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PHARMACEUTICO-ANALYTICAL STUDY OF ARJUNA GHRITA PREPAREDWITH MURCHITA AND AMURCHITA GOGHRITA

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ABSTRACT

Terminalia arjuna, commonly known as *Arjuna*, is a member of Combretaceae family. It is considered as a potential cardioprotective agent since the Vedic era. *Arjuna Ghrita* is a well-known ghee based Ayurvedic formulation. *Sneha Kalpana* can be defined as a pharmaceutical process to prepare oleaginous medicaments from the substances such as *Kalka*, *Kwatha* or *Drava Dravya* in specific proportion by subjecting it to unique heating pattern and duration to fulfil certain pharmaceutical parameters, according to the need of therapeutics. *Murchana* is a unique pharmaceutical procedure which has to be done before subjecting the drugs to *Sneha Paka*. It is considered as one of *Samskaras* of *Sneha* and aids in the acquisition of particular pharmacological as well as therapeutic properties. There is no record of any reference to *Sneha Murchana* in *Brihattrayee* and therefore canbe considered as a later development. In the present study, *Arjuna Ghrita* samples were prepared separately using*Murchita Ghrita* and plain ghee (Indian cow's ghee). Organoleptic characters (colour, odour, taste, texture and touch) and physicochemical parameters (acid value, peroxide value, iodine value, saponification value, refractive index and specific gravity) were determined for both the samples. The *Murchana* process was found to be beneficial towards quality of *Ghrita*. Decrease in acid value, peroxide value and free fatty acids indicates decrease in the degree of rancidity. *Murchana* process not only imparts good colour and odour but also minimises rancidity and increases the stability of the formulation.

KEYWORDS: *Goghrita*; *Murchana; Arjuna Ghrita.*

INTRODUCTION

Bhaishajya Kalpana is a unique branch of Ayurveda which deals with preparation of various formulations whichare used for therapeutic purposes. The term *Bhaishajya* means medicine or therapeutic remedy, while *Kalpana* refers to the process of preparation or formulation. Essentially, *Bhaishajya Kalpana* deals with the methods andtechniques involved in preparing medicines. *Sneha Kalpana* is an important dosage form in Ayurveda which includes *Ghrita Kalpana* and *Taila Kalpana*. It is a pharmaceutical process where the fat soluble as well as watersoluble active principles from the basic ingredients (*Kalka Dravya* and *Kwatha Dravya*) are extracted into the *Sneha*. The main advantage of *Sneha Kalpana* is its longer shelf life and versatile clinical use as these can be administered both internally as well as externally.

Murchana is a special pharmaceutical procedure mentioned in *Bhaishajya Ratnavali*. It is the first step to be adopted in any *Sneha Paka* process. This intermediate process in *Sneha Kalpana* not only enhances the potencyof the Sneha, but also removes *Amadosha* from the *Sneha* and increases it's *Veerya* as well.[1]

Arjuna Ghrita is a formulation mentioned in *Chakradatta Hridroga Chikitsa*[2] which contains only 2 ingredients, *Arjuna*[3] and *Goghrita*. It is used in the treatment of cardiac disorders. But *Acharya* Chakrapanidatta has not mentioned about *Murchana* process while describing this formulation. It is the need of the present era to understand the effect of *Murchana* using standardised physico-chemical parameters to ensure the quality of *Ghritas* and *Tailas*. In the present study, an attempt was made to study the effect of *Murchana* processes by evaluating the organoleptic and physicochemical parameters of *Arjuna Ghrita* prepared with *Murchita Goghrita*and *Arjuna Ghrita* prepared with *Amurchita Goghrita*.

AIMS AND OBJECTIVES

- To prepare *Murchita Ghrita* as per classical method.
- To prepare *Arjuna Ghrita* using *Murchita Ghrita* and *Amurchita Ghrita.*
- To carry out physicochemical analysis of both the samples.
- To compare the analytical parameters of *Arjuna Ghrita* prepared with *Murchita Goghrita* and *ArjunaGhrita* prepared with *Amurchita Goghrita*.

