

ORIGINAL RESEARCH ARTICLE

Accountability of *Woodfordia fruticosa* in Relation to *Arjunarista*: Bio-Medical FermentationAkhilesh K Verma¹, Neeraj Kumar*¹, L N Gupta¹, Arvind²¹Department of Rasa Shastra, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, India²Center of Food Science & Technology, Institute of Agricultural Sciences, Banaras Hindu University, India

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ABSTRACT

Arjunarista is an Ayurvedic liquid medicine, popularly used as herbal heart tonic. This contain self generated alcohol and water present in it acts as a media to deliver water and alcohol soluble active herbal components to the body. To assess the accountability of *Dhataki puspa* in pharmaceutical process of *Arjunarista*. Two batches of *Arjunarista* were prepared as per *sandhana kalpana* (Bio-medical fermentation). First batch contained *Arjuna twak* (*Terminalia arjuna*), *Draksha phala* (*Vitis vinifera*), *Madhuka puspa* (*Madhuka indica*), and *Jaggery* (*Saccharum officinarum*) and second batch having *Dhataki puspa* (*Woodfordia fruticosa*) along with the ingredients of first batch, both batches were prepared in earthen pot. Higher yield of *Arjunarista* was observed in batch I 35.05 % than batch II 24.45 %. We found that *Dhataki puspa* have no significant role in the fermentation.

Key words: *Arjunarista*, *Dhataki puspa*, *Arjuna*, herbal heart tonic.**INTRODUCTION**

This traditional system comprises of various types of medicines including fermented forms namely, *Aristas* and *Asavas*. *Terminalia arjuna* has shown positive results on cardiovascular disorders [1]. The stem bark of *Terminalia arjuna* has been used for alleviating angina and other cardiovascular conditions [2]. The extract also improved the symptoms of refractory chronic congestive heart failure [3]. Oral administration of *Terminalia arjuna* bark also prevented ischemic-reperfusion injury induced oxidative stress and tissue injury of heart in rabbits indicating its beneficial therapeutic effect in ischemic heart disease [4]. Arjunolic acid was shown to have protective effect on arsenic-induced myocardial injury [5]. Similarly, the effect of arjunic acid, arjungenin, arjunetin and arjunglucoside II was studied on process of respiratory oxygen burst [6]. *Arjunarista* is liquid oral formulations containing highest percentage of *Arjuna* prescribed in *Ayurveda* for treatment of cardiovascular disorders. It nourishes and strengthens heart muscle and promotes cardiac functioning by regulating blood pressure and cholesterol [1]. It contains *Terminalia arjuna*, *Madhuca indica*,

Vitis vinifera, *Woodfordia fruticosa* and *Saccharum officinarum* [7].

According to Ayurvedic texts [8] *Woodfordia fruticosa* flowers contain wild yeasts, which can tolerate high sugar concentration and are clearly able to bring out the fermentation process in *Asava* and *Arista* [9]. It was also reported previously that *Dhataki* flower bacteria did not bring about alcoholic fermentation in *Parthadyarishtam* [10]. Due to above contradictory report available regarding *Dhataki puspa*, there is immense need to find out its role in *Sandhan Kalpana*.

MATERIALS AND METHODS

In present study, two batches of *Arjunarista* were prepared in earthen pot. In batch I (having three samples), *Arjunarista* were prepared as per *sandhana kalpana* (Bio-medical fermentation) with *Arjuna twak* (*Terminalia arjuna*), *Draksha phala* (*Vitis vinifera*), *Madhuka puspa* (*Madhuka indica*) and *Jaggery* (*Saccharum officinarum*) and in batch II (having three samples) containing *Dhataki puspa* (*Woodfordia fruticosa*) along with the all ingredients of first batch by same pharmaceutical methodology.

Identification and Procurement:

Fresh *Arjuna* (*Terminalia arjuna*) stem bark was collected from BHU campus nearby Dhanwantari Bhawana, Faculty of Ayurveda, IMS, BHU, and Nagarjuna Doctors Hostel BHU. Jaggery (*Saccharum officinarum*) was taken from the home, made by sugar-cane, and rest of the drugs i.e. *Draksha* (*Vitis vinifera*), *Madhuka* (*Madhuka indica*), *Dhataki* (*Woodfordia fruticosa*) were purchased from the local market of Varanasi publically known as Dina Nath Gola market. Authentication of all raw materials was done by experts as well as herbarium sheet of Department of Dravya Guna, Institute of Medical Sciences BHU.

