



Review Of Arjunarishta: Bridging Ancient Ayurvedic Tradition With Contemporary Scientific Validation

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Abstract: Ayurveda and allopathy represent distinct therapeutic paradigms, with Ayurveda focusing on holistic well-being and allopathy emphasizing symptom management often with adverse effects. This review explores the intersection of these approaches, particularly in the context of fermented Ayurvedic remedies like Arjunarishta and Asava. Fermented formulations in Ayurveda offer benefits such as enhanced extraction of phytoconstituents, improved bioavailability, and extended shelf life, while reducing toxicity from heavy metals. Arjunarishta, a traditional Ayurvedic cardi tonic, incorporates ingredients like Terminalia arjuna, Madhuca indica, and Woodfordia fruticosa, and is noted for its heart-strengthening and therapeutic properties. Traditional preparation methods, involving natural fermentation, have been complemented by modern techniques to optimize efficacy and safety. Recent studies have introduced controlled fermentation processes using isolated yeast strains, which improve consistency and yield compared to traditional methods. Comparative analyses between traditional and modern methods reveal variations in alcohol content, physicochemical properties, and therapeutic efficacy, with modern approaches ensuring more reliable outcomes. Quality control and standardization are essential, with modern analytical techniques like HPTLC and HPLC providing valuable insights into the formulation's consistency and potency. Therapeutically, Arjunarishta exhibits significant cardi tonic, anti-hyperglycemic, anti-hyperlipidemic, antihypertensive, antimicrobial, anticancer activities and antioxidant activity, underscoring its potential as a multifaceted remedy. This review highlights the integration of modern scientific validation with traditional practices to enhance the effectiveness and acceptance of Ayurvedic formulations.

Index Terms - Arjunarishta, Modern formulation, Standardisation, Pharmacological.

1. INTRODUCTION

Ayurveda promotes general well-being and aims to protect and restore health with the fewest possible negative effects, while allopathy is supported by science, prioritizes symptom minimization and has many negative consequences. These therapeutic approaches differ from one another. Since allopathy may support Ayurveda in areas where it seems weak, like essential medications, medical diagnostics, and surgery, a more comprehensive approach to treatment should recognize and capitalize on the advantages provided by each field. It is acknowledged that additional advancements in the current research process could be necessary to promote Ayurveda in the medical area (Chauhan, et al., 2015).

In Ayurveda, some of the most widely used dose forms are fermented remedies like Arishta and Asava. These alcoholic formulations provide a number of advantages, such as increased phytoconstituent extraction efficiency, increased active ingredient bioavailability, longer shelf life, and less toxicity from heavy metal neutralization. In addition to improving the extraction and absorption of medicinal ingredients, fermentation also adds long-term stability and safety to these formulations. Because they combine the benefits of fermentation with traditional knowledge to create safer and more effective therapeutic preparations, this makes Arishta and Asava especially beneficial in Ayurvedic therapy (Singla, et al., 2024). Asavarista are unique remedies of medicinal plants that are made through fermentation using different wild yeast strains.

The majority of these microorganisms are present in the natural components of medicinal medicines. While both arista and asava are fermented foods, arista is reportedly better at extracting bioactive phytochemicals than asava. The nomenclature of these compositions is often derived from the primary herb ingredient, which has essential therapeutic characteristics. Apart from diverse plant-based components that demonstrate promising therapeutic properties, these products may also include natural aroma components and fermenters. Usually, jaggery is added to these mixtures as the main source of sugar required for the fermentation process (Sekar and Vinothkanna, 2019). In Ayurveda, *Madhuca indica* and *Woodfordia fruticosa* flowers serve as vital ingredients in fermentation processes. The microbes involved in fermentation are transported by these flowers. Essential nutrients from both kinds of flowers support the development and activity of these microorganisms. But studies have indicated that using yeast strains such as *Saccharomyces cerevisiae* directly improves fermentation more successfully than depending only on these flowers. The proliferation of different bacteria within the blossoms might occasionally impede the fermentation process, resulting in inconsistent results. As a result, even while these flowers help create a favorable environment for microbial activity, using specialist yeast directly could lead to more reliable and enhanced fermentation processes (Pillai, et al., 2020). Arjunarishta is a traditional Ayurvedic liquid formulation widely recognized as herbal heart tonic. It typically contains between 6-12% of naturally occurring alcohol. This alcohol, along with the water in the formulation, serves as a medium to facilitate the delivery of both water-soluble and alcohol-soluble active herbal ingredients into the body. Commonly referred to as Parthadyarishtam, this preparation is beneficial for treating various conditions such as chest injuries, general weakness, chronic fatigue, respiratory disorders, cough, and throat ailments. Additionally, it enhances physical strength and supports intestinal cleansing (Sadhanandham, et al., 2015). Arjunarista is a popular liquid cardi tonic that contains *Terminalia arjuna* as its primary component. It works by reviving and strengthening the heart muscles and improving heart health by controlling blood pressure and cholesterol levels (Mehta and Sud, 2020). Studies that have been published indicate that the fermentation process for Arjunarishta takes between 22 and 27 days to finish (Verma, et al., 2014). Furthermore, variations in physicochemical properties have been observed among various brands (Randive, et al., 2016^a). The aim of this review study is to comprehensively assess Arjunarishta by integrating scientific aspects with traditional practices. It concentrates on assessing contemporary preparation processes, quality control standardization procedures, and scientific approaches for determining Arjunarishta's therapeutic efficacy. With the help of modern scientific validation, this method aims to give a comprehensive understanding of Arjunarishta's preparation, quality assurance, and therapeutic advantages.