MATERIALS AND METHODS

Pharmaceutical study

The raw materials were collected from Alva's pharmacy Mijar. *Goghrita* satisfying the quality parameters werecollected from the local market of Moodbidire. All the raw drugs were identified as genuine by experts from P.G. Department of Dravyaguna Vijnana, Alva's Ayurveda Medical College, Moodbidire. Pharmaceutical study was carried out in the Laboratory of P.G. Department of Rasashastra and Bhaishajya Kalpana, Alva's Ayurveda Medical College, Moodbidire. Two samples of *Arjuna Ghrita* were prepared, one with *Murchita Goghrita* (Sample 1) and the other with *Amurchita Goghrita* (Sample 2) and were compared to find out the effect of *Murchana* process.

Preparation of *arjuna ghrita* using *murchita goghrita*

Preparation of *Arjuna Ghrita* with *Murchita Ghrita* includes the following steps

- *Ghrita Murchana*
- Preparation of *Arjuna Kashaya*
- Preparation of *Arjuna Kalka*
- *Ghrita Paka* using *Murchita Ghrita*

Ghrita murchana

The raw materials for *Ghrita Murchana* i.e. *Haritaki* (*Terminalia chebula* Retz.),[4] *Vibhitaki* (*Terminalia bellirica* Roxb.),[5] *Amalaki* (*Emblica officinalis* Gaertn.),[6] *Musta* (*Cyperus rotundus* Linn.)[7] and *Haridra* (*Curcuma longa* Linn.)[8] were washed thoroughly, dried and powdered using a pulverizer and passed through sieve number 85. These ingredients, each 48g, were taken and made into a bolus by grinding in a mortar and pestle after mixing with 48ml of *Matulunga* (*Citrus medica* Linn.)[9] *Swarasa.*768ml of *Goghrita* was taken in a wide mouthed stainless-steel vessel and heated over mild fire. The prepared *Kalka* was added to the *Ghrita* followed by addition of 768ml of water. The mixture was stirred continuously to prevent *Kalka* from getting charred or adhering to thebottom of the vessel. The process was continued till the attainment of *Madhyamapaka Siddhi Lakshana*. After confirming *Sneha Siddhi Lakshanas*[10] the stove was turned off and the *Murchita Ghrita* was filtered through a clean cloth.

Date of commencement: 19/03/2024

Date of completion: 20/03/2024

Equipments and instruments: Wide mouthed stainless-steel vessel, spatula with long handle,

weighing machine, measuring jars, steel plates and spoon and clean cloth for filtering.

Table No. 1: Ingredients and quantity of ingredients for *ghrita murchana.*

Sl. No.	Drug	Botanical Name	Family	Part Used	Quantity
1.	*Haritaki*	*Terminalia chebula* Retz.	Combretaceae	Pericarp of	48g
2.	*Vibhitaki*	*Terminalia belerica* Roxb.	Combretaceae	Fruit	48g
3.	*Amalaki*	*Emblica officinalis* Gaertn.	Euphorbiaceae	Fruit	48g
4.	*Musta*	*Cyperus rotundus* Linn.	Cyperaceae	Tuber	48g
5.	*Haridra*	*Curcuma longa* Linn.	Zingiberaceae	Rhizome	48g
6.	*Matulunga*	*Citrus medica* Linn.	Rutacea	Fruit	48g
7.	*Goghrita*	-	-	-	768ml
8.	*Jala*	-	-	-	768ml

Observations during various stages of *Ghrita Murchana*

Day 1-19/03/2024

10 am: *Ghrita* was added to the stainless-steel vessel kept over mild fire.

10.10 am: The temperature of *Ghrita* was 50^0C. *Kalka* was added followed by addition of water.

10.35 am: *Ghrita* started boiling and the temperature was 110^0C.

11.45 am: *Ghrita* had reached *Amapaka* stage and the temperature was 125^0C. At this stage *Kalka* got completely mixed with *Ghrita*. The stove was turned off and the vessel was covered with a clean cloth and kept overnight.

Day 2-20/03/2024

9.30 am: *Ghrita Paka* restarted.

10.50 am: *Ghrita* started separating from *Kalka*, temperature was 125^0C. The *Ghrita* had reached to *Mridu Paka.*

12.20 pm: *Phenasanti* was observed. Dark yellow coloured *Ghrita* was completely separated from *Kalka* and temperature was 126^0C.

