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ORIGINAL RESEARCH ARTICLE: EXPERIMENTAL STUDY

PHARMACEUTICO-ANALYTICAL STUDY OF *ARJUNARISTA* PREPARED BY CLASSICAL AND MODIFIED METHOD

PUSHPALATHA A.S[1] S.A.DODDAMANI[2] SUREKHA S MEDIKERI[3]

ABSTRACT

Sandhana Kalpana is an effective and popular dosage of *Ayurvedic* pharmaceuticals by virtue of its palatability, long shelf life and possession of self-generated alcohol which acts as natural/self- preservative. Asava-Aristas are types of Sandhana Kalpana. *Arjunarista*/*Parthadyarista* is one such important *Sandhanakalpana* useful in the management of cardiovascular disorders. As per the classical method of preparation of *Arjunarista,* prepared with jaggery following classical method, will leaves out 30-40% sugar content in the product, which is not advisable to the patients of cardiac disorders with co-morbid Diabetes Mellitus. An innovation to modify the classical preparation of *Arjunarista* was thought off, hence in the present study *Arjunarishta* was prepared by following classical method using jaggery and another sample by following same method but changing the fermenting media from jaggery to wheat flour as Wheat is considered as one of sandhana dravya in the classics.Both the samples i.e classically prepared and Arjunarista prepared using wheat flour are taken for analytical study. Arjunarista of Godhuma (wheat flour) shows low percentage (with in standard limits) of, alcohol, reducing and non- reducing sugars which can be readily advisable to patients of cardiac disease with co-morbid Diabetes Mellitus.

Key words: Asava Arista, Sandhana Kalpana, Arjunarishta, Fermentation

[1]PG Scholar, [2]Associate Professor, [3]HOD & Professor, Dept. of Rasashastra and Bhaisajya Kalpana, GAMC, Bengaluru, Karnataka, INDIA

Corresponding Email id: pushpa1750mdy@gmail.com Access this article online: www.jahm.in

INTRODUCTION

The making of *asava a*nd *arista is* a challenging task for the Ayurvedic pharmaceutical industries, but still these are extensively prepared in present days. There is evidence for the probable mode of chemical reactions involved during the preparation and thus imparting various changes in the final product with respect to their organoleptic, physio-chemical, biochemical and nutritive properties, which is important for the therapeutic utility of any *asavaaristas*[1].

MATERIALS AND METHODS

This is a pharmaceutical and analytical study of Arjunarishta prepared in two different batches comprising of classical and modified method of fermentation.

Ingredients of *Arjunarista* and their ratio[2]:

Ingredients	**Botanical name**	**Officinal part**	**Ratio taken for the preparation**
Arjuna	Terminalia arjuna	Bark	3kg
Draksha	Vitis vinifera	Dried Fruit/Raisins	1.5kg
Madhukapuspa	Madhukaindica	Flower	600g
Dhatakipuspa	Woodfordiafructicosa	Flower	600g
Guda	Saccharum officinarum	Solidified juice	1.5kg
Godhuma	Tritium asetivum	Flour	750g
Jala			30 Liter

The preparation of *Arjunarista*was conducted according to the reference of *BhaishajyaRatnavali, Hridrogadikara.*

Pharmaceutical procedures involved are,

1.PURVAKARMA

preparation and Fumigation of *Sandhanapaatra*

- The fermenting vessel (*Sandhanapaatra*) used here was acid proof plastic can of 5L capacity. It was cleaned thoroughly with fresh water, then with hot water and dried.
- The fermenting vessel was subjected to fumigation (*dhupana*) using the drugs- *guggulu (Comniphoramukul), Vacha (Acorus calamus), Jatamansi*[3]*. (Nordastachisjatamansi), Haridra (Curcuma longa), Aguru (Aquillariaagallocha), Guda, Karpura.*
- This process was done 20 min prior to the filling of the wort into it.

2.PRADHANA KARMA

Preparation of *Kwatha* for *Arjunarista*.

The preparation of the *kwatha* of, *Arjuna twak + Draksha + Madhukapuspa* as per the reference of *BhaishajyaRatnavali.* 4 prastha i.e. approximately, 3kg of *Arjuna twakchurna* + 2 *prastha*i.e 1.5 kg of pounded *draksha*+ 6 *palai*.e 600g of powdered *Madhukapuspa*were taken in a clean stainless steel vessel of 40L capacity. Vessel kept for boiling on gas stove in mandagni. Boiling continued till it reaches ¼ quantity. Vessel is taken out of fire.