2. Traditional and Modern Approaches to Arjunarishta Preparation

2.1 Traditional Approach

Arjunarishta is traditionally prepared using the bark of *Terminalia arjuna*, flowers of *Madhuca indica*, and *Woodfordia fruticosa*. The finely ground bark is sieved and soaked overnight in potable water. The mixture is then mildly heated until the volume reduces to one-fourth, after which it is filtered through muslin cloth. Jaggery is dissolved in the decoction, stirred, and filtered again. The filtrate is transferred to a clean container, where the remaining ingredients, including *Woodfordia fruticosa* flowers, are added and mixed. The container is sealed with a cloth smeared with mud and kept in a clean, dry room for fermentation. Once fermentation is complete, the mixture is filtered through muslin cloth, and the final product is stored in an airtight container (Sayyad, et al., 2012).

2.2 Modern Approach

Pushpalatha et al. detailed both traditional and modified methods for preparing Arjunarishta. The process involves boiling 3 kg of Arjuna twak churna, 1.5 kg of pounded draksha, and 600 g of powdered Madhuka puspa in a 40L stainless steel vessel until reduced to a quarter of its volume. The warm kwatha is then filtered, yielding 6.07L of liquid and 3,070g of residue. For Arjunarishta with guda, 3L of warm kwatha is mixed with 1.5 kg of powdered guda and 300g of Dhatakibuspa, then fermented in a pre-treated vessel. After fermentation, the vessel is sealed and kept in a temperature-controlled husk box. For the Godhuma variant, 750g of Godhuma flour replaces guda. The final yield was 96.66% (2.9L) for guda and 43.33% (1.3L) for Godhuma, with fermentation periods of 64 and 45 days, respectively. Analytical results showed desirable pH, alcohol content, and absence of methanol, ketones, and steroids in both samples. The study highlights Arjunarishta with Godhuma's low alcohol and sugar content, providing anti-hyperglycemic effects and cardiac benefits, making it a cost-effective herbal remedy for cardiovascular diseases and diabetes (Pushpalatha, et al., 2019).

In another study, two variations were tested including earthen vs. porcelain pots, and the addition or exclusion of Dhataki puspa. Fermentation began on the 4th day in all batches except one, with completion occurring between 12-18 days and maturation in 7-10 days, totaling 22-27 days. Arjunarishta made in porcelain pots had a higher yield than in earthen pots, with batches excluding Dhataki puspa producing even higher yields. The study found that Dhataki puspa did not contribute to fermentation and its presence may have reduced yield due to absorption. The earthen pot's greater porosity also contributed to lower yields by allowing more evaporation compared to the non-porous porcelain pot. Alcohol was generated naturally during fermentation, likely due to the transformation of phytochemicals in the herbs (Verma, et al., 2014).

Arjunarishta formulation has been enhanced through contemporary methodology, optimizing three key process parameters for maximum alcohol production using the Box–Behnken design of response surface methodology (RSM) with Design Expert software. The optimal conditions were identified as 33.33°C incubation temperature, pH 4.73, and 3.25 ml inoculum volume (4×10^7 yeast cells/ml), resulting in 7.68% alcohol production, detected via dichromate oxidation. Additionally, gallic acid was present in the optimized formulation at 0.296% (w/v), as identified by HPTLC. Implementing advanced formulation strategies through RSM not only optimized Arjunarishta production but also allowed for its preparation in any season, improving consistency and safety. Such advancements in traditional dosage forms may enhance the regulatory acceptance of complementary medicines (Sayyad, et al., 2016). Modern approach for the preparation of Arjunarishta using isolated fermentative microbes from *Woodfordia fruticosa* flowers was also evaluated and compared with the traditional method. In this approach, microbial colonies from Dhātākī flowers were isolated on Sabouraud dextrose media, suspended in sterile water, and aseptically added to a sterilized mixture of Arjunarishta ingredients. The formulation was incubated at 37°C for 20 days for optimal fermentation. Results showed that the alcohol content produced using this method was comparable to traditional processes but with enhanced control, preventing the growth of unwanted microbes and ensuring greater purity and safety (Randive, et al., 2016^b).