Initial quantity of Ghee taken: 768ml

Final product obtained: 680ml

Table No. 2: Ingredients for preparation of *Arjuna Ghrita.*

Sl. No.	Drug	Botanical Name	Family	Part Used	Quantity
1.	*Arjuna Kalka*	*Terminalia arjuna* Roxb	Combretaceae	Bark	150g
2.	*Goghrita*	-	-		600ml
3.	*Arjuna Kashaya*	*Terminalia arjuna* Roxb	Combretaceae	Bark	2400ml

Preparation of *arjuna kashaya*

1200g of *Arjuna* Bark was taken, washed thoroughly and crushed in a clean *Khalwa Yantra* to obtain coarse powder. This coarse powder of *Arjuna Twak* was transferred to a stainless-steel vessel added with 9600ml of water and was mixed uniformly with a spatula. This vessel was then kept over gas stove and moderate heat was given. When the mixture started boiling, it was stirred occasionally with the spatula to prevent charring of the drug material. When the water content was reduced to 1/8th of the initial quantity, ie, 2400ml, the vessel was taken from stove, and the *Kashaya* obtained was filtered through a clean cloth.

Observations during preparation of *kashaya*

20/03/2024

9 am: *Arjuna Twak* was added with 8 times water and kept for boiling.

9.35 am: Boiling started and the colour of the water became light brown.

10.15 am: The colour has turned into reddish brown.

12.50 pm: The *Kashaya* had reduced to 1/8 of the initial quantity, the stove was turned off, and the obtained *Kashaya* was filtered through a clean cloth and measured. The colour of *Kashaya* was reddish brown, taste was bitter with slight astringent.

Preparation of *Kalka*

Fresh bark of *Arjuna* was taken in required quantity, washed to remove impurities and dirt. It was then crushedin a clean *Khalwa Yantra* and the *Kalka* was made by adding water.

Observations during preparation of *Kalka*

Arjuna Twak Kalka was brown in colour with a characteristic smell and bitter taste.

Ghrita Paka* using *Murchita Ghrita

600ml of *Murchita Ghrita* was taken in a stainless-steel vessel placed over mild fire. The prepared *Kalka* (150g) was added to it followed by addition of the prepared *Kashaya* (2400ml). *Ghrita* was stirred continuously to prevent adhesion of *Kalka* to the bottom of the vessel and charring. *Sneha Paka* was continued till the appearanceof *Madhyama Paka Siddhi Lakshanas.* After attaining *Sneha Siddhi Lakshanas* which was assessed by different confirmatory tests, i.e. *Varti Pareeksha* (Formation of vick when *Kalka* is rolled between thumb and index finger), *Agni Pareeksha* and the fire was turned off. The prepared *Ghrita* was filtered immediately through a clean clothand was stored in an airtight container.

Day 1-20/03/2024

1.30 pm: *Murchita Ghrita* was poured to a vessel placed over mild fire.

1.40 pm: *Arjuna Kalka* was added to the *Ghrita.*

1.45 pm: *Arjuna Kashaya* was added to the vessel containing *Ghrita* and *Kalka.*

2.07 pm: The mixture started boiling and the temperature was 112^{0}C. The colour of the mixture became reddish brown.

2.45 pm: The stove was turned off and the mixture was kept overnight.

Day 2-21/03/2024

9.30 am: Boiling of *Ghrita* was observed and the temperature was 116^{0}C.

10.45 am: *Kalka* became thick and the temperature was 132^{0}C. The stovewas turned off and the mixture was kept overnight.

Day 3-22/03/2024

9.30 am: Boiling of *Ghrita* started.

10.45 am: *Kalka* became thick and started sticking to the vessel. The mixture became sludge like. Continuous stirring was done toprevent adhesion to the bottom of the vessel.

11.30 am: *Kalka* started separating from *Ghrita*, stirring was continued toprevent charring.

12.30 pm: Yellow coloured *Ghrita* was separated out from dark brown *Kalka*. *Phenasanti* was observed. *Sneha siddhi lakshanas* were observed and confirmed. Temperature was 145^{0}C.

