12.58%	0.164%	2.119%	5.98%

Arjunarishta

Chart Title

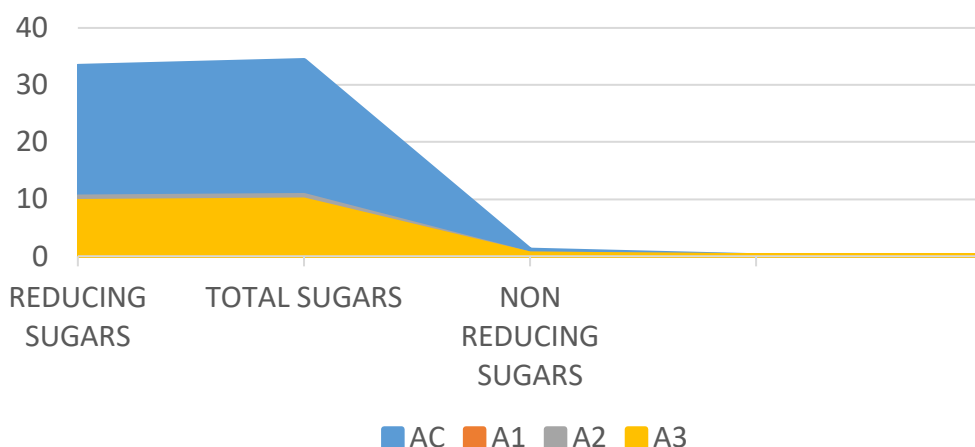
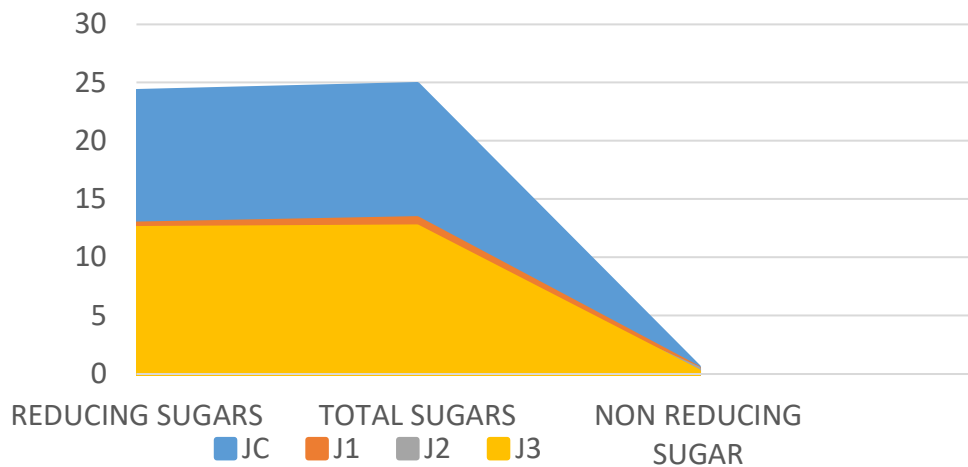
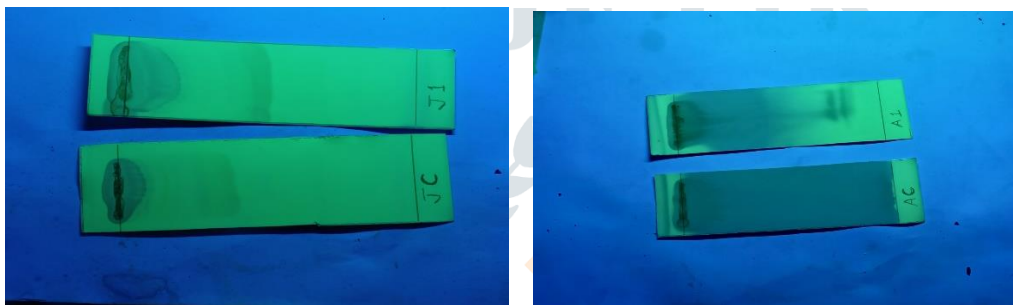


Chart Title



Jambu asava



	JC	J1	AC	A1
Rf value	0.4	0.5	0.975	0.85

Statistical analysis: The statistical significance in terms of parameters between the classical samples and the sugar-free samples were conducted with Two way Anova tests and the results of “f” value showed lesser than 0.5 in the tests conducted in comparison to the classical preparation with the sugar free preparation of both *Arunarishta* and *Jambu asava*. The products obtained with the *samskara* of *Sandhana* with *Rakta shali* had very low values in parameters like reducing, non-reducing and total sugars which was very significant.

Discussion:

The method to prepare Sugar free *Asavarishtas* was successfully generated in this study. However, there were challenges at every level from the use of porcelain jars/ mud pots till the analysis of sugar content. The study emphasises the significance of plastic containers as it was less susceptible for fungal infestations. The use of *Godhuma* was probably not suitable for fermentation by the method adopted because of *Gurutwa* as the basic quality of the *dravya*, it absorbs more water content leading to lesser yield and taking a longer time for the growth of microorganisms. This quality can be attributed to as responsible factor for fungal growth

On considering the analytical parameters, results of the samples made of fermentation with *shali* showed lower in total sugars, non-reducing and reducing sugars which is highly evident-thus proving it to be more promising products in treating metabolic syndrome. The value of pH and specific gravity is comparatively same or reduced proving that the acidic quality and density of the liquid preparation is maintained. The Alcohol percentage of sugar free preparations was lower when compared to classical preparation which can ensure no irritation and other side effects while administering. However, establishment of clinical efficacy needs further study.

The utility of these sugar free products have their advantages over the use of Artificial sweeteners and their hazards which is prevalent in recent medicinal products. Moreover, rice is composed of starch as a major constituent which is made of amylase and amylopectin. Starch can be hydrolyzed into simpler carbohydrates by acids, various enzymes, or a combination of the two which is longer process compared to simple carbohydrate present in *Guda*, *Sharkara* and *Madhu*. Hence the immediate load of sugar on the system is well controlled without compromising with the effective active ingredients in the drug. Hence, Sugar free *Asavarishtas* can be considered as a magnificent modification of *Asavarishtas* in general which can be administered without any hassle in metabolic disorders.

The statistical Data obtained also showed F value within 0.5 which means there is significant difference in parameters of the classical and sugar-free samples. The F value of the rest of the analysis in between the samples were greater than 0.5 which states that there is no significant difference in the parameters of the sugar-free samples between each sample. By this we can conclude the samples can be taken as standardized. Also, total cost of 450ml would cost less than Rs 100 approximately and is still more cost effective when manufactured on a large scale.

Conclusion:

The standardized formulations of *Arjunarishta*³⁰ and *Jambu asava*³¹ were successfully prepared with *Shali* using it as a *Sandhana dravya*. The prepared samples have all the parameters within the permissible limits. All the samples of developed as sugar free *Asavarishtas* although contain sugar (total, reducing and non-reducing sugars) they can be considered as hydrolysed sugar alcohols formed as a result of starch. Starch and fibers take a longer time for glycolysis when compared to simple sugars. These are present abundantly in rice. Thus Red Rice/ *Rakta Shali* can be considered as a potent fermenting media with which any *Asavarishtas* can be developed without using sweetening agent otherwise mentioned in our classics.

Scope of further study:

1. Comparatives Clinical study on the efficacy of the product
2. Development of various other *Asavarishtas* by adopting the same method, Dose fixation and dilution.
3. Application and adaptation of this method on a large scale in pharmaceutical industry.

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