When the *Kwatha* was in warm state, smaller quantity was taken in a double folded starch free cloth and squeezed using the hands in order to extract the maximum *kwatha.* The residue obtained was kept aside.

Final yield: 6.07L of *kwatha*and 3070g of residue was obtained after filtration

Preparation of the wort and keeping it for fermentation i.e. *Arjunarista with Guda (Sample 1)*

- 3L of prepared *kwatha* in luke warm is taken and other ingredient i.e. coarsely powdered *guda* in the quantity of 1.5 kg is added and continuously stirred till the *guda* melts and uniformly mixes with the wort.
- *Dhatakipuspa* of the quantity 300 g were added and mixed well with a clean stainless-steel ladle.
- This wort is transferred to the fermenting vessel i.e. the acid proof plastic can of 5L capacity which was pre-treated with fumigation.
- The fermenting vessel was closed in such a way that it is not air tight but sufficient to resist entry of gross contaminates/foreign particles.
- After the confirmation of the onset of the fermentation (Candle light test/Burning matchstick test, Lime water test) the can was sealed with an air-tight lid. Lid was covered with mud smeared cloth in three layers. Thus, the *sandhibandhana* of the fermenting vessel was performed.
- Then the entire set up was placed in a carton box filled with husk in order to maintain constant temperature.
- This was placed in a room which is unexposed to direct sunlight and free air.

©Preparation of the wort and keeping it for fermentation i.e. *Arjunarista with Godhuma*[(4)] (sample 2) i.e ARGM

- 3L of prepared *kwatha* which is in luke warm state is taken and other ingredient i.e. flour of *Godhuma* in the quantity of 750g is added and continuously stirred till it uniformly mixes with the wort.
- *Dhatakipuspa* of the quantity 300g were added and mixed well with a clean stainless-steel ladle.

This wort is transferred to the fermenting vessel i.e. the acid proof plastic can of 5L capacity which was pre-treated with fumigation.

- The fermenting vessel was closed in such a way that it is not air tight but sufficient to resist entry of gross contaminates/foreign particles.
- After the confirmation of the onset of the fermentation (Candle light test/Burning matchstick test, Lime water test) the can was sealed with an air-tight lid. Lid was covered with mud smeared cloth in three layers. Thus, the *sandhibandhana* of the fermenting vessel was performed.
- Then the entire set up was placed in a carton box filled with husk in order to maintain constant temperature.
- This was placed in a room which is unexposed to direct sunlight and free air.

3.PASCHATH KARMA

Collection of the completely fermentated *Arjunarista with Guda (Sample 1)*

- After the confirmation of the completion of fermentation, the supernatant fluid decanted in other vessel after filtering through a double folded non-reactive cotton cloth.
- The marc remined in the bottom of the vessel was discarded.
- Total quantity of *kwatha taken*: 3000 ml.
- Quantity of *quatity of Arista o*btained: 2900 ml.
- Total loss: 100 ml
- Total time taken for the procedure: 64 days.

b.Arjunarista with Godhuma (Sample 2)

- After the confirmation of the completion of fermentation by Burning the matchsticktest, supernatant fluid was decanted in other vessel after filtering through a doublefolded non-reactive cotton cloth.
- The marc remined in the bottom of the vessel was discarded.
- Total quantity of *kwatha taken*: 3000 ml
- Quantity of *quatity of Arista o*btained: 1700 ml
- Total loss: 1300 ml
- Total time taken for the procedure: 45 days.

Table 1: **The details and observation of the preparation of *Arjunarista* with *Guda*(Sample 1).**

CRITERIAE	**KWATHA**	**AJGD**	**4th DAY**	**10th DAY**	**30th DAY**	**40th DAY**	**AFTER COMPLETION**
CONTAINER	Stainless steel	Acid proof plastic can					
PLACE	Department museum, avoiding direct sun light and free air.						
EFFERVESCENCE	Absent	Absent	Slight	Present			Absent
ODOUR	characteristic	Characteristic	Slight alcoholic			Alcoholic	Alcoholic

HISSING	Absent	Absent	Slightly audible	Audible			Absent
BURNING MATCHSTICK TEST		Extinguishing of flame					Continues to burn
LIME WATER TEST			Turned milky			No change	No change
FINAL YIELD	3L						2.9L