Initial quantity of Ghee: 600ml

Final product obtained: 560ml

Preparation of *Arjuna Ghrita* with *Amurchita Goghrita*

600ml of *Amurchita Goghrita* was taken in a stainless-steel vessel placed over mild fire. To this, 150g of *Kalka* was added to it followed by addition of the prepared *Kashaya* (2400ml). The *Ghrita* was stirred continuously to prevent sticking of *Kalka* to the bottom of the vessel and charring. *Sneha Paka* was continued till the appearance of *Madhyama Paka Siddhi Lakshanas.* After attaining *Sneha Siddhi Lakshanas* which was assessed by different confirmatory tests, the fire was turned off. The prepared *Ghrita* was filtered immediately through a clean cloth and was stored in an airtight container.

Day 1 -20/03/2024

1.30 pm: *Amurchita Ghrita* was poured to a vessel placed over mild fire.

1.40 pm: *Arjuna Kalka* was added to the *Ghrita.*

1.45 pm: *Arjuna Kashaya* was added to the vessel containing *Ghrita* and *Kalka.*

2.10 pm: The mixture started boiling and the temperature was 114^{0}C. The colour of the mixture became reddish brown.

2.45 pm: The stove was turned off and the mixture was kept overnight.

Day 2-21/03/2024

9.30 am: Boiling of *Ghrita* was observed and the temperature was 115^{0}C.

11 am: *Kalka* became thick and the temperature was 136^{0}C. The stove was turned off and the mixture was kept overnight.

Day 3 -22/03/2024

9.45 am: Boiling of *Ghrita* started.

10.55 am: *Kalka* became thick and started sticking to the vessel. The mixture became sludge like. Continuous stirring was done toprevent adhesion to the bottom of the vessel.

11.50 am: *Kalka* started separating from *Ghrita*, stirring was continued toprevent charring.

12.55 pm: Yellow coloured *Ghrita* was separated out from dark brown *Kalka*. *Phenasanti* was observed. *Sneha siddhi lakshanas* were observed and confirmed. Temperature was 148^{0}C.

Initial quantity of Ghee taken for *Paka*: 600ml

Final product obtained: 540ml

RESULTS

Table No. 3: Organoleptic characters of *Arjuna Ghrita* with *Murchita Ghrita* and *Arjuna Ghrita* with *Amurchita Ghrita.*

Parameter	***Arjuna Ghrita* with *Murchita Ghrita***	***Arjuna Ghrita* with *Amurchita Ghrita***
Colour	Dark yellow	Yellow
Taste	Bitter	Bitter
Odour	Characteristic odour	Characteristic odour
Consistency	Unctuous liquid	Unctuous liquid

Table No. 4: Results of analytical study.

Parameter	***Arjuna Ghrita* with *Murchita Ghrita***	***Arjuna Ghrita* with *Amurchita Ghrita***
Iodine value	33.27	33.54
Saponification value	216.57	241.24
Acid value	0.90	1.24
Peroxide value	0.52	0.80

Specific gravity	0.9148	0.9150
Refractive index at 25^{0}C	1.4575	1.4570
Free fatty acid	0.45	0.62
Solubility	Not soluble in water	Not soluble in water
Rancidity	Absent	Absent

DISCUSSION

Preparation of *murchita ghrita*

For preparation of *Murchita Ghrita,* cow's ghee fulfilling the quality parameters was procured from the local market of Mudbidire. It was light yellow in colour with characteristic smell of ghee. *Ghrita Murchana* was done according to the classical reference mentioned in the textbook *Bhaishajya Ratnavali*. The plain *Ghrita* used for *Murchana* was light yellow in colour, but the *Murchita Ghrita* was greenish yellow in colour with an aromatic odour. The characteristic colour and odour of *Murchita Ghrita* was due to the ingredients like *Haridra* and *Matulunga* used for *Ghrita Murchana*. The process was completed in two days as mentioned in the classics. The temperature at which *Madhyama Paka* was obtained is 126^{0}C and the time taken to do *Murchana* of 768ml of *Ghrita* is 4hrs 35minutes.

Preparation of *Arjuna Ghrita* using *Murchita Ghrita* and *Amurchita Goghrita*

The pharmaceutical processing of *Arjuna Ghrita* was carried out according to *Sneha Paka Vidhi* mentioned by *Acharya Sharangadhara*.