3. Qualitative Assessment and Standardisation

3.1 Organoleptic and Physicochemical study

Standardizing Ayurvedic formulations is crucial for ensuring quality. Six marketed brands of Arjunarishta were evaluated for organoleptic characteristics like color, odor, and taste while physicochemical parameters, including pH, refractive index, specific gravity, viscosity, density, surface tension, water-soluble and alcohol-soluble extractives, acid value, alcohol content, total solid content, and total phenol content. A TLC method was used to quantify gallic acid and ellagic acid. The evaluation revealed Dhootapeshwar Arishta had the highest pH at 5.152, while Arkashala Satara had the lowest at 3.52. Refractive indices ranged from 1.340 to 1.390, and viscosities varied between 1.436 cps and 2.926 cps. Total solid content ranged from 6.365% to 10.88%, with Dhootapeshwar showing the highest and Baidyanath the lowest. Total phenol content varied from 3.9% to 7.6%. TLC profiling showed Dabur with the 7 spots and Sandu with 4 spots, indicating content variability. Self-generated alcohol ranged from 5.2% to 11.2% v/v, with Baidyanath having the highest and Dhootapeshwar the lowest. Modern techniques and tools can aid in standardizing these formulations, reducing variability and enhancing global use (Randive, et al., 2016^a).

3.2 Analytical study

Preparation of Arjunarishta by using isolated microorganisms on the basis of their fermenting capabilities can help generate approximately same quantities of alcohol in formulation. Modern techniques utilizing these microorganisms from Dhātākī flowers yielded comparable alcohol levels to traditional methods. This approach provides uniformity in alcohol content, total phenol, and solid content, and delivers consistent results in both thin layer chromatography (TLC) and high-performance thin layer chromatography (HPTLC) for gallic acid. Additionally, the modern method effectively prevents the growth of unwanted microbes, leading to uniform extraction across batches and enhancing the overall quality of the product (Randive, et al., 2016^b). A High-Performance Thin Layer Chromatography (HPTLC) method was reported to quantify quercetin and rutin in Arjunarishta prepared by both traditional (Arjunarishta-T) and modern methods (Arjunarishta-M), as well as in its marketed formulation. The HPTLC method was validated for precision, accuracy, limit of detection (LOD), limit of quantification (LOQ), specificity, robustness, and ruggedness. The quercetin content in Arjunarishta-T, Arjunarishta-M, and the marketed formulation was determined to be 0.00260%, 0.00234%, and 0.00252% w/w, respectively, while rutin levels were found to be 0.00585%, 0.00553%, and 0.00568%

w/w, respectively (Tiwari and Patel, 2011). A similar HPTLC analysis was executed for gallic acid and ellagic acid. The amount of gallic acid in Arjunarishta-T, M and its marketed formulation was found to be 0.0332, 0.0331 and 0.0330% w/w respectively while ellagic acid was found to be 0.0361, 0.0360 and 0.0359% w/w respectively (Tiwari and Patel, 2012). In another one study, HPTLC method has been developed for the determination of catechin in Arjunarishta prepared by traditional in-house method and also in its marketed formulation (Mehta and Sud, 2020).

A High-Performance Liquid Chromatography with Photodiode Array detection (HPLC-PDA) method was established for standardizing Arjunarishta by quantifying key antioxidant compounds, including ellagic acid, gallic acid, ethyl gallate, quercetin, and kaempferol as markers. The method was validated for linearity, precision, accuracy, and robustness. The HPLC analysis revealed an increase in the levels of ellagic and gallic acids during preparation, comparing the decoction to the final formulation. (Lal, et al., 2009).

GC MS analysis of Arjunarishta revealed the presence of 49 compounds including glycerol tricaprilate, piperine and pyrazole derivatives (Sadhanandham, et al., 2015). In another one study with same technique revealed the presence of 30 different compounds in dichloromethane and ethyl acetate extract of Arjunarishta (Venkataramanan and Kamat, 2023). GC-MS analysis also revealed that the presence of compounds like 2,3-dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one and 4-ethyl-2-hydroxycyclopent-2-en-1-one (B.S., et al., 2017).

4. Pharmacological Study:

4.1 Cardiotoxic activity

The therapeutic effects of Modified Arjunarishta (MA) were evaluated in isoproterenol (IPN)-induced myocardial infarction (MI) in rats. Serum samples were analyzed for myocardium-expressed pro-inflammatory cytokines, while heart tissues were examined for calcium and lipid profiles. IPN-induced rats showed significantly elevated levels of cholesterol, triglycerides, free fatty acids, and calcium. MA treatment led to a notable reduction in these elevated levels across three different doses. Additionally, pro-inflammatory cytokines such as TNF- α , IL-6, IL-1 α , and IL-1 β were significantly reduced in MA-treated rats compared to the IPN group. These results highlight MA's effective therapeutic action against IPN-induced MI (Santoshkumar, et al., 2022).