Table 2: The details and observation of the preparation of *Arjunarista*with *Godhuma (Sample 2).*

CRITERIAE	**KWATHA**	**AJGM**	**4th DAY**	**10th DAY**	**30th DAY**	**40th DAY**	**AFTER COMPLETION**
CONTAINER	Stainless steel	Acid proof plastic can					
PLACE	Department museum, avoiding direct sun light and free air.						
EFFERVESCENCE	Absent	Absent	Slight	Present			Absent
ODOUR	characteristic	Characteristic	Slight alcoholic			Alcoholic	Alcoholic
HISSING	Absent	Absent	Slightly audible	Audible			Absent
BURNING MATCHSTICK TEST		Extinguishing of flame					Continues to burn
LIME WATER TEST			Turned milky			No change	No change
FINAL YIELD	3L						1.7L

ANALYTICAL STUDY:

The analytical study reveals the chemical composition of formulation as well as their concentration. By this it helps to ensure safety limits and accuracy of the drug. Physico-chemical analysis of the drugs is carried out by using current analytical methodologies for understanding and interpreting the Physico-chemical changes occurring during and after pharmaceutical processing.

Keeping this aspect in mind, the analysis of the end product has been carried out.

1. **ORAGNOLEPTIC CHARACTERS:**

Table 3 : Showing Classical Parameters and Organoleptic characters of Arjunarista with Guda*(*ARGD) Sample 1

Classical parameters		**Organoleptic characters**	
Parameters	**Observation**	**Parameters**	***Observation***
Varna	Dark brown	*Colour*	*Dark brown*
Sparsha	Thin,watery	Odor	*Alcoholic*
Rasa	Madhura	*Appearance*	*Thin,watery*
Gandha	Characteristic odor	*Consistency*	*Sticky*

Table 4: Showing Classical Parameters and Organoleptic characters of Arjunarista with Godhuma *(*ARGM) Sample 2

Classical parameters		**Organoleptic characters**	
Parameters	**Observation**	**Parameters**	***Observation***
Varna	Light brown	*Colour*	*Light brown*
Sparsha	Thick,watery	Odor	*Alcoholic*
Rasa	Tikta	*Appearance*	*Thick ,watery*
Gandha	Characteristic odor	*Consistency*	*Sticky*

The physico-chemical parameters like pH, specific gravity, alcohol content, solid content of *Arjunarista*with *Guda* and *Arjunarista* with *Godhuma* were carried out.

Accepted standard protocols were employed to estimate Reducing & non reducing sugars, Acidity and for various functional groups.

Table 5: physio-chemical properties of both samples of *Arjunarista.*

Sample	ARGD	ARGM
pH	4.8	4.5
Specific gravity	1.093	1.027
Solids	8.3225%	26.4410%
Water soluble extractive	0.3314	0.0937
Alcohol	4.066%	1.866%
Acidity	2.852%	0.713%
Reducing sugars	2.16%	0.3%
Non reducing sugars	0.3	0.014
Methanol	Absent	Absent

Ethanol	Present	Present
Aldehydes	Present	Present
Ketones	Absent	Absent
Steroids	Absent	Absent

RESULTS:

Pharmaceutical study:

- Quantity of the *kwatha*obtained is 6.07L.
- The quantity of final product i.e*Arjunarista with Guda*was 2.9L &*Arjunarista withGodhuma* was 1.3L.
- The total yield of *Arjunarista withGuda*is 96.66% and that of *Arjunarista with Godhuma*was 43.33%.
- The total number of days for the completion of fermentation of *Arjunarista with Guda* was 64 days and *Arjunarista with Godhuma* was 45 days.

Analytical study:

- *Arjunarista with Guda*(ARGD) had the colour of clear dark brown liquid with sweet(++), astringent(+) in taste, alcoholic odour and slightly sticky and thinner in consistency.
- *Arjunarista with Godhuma*(ARGM) had the colour of light brown liquid with significant sedimentation; sweet(+), astringent(++) in taste, aromatic odour and sticky and thicker in consistency.
- The pH, specific gravity, acidity, solids, water soluble extractive, alcohol content, reducing sugars and non-reducing sugars of ARGD is 4.8, 1.093, 8.3225%, 0.3314, 2.852, 1.8664, and 2.16 & 0.3 respectively.
- The pH, specific gravity, acidity, solids, water soluble extractive, alcohol content, reducing sugars and non-reducing sugars of ARGM is 4.5, 1.027, 26.4410%, 0.0937, 0.713, 0.333, 1.4, 0.014 respectively.
- Methanol is absent in both the samples of *Arjunarista.*
- Ketones are also absent in both the samples of *Arjunarista.*
- Steroids are also absent in both the samples of *Arjunarista.*
- Overall the data revealed the desirable properties such as aliphatic amines, tertiary alcohols and aromatic groups with no significant changes.