Fresh bark of *Arjuna* was made into *Kalka*. 150g of *Kalka* was prepared. *Arjuna Twak Kalka* was dark brown in colour with a characteristic smell. The *Kalka* seemed to be bulky as the bark of *Arjuna* was hard. *Arjuna Kashaya* was used as *Dravadravya*. *Kashaya* was prepared by classical method of preparation. The colour of *Kashaya* was reddish brown and the taste was bitter with slight astringent taste. The time taken for the preparation of 2.4L of *Kashaya* was 3 hours 50 minutes. As *Kashaya* being the only liquid use *Snehapaka* was carried out for 3 days soas to facilitate maximum extraction of active principles.

Arjuna Ghrita was prepared by boiling 1 part of *Arjuna Twak Kalka*, 4 parts of *Goghrita* and 16 parts of *ArjunaKashaya* till the appearance of *Madhyama Paka Siddhi Lakshanas*.

Madhyamagni was maintained throughout the procedure to prevent ghee from reaching its smoke point. Heating at constant temperature for a specific duration of time helps in evaporation of water molecules and transfer of liquid soluble active principles from *Kalka* and *Dravadravya* to *Ghrita*.

The average temperature at which *Madhyama Paka* was obtained in *Arjuna Ghrita* prepared with *Murchita Ghrita* was 140-148^{0}C which was more in comparison to the temperature obtained during the preparation of *Arjuna Ghrita* with *Amurchita Goghrita*. This might be due to the difference in time taken for both the process. The time taken for the preparation of *Arjuna Ghrita* with *Murchita Ghrita* is 5 hours 45 minutes and the time taken for preparation of *Arjuna Ghrita* with *Amurchita Goghrita* is 6 hours 10 minutes. Heating of *Ghrita* during *Murchana* process causes complete evaporation of moisture contents from the *Ghrita* which may lead to reduction in time taken for preparation.

The organoleptic characters are evaluated immediately after the preparation as the taste and odour are best perceived when the sample is warm.

Arjuna Ghrita prepared with *Murchita Ghrita* was dark yellow in colour and *Arjuna Ghrita* prepared with *Amurchita Ghrita* was yellow in colour. The cow's ghee contains carotenoids which are responsible for its golden yellow colour. Colour of *Ghrita* preparations depends on the temperature given during processing, duration of heating, nature of the herbal ingredients used in the formulation which in turn lead to the degradation of carotenoids and other pigments in ghee.

The presence of *Haridra* and other *Murchana* drugs are responsible for the dark yellow colour of *Arjuna Ghrita* prepared with *Murchita Ghrita*. The characteristic smell of the samples might be due to the presence of various phytoconstituents present in the ingredients used for the preparation.

Iodine value

Iodine value is used to determine the degree of unsaturation in fatty acids. Higher the iodine value, more will be the unsaturated fatty acids. The formulation with higher iodine value is more reactive, less stable and more susceptible to oxidation. The Iodine value of *Arjuna Ghrita* prepared with *Murchita Ghrita* is 33.27 and *Arjuna Ghrita* prepared with *Amurchita Ghrita* is 33.54. Decrease in Iodine value after *Murchana* decreases the chance of rancidity and thereby increases the stability of the formulation.

Saponification value

Saponification value is the measure of average molecular weight or chain length of all the fatty acids present in the formulation. More the carboxylic functional group, more will be the

chances of rancidity and less will be theshelf life. The saponification value of *Arjuna Ghrita* prepared with *Murchita Ghrita* is 216.57 whereas *Arjuna Ghrita* prepared with *Amurchita Ghrita* is 241.24. This indicates the presence of medium chain fatty acids in both the formulations.

Acid value

The acid value is a measure of the amount of carboxylic acid groups in a chemical compound. As oils and fats rancidify, triglycerides are converted into fatty acid and glycerol, causing an increase in acid number. Less acid value indicates less chance of decomposition of Ghrita which in turn increases the shelf-life and therapeutic value of the formulation. The acid value of *Arjuna Ghrita* prepared with *Murchita Ghrita* is 0.90 and *Arjuna Ghrita* prepared with *Amurchita Ghrita* is 1.24. The reduced value indicates the good quality of the drug.