Pharmaceutical Study:**Pot Preparation:**

New earthen pots were purchased from the market, soaked overnight and porcelain pot were washed with detergent, rinsed & dried in sunlight for 12 h. After this Lepana^[11] (Coating) was done in all pots with Honey & Cow ghee on their internal surface and Dhoo pana^[12]. (Fumigation) was done along with *Guggulu*, *Karpura*, *Raal*, *Sarsapa*, *Guda* for twenty minutes.

Decoction:

Fresh *Arjuna* stem bark was dried in indirect sunlight for three to four days till complete drying and powdering was done in Ayurvedic Pharmacy, IMS, BHU. *Yavakuta churna* (Coarse powder)^[13] of stem bark of *Arjuna* (*Terminalia arjuna*) and *Draksha* (*Vitis vinifera*), *Madhuka* (*Madhuka indica*) used as a whole were heated along with water at mild temperature i.e. (150-250 °C) till it reduced to ¼ of initial volume after that it was strained with double layered cotton cloth. In this way decoction of *Arjuna* (*Terminalia arjuna*) and *Draksha* (*Vitis vinifera*), *Madhuka* (*Madhuka indica*) was prepared and used for preparation of *Arjunarista*

Fermentation Process:

After straining of *kwatha*, jaggery and *Dhataki puspa* were added in batch II and *Dhataki puspa* was excluded from batch I, only jaggery was mixed into it and dissolved it thoroughly by proper mixing with steel ladle. These pots were placed in husk and temperature of husk as well as room temperature was recorded during procedure, it was 36°C and 35°C - 37°C respectively^[14]. After starting the fermentation process, mouth of pot was sealed with cotton cloth smeared with clay. Whole arrangement was kept and observations were recorded during process. After acquiring the *siddhi lakashan* (completion test i.e. colour, test, smell, sound, effervescent, burning match stick test, lime water test, temperature and consistency), prepared *Arjunarista* was filtered with cotton cloth and stored in clean container and labeled as per guideline^[15].

RESULTS**Fermentation:**

Fermentation started at 4th day in all batches except batch II and fermentation was completed between 12 – 18 days were summarized in (Table 1).

Yield of Arjunarista:

Batch II with *Dhataki puspa* have lesser yield (24.45%) than Batch I without *dhataki puspa* (35.05%), summarized in (Table 2)

Table 1: Showing details about fermentation process

Fermentation	Batch I	Batch II
Started	4 th	5 th
Completed	15 day	12 day

Table 2: Showing details about yield of Arjunarista

Parameters	Batch I	Batch II
Total wart	7.150 L	7.000 L
Yield	2.505 L	1.712 L
Percentage (%)	35.05 %	24.45 %

L: liter, %: percentage.

Table 3: General observation of fermentation process in both batches

Parameter	Batch I Fermentation (Day)				Batch II Fermentation (Day)			
	0	Start.	During	After	0	Start.	During	After
Colour	DB	DB	DB	DB	DB	DB	DB	DB
Smell	S/f	S/f	V/A	V/A	S/f	S/f	V/A	V/A
Taste	Astringent	++	++	++	++	++	++	++
	Sweet	++	++	-	-	++	++	-
	Sour	-	-	++	+++	-	-	++
Sound	-	-	+	-	-	-	+	-
Effervescent	-	-	+	-	-	-	+	-
BMST	-	-	+	-	-	-	+	-
L.W.T	-	-	+	-	-	-	+	-
Temperature	RT	RT	Rais.	RT	RT	RT	Rais	RT
Consistency	++	++	+	+	++	++	+	+

Start: starting day, DB.: dark brown, S/f: sweet/fruity, V/A: vinegar/alcoholic, , Sound: hissing sound, Eff.: effervescent, BMST: burning match stick test, L.W.T.: lime water test, RT: room temperature, Rais: raised, +, ++, +++: showing increasing grading sequence.