DISCUSSION:

- Organoleptic tests are the important parameters, because patient's compatibility of a formulation completely depends on this character. Theses parameters also indicate the completion of fermentation in fermentative preparation i.e. *Jatagandha varna rasotpatti*. Table 3&4 give the details of organoleptic characters.

- *Varna* of *Arjunarista with Guda* has been found to be dark brown as opposed to light brown in *Arjunarista with Godhuma* which could be due to enhanced extractives of phenolics. Phenolic compounds are generally found in almost all botanicals and are known to prevent oxidative stress conditions via their anti-oxidative capacity. Oxidative stress (OS) has been known to be generated by reactive oxygen species which are generated in the body during some of the metabolic reactions such as respiration. Excessive generation of Reactive Oxygen Species (ROS) is scavenged by the body by natural antioxidants/ anti oxidative enzymes such as glutathione/ glutathione peroxidase, superoxide dismutase, catalase etc. it is possible that excessive browning could be due to enhance phenolic content which means enhanced anti oxidative properties.
- Rupa (consistency) of *Arjunarista with Godhuma* was found to be liquid with significant sedimentations, while that of *Arjunarista with Guda* appear to be clear liquid. Obtaining homogenous clear liquid form is very essential if we are prescribing for patients. Because, sedimentation process is a continuous process and it is due to incomplete missibility. Incompletely missible sediments have lesser bio accessibility and bioavailability also because of their property. This essentially results in lots of variation in the components present in the decoction. Obviously, such types of preparations are bound to yield inconsistent results. Since *arista* preparation yielded a clear liquid, one can anticipate effective delivery of the compounds present in them to the system and hence predictable result in terms of disease preventive or curative potential.
- Taste of *Arjunarista with Guda* (ARGD) and *Arjunarista with Godhuma*(ARGM) appear to be sweet (++), astringent (+) and sweet(+), astringent(++) respectively, *Gandha*(Odour) however is changed from aromatic in *Arjunarista with Godhuma* to alcoholic in *Arjunarista* with*Guda* suggesting that aromatic compounds may be use of broken down to yield an end product alcohol in *Arjunarista with Guda*. Consistency is slightly sticky and thicker in ARGM to thin in ARGD
- Changes in organoleptic characters are also substantiated by physic-chemical parameters such as pH, Specific gravity, Solid content, water soluble extractive, acidity, reducing and non-reducing sugars & Alcohol content (Table 5.2.2). Reduction in pH in ARGM (pH4.5) as opposed to pH 4.8 of ARGD may suggest little accumulation of acidic components in ARGM. Since wheat contains lots of phenolic acids in the bound

form, release of the same to free form during fermentation may also bring in reduction in the pH. This implies that the increase extractive value contributes to a decrease in pH or simply acidic in nature.

- Reduction is Specific gravity value when compared to ARGD (Table 5.2.2) support the organoleptic characters such as reduction in the stickiness and clarification of the liquid in ARGM without any sediment as that in ARGD. Also, conversion of the carbohydrates into lighter alcohol and carbon dioxide has caused slight fall in specific gravity.
- Overall results presented in table 5 reveals that Fermentation process has provided more organoleptically accepted product which may find better medicinal property, since they have better bio-accessibility and availability.

CONCLUSION

On the basis of observation and results of pharmaceutical, analytical studies, it could be concluded that *Arjunarista with Guda* & *Arjunarista with Godhuma*, in addition to the added advantage of generation of alcohol, shows

- The low alcohol % (i.e with in standard limits) , low reducing & non reducing sugars in *Arjunarista* with *Godhuma*is not only offers anti-hyperglycemic effect but also offers health benefits. As *Godhuma* is a staple and indicated food for *prameha* patients as mentioned in all samhitas[(5)], also gives cardiac strength**.**
- The present study is first of its kind in throwing light towards modified preparation of *Arjunarista* to combact growing need for effective herbal remedy for two fast approaching global diseases i.e., cardio-vascular Diseases and Diabetes Mellitus. Best remedy, cost effective and also for reducing complications and death.

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