Peroxide value

Peroxide Value indicates the degree of rancidification of fats and oils. Peroxide value is associated with the development of peroxides in unsaturated fat, resulted from the breakage of double bonds which produces short chain volatile products responsible for the rancid odour. The peroxide value of *Arjuna Ghrita* prepared with *Murchita Ghrita* is 0.52 and *Arjuna Ghrita* prepared with *Amurchita Ghrita* is 0.80. The values indicate that *Arjuna Ghrita* prepared with *Murchita Ghrita* is more stable than *Arjuna Ghrita* prepared with *Amurchita Ghrita.*

Specific gravity

Specific gravity is the measure of density of an object in comparison to the density of water at same temperatureand pressure. The specific gravity of *Arjuna Ghrita* prepared with *Murchita Ghrita* is 0.9148 and *Arjuna Ghrita* prepared with *Amurchita Ghrita* is 0.9150. This slight difference in density may be due to the *Murchana* processwhich results in better dissolution of the bioconstituents of *Ghrita*.

Refractive index

The refractive index of a medium is a measure of the bending of a ray of light when passing from one medium into another. It is the ratio of the velocity of light in a vacuum to its velocity in the substance or medium. Refractive index is a fundamental physical property of a substance often used to identify a particular substance, confirm its purity, or measure its concentration. Most commonly it is used to measure the concentration of a solute in an

aqueous solution. Refractive index of Arjuna Ghrita prepared with *Murchita Ghrita* is 1.4575 and Arjuna Ghrita prepared with *Amurchita Ghrita* 1.4570. This indicates that both the formulations are denser thanair.

Free fatty acids

Free fatty acids refers to a small portion fatty acids that are not esterified in triglycerides. The FFA content of ghee depends on the method of preparation of ghee, the temperature given and the residual moisture content. Presence of moisture accelerates the hydrolysis of fats and thereby release Free Fatty Acids. (According to FSSAI rules, maximum limit of FFA is 3%).[11] The FFA value of *Arjuna Ghrita* prepared with *Murchita Ghrita* is 0.45 and *Arjuna Ghrita* prepared with *Amurchita Ghrita* is 0.62. Lower the FFA value, better the shelf life of the *Ghrita* and better the stability.

Solubility

It is one of the parameters used to judge the purity and percentage composition of *Ghrita*. Both the samples wereinsoluble in water indicative of good quality of *Ghrita*.

Rancidity

Rancidification is the decomposition of fats, oils and other lipids by hydrolysis or oxidation, or both. Fats and oils are composed of triglycerides, which consist of three fatty acid molecules bound to a glycerol molecule. Rancidity is absent in both the samples of *Arjuna Ghrita* This indicates that both the formulations are within pharmacopeial standards.

CONCLUSION

Ghrita Kalpana is a unique lipid based preparation in which *Ghrita* is boiled with *Kalka* (paste of drugs) and *Dravadravya* (liquid media) which facilitates the transfer of lipid soluble active ingredients from *Kalka* and *Dravadravya* to *Ghrita*.

Even though the procedure of *Murchana* is not mentioned in *Bruhatrayees*, textbooks like *Bhaishajya Ratnavali* explains the importance of *Murchana*, which makes the need of *Sneha Murchana* still debatable.

In the present study, it is noted that *Sneha Siddhi Lakshanas* occurred earlier in *Arjuna Ghrita* prepared using *Murchita Ghrita* than that prepared with *Amurchita Ghrita*.

Difference in physico-chemical parameters were also observed. Decrease in acid value,

peroxide value, saponification value and free fatty acids indicates reduced oxidation rate in *Arjuna Ghrita* prepared with *Murchita Ghrita* than *Arjuna Ghrita* prepared with *Amurchita Ghrita*. *Murchana* herbs are rich sources of polyphenolic compounds such as gallic acid, chebulinic acid, ellagic acid, flavonoids and tannins, hence helps in protection against oxidative damage. *Murchana* not only imparts good colour and good odour to the *Ghrita*, it also helps inpreventing the *Ghrita* from oxidation and thereby increasing its shelf life.

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