DISCUSSION

Selection of a dosage form depends upon maximum possible extraction of the active components required for therapeutic use. There are several dosage forms in our literature like *swaras kalpana*, *kwatha kalpana*, *sneha kalpana*, *sandhan kalpana* etc., among these *sandhana kalpana* are the most suited formulations having hydro- alcoholic nature with quick absorption capacity. In *arista* self generated alcohols produced during process are also proved to be as a better solvent as well as good preservative [16]. Fermentation actively ruptures the cells of the herb, exposing it openly to the menstrum and bacteria have enzymes that break down cell walls to further assist in the leaching process. Fermentation also creates an active transport system that moves the dissolved constituents from the herbal material to the menstruum [17]. *Gandha dravyas* (Aromatic drugs) are commonly used for *lepana samsakara* along with *ghrita* and *madhu*. These are attributed for their antimicrobial properties, which may not hamper the activity of required yeast and help in sterilization. All micro-organisms require water, source of energy, carbon, nitrogen, mineral elements and possibly vitamins plus oxygen [18]. *Kwatha* which was prepared with *Arjuna*, *Draksha* and *Madhuk* an essential part of *Arjunrista*. It acts as solvent for the fermentation media and provides water which forms one of the constituents of growth of micro-organism. Micro-organisms utilize this appropriate culture media for the production of the primary and secondary metabolite. It is also helpful in the extraction of active constituent of respective herbs. Grapes consist of clear juice (80%) this juice consists of 79% water, 20% carbohydrates, 1% organic acids, trace amounts of organic acids, phenolics, vitamins, minerals and nitrogenous compounds [19]. The sugars, organic acids and phenolics of grape provided the juice its flavour, while the vitamins, minerals and nitrogenous compounds play essential role for yeast growth and fermentation. The most important sugars in grape juice are the two six-carbon sugars glucose and fructose. These are the sugars that make the juice sweet and are fermented to alcohol. There are many sources of nitrogen in grapes (e.g. DNA, enzymes, inorganic nitrogen etc.) but the most common and significant of these are amino acids. As free amino acids are important building blocks for fermentation. The most important minerals like magnesium, potassium and phosphate help in fermentation process and addition of nitrogenous

compound like *drksha* (partially dried grapes) during fermentation must increase fermentation rate [20]. *Mahua* flowers contain 65-70 % sugars, reducing sugars 48-55%, Invert sugar 14-18%, crude protein 4.0-6.5%, Ferrous 21-48 % fat 0.9-1.3%, ash 2.5-5.2%, calcium 177-266% [21]. It is reported that *Mahua* flower help in the fermentation process [22]. It might be reason for addition of it. *Mahua* is also suitable substrate for the production of ethanol in large scale process, because it consists of Phosphorous about 140 mg, Calcium 150 mg, Magnesium and Copper are present [23]. Concentration of *madhura dravya* play important role for fermentation as well as the quality of yield product [24]. Although the percentage of total sugar content in jaggery was found to be in the range of 60-80% only. It increases the concentration of sugar in liquid media restricting the growth of organisms for required action. Sugar used in the *Arjunarista* provides optimum concentration of sugar required for fermentation process. Time and temperature plays critical role in the breakdown of sugar. Optimum range of temperature and time fit for breakdown of sugar is between 74-84 F (21-29 °C) and 8-14 days [25]. *Arjunarista* was prepared in summer season at environmental temperature ranging from 34-37 °C and total time taken for completion of process was 15 days (average). During pharmaceutical process sound was perceived which showed that the reaction was started i.e. production of CO₂ probably by converting sugar in to alcohol as occur in fermentation process. It can be tested by passing through lime water and it was converted in to turbid solution due to formation of CaCO₃, i.e. presence of CO₂ production in process it is also indicative that the process is going on. And sound was disappeared after completion of process i.e. stoppage of CO₂ production it is tested by passing through lime water and lime water do not converted in to turbid solution. Absence of hissing sound, unable to change lime water colour and burning of match stick denote the completion of process that indicate CO₂ was not released in the fermentation. Quantity of *Arjunarista* obtained in batch having *Dhataki puspa* as fermenter is less in comparison to batch without *Dhataki puspa*, it may be due to soaking of some quantity of *Arjunrista* by *Dhataki puspa*... Self generated alcohol which was prepared during the process probably due to transformation of several phytochemical compounds present in the

herbs. It have preservative properties and help in potentiation of drug due to biotransformation, mediated by native microbes, besides helping in their rapid absorption [17].

CONCLUSION

In this study we observed that *Dhataki puspa* do not possess significant role in pharmaceutical process of *Arjunarista*.

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