4.2 Anti-hyperglycemic and anti-hyperlipidemic activity

Anti-hyperglycemic and anti-hyperlipidemic effect of Arjunarishta was studied on high-fat diet (HFD) fed animals. HFD elevated fasting blood glucose, liver triglycerides, systolic blood pressure, and gene expression of TNF- α , IRS-1, and PGC-1 α . Arjunarishta treatment significantly lowered fasting blood glucose, systolic blood pressure, total cholesterol, and triglycerides. Additionally, it reduced TNF- α expression while increasing IRS-1 and PGC-1 α levels compared to the untreated HFD group. These findings suggest that the anti-hyperglycemic and anti-hyperlipidemic effects of Arjunarishta may be linked to decreased TNF- α and enhanced IRS-1 and PGC-1 α activity (Shengule, et al., 2018).

4.3 Antihypertensive activity

A case study reported the antihypertensive efficacy of Arjunarishta in a 35-year-old patient. The patient had been asymptomatic for three years but began experiencing symptoms like headache, palpitations, chest tightness, acidic belching, sweating, and nausea over the past three months. The study concluded that Arjunarishta effectively manages high blood pressure without the harmful side effects associated with conventional drugs (Bhardwaj, 2021).

4.4 Antimicrobial activity

The antimicrobial properties of Arjunarishta, prepared with variations in pot material (earthen and porcelain) and the presence or absence of Dhataki flowers, were evaluated against *E. coli*, *Salmonella*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* using standard agar methods. The results demonstrated consistent antimicrobial activity across all variations, regardless of the preparation method (Verma, et al., 2014).

4.5 Colitis mitigation

The therapeutic potential of Arjunarishta (AA) was investigated in a Trinitrobenzenesulphonic acid (TNBS) induced colitis model. The activity was assessed through the Disease Activity Index (DAI), histological damage, pro-inflammatory cytokine/chemokine expression, and oxidative stress biomarkers. AA treatment significantly reduced colitis symptoms like weight loss, diarrhea, and blood in stool, while minimizing

histological damage. Pro-inflammatory markers (TNF- α , IL-1 β , IL-6) and MCP-1 were downregulated, and oxidative stress markers (NO, MPO, MDA) decreased, with an increase in antioxidant levels (CAT, SOD, GSH). Additionally, AA improved the gut microbiome and restored plasma zinc levels. These results suggest AA's therapeutic action is due to its anti-inflammatory, antioxidant, and microbiome-modulating effects (Cota, et al., 2020^a).

4.6 Anticancer activity

Arjunarishta was investigated for its potential in treating inflammatory bowel disease (IBD) and colorectal cancer. Cytotoxicity was assessed in human colorectal adenocarcinoma cells, while cytocompatibility was tested in normal rat intestinal epithelial (IEC-6) and mouse fibroblast (L929) cells. Oxidative stress was measured through lipid peroxidation biomarkers, showing dose-dependent effects across different cell lines. Malondialdehyde levels were significantly higher in Arjunarishta compared to controls. These results suggest Arjunarishta may offer therapeutic benefits for IBD and colorectal cancer, supported by its biological activity (Cota, et al., 2020^b).

4.7 Antioxidant activity

Arjunarishta can express antioxidant activity was evaluated by DPPH assay, ferric thiocyanate method and thiobarbituric acid test. Free radical scavenging activity of the formulation may be attributed to phenolic components available through fermentation process. There is almost 50% increase in free radical scavenging activity of the final prepared formulation compared to decoction (Lal, et al., 2009).

Conclusion:

In conclusion, this review highlights the significant potential of Arjunarishta, an Ayurvedic formulation, both in its traditional and modern adaptations. The traditional preparation methods, utilizing natural ingredients and fermentation processes, provide a robust foundation for the formulation, while modern advancements offer enhanced control and consistency in production. The integration of contemporary techniques, such as optimized fermentation conditions and the use of isolated fermentative microbes, has proven to elevate the quality and effectiveness of Arjunarishta. The formulation exhibits notable therapeutic benefits, including cardiogenic, anti-hyperglycemic, anti-hyperlipidemic, antihypertensive, antimicrobial, anti-inflammatory activities and antioxidant activity. These findings underscore the importance of bridging traditional practices with modern scientific validation to maximize the therapeutic potential and standardization of Ayurvedic remedies. Future research should focus on further refining these methods and exploring the broader clinical applications of Arjunarishta to solidify its place in integrative medicine.

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