ORIGINAL ARTICLE

# Quality assessment of *Yashtimadhukadi taila*: Ayurveda remedy for *Khalitya* (hair fall)

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## Abstract

**Introduction:** Hair fall is a physiological phenomenon, generally, after the mid-forties, but it is considered as a disease if it occurs before this period. *Ayurveda* texts describe hair fall under *Shirogata rogas* (diseases of head) under the broad heading of *Khalitya*. *Yashtimadhukadi taila* has been described in *Chakradatta* to be used in *Khalitya* (hair fall) and *Palitya* (graying of hair) as a nasal administration medicine. In the present study, attempt has been made to assess the quality of *Yashtimadhukadi taila* and to establish the quality control standards for the same. **Materials and Methods:** Organoleptic properties (color, smell, appearance, and taste) and physicochemical parameters (specific gravity, saponification value, unsaponifiable matter, refractive index, relative density, viscosity, mineral oil, free fatty acids, rancidity, acid value, and iodine value) were determined to assess the quality of this oil using standard protocols. Thin-layer chromatography (TLC) fingerprint was developed for oil using toluene:ethyl acetate:hexane:chloroform in a ratio of 4:2:1:3. **Results:** *Yashtimadhukadi taila* appeared to be brownish black viscous oil with characteristic sesame oil odor and bitter taste. In addition, saponification value (mg/g) was 456.65, unsaponifiable matter (%) was 24.32%, viscosity (cPA) was 27.98, acid value (%) was 11.6127, and iodine value ($I_2$ 100/g) was 102.34, respectively. TLC fingerprint profile consists of 4 prominent spots under UV light. **Conclusion:** The present study reveals the quality of *Yashtimadhukadi taila* for the first time.

**Key words:** Physicochemical parameters, quality control, thin-layer chromatography, *Yashtimadhukadi taila*

## INTRODUCTION

God while creating human being has given esthetic touch so that his creation could look beautiful and attractive and so were added "Hairs of the scalp" as an additive factor of personality. Beautiful, long and attractive hairs of the scalp add plus factor to the personality. In addition, healthy looking hair is, in general, a sign of good health and good hair-care practices.

World today has a race for cosmetics. Changed lifestyle or more specifically indifferent dietary habits have resulted the hairs either turn gray at prematurity or to fall down in young age. Universally, this is an extremely common disorder that affects roughly 50% of men and perhaps as many women older than 40 years.[1] As many as 13% of premenopausal women reportedly have some evidences of androgenic alopecia.[2] However, the incidence increases greatly in women following menopause, and according to some authors, it may affect 75% of women older than 65 years.[2]

Market today is loaded with the claims to provide solutions in the form of different types of oil (chemical oils), shampoos, soaps, and many other cosmetic products in the name of *Saundarya prasadhana* (beauty enhancers) to promote the growth of hairs which, in turn, has made the condition worse.

*Ayurveda* is the science, more than 3000 years old and has been adopting healing traditional method in ancient Indian culture. *Ayurveda* being a holistic science has given rich guidance regarding the *Dincharya*[3] (daily regimen for health) and *Ritucharya*[4] (season regimens for healthy being). *Abhyanga* (head massage), *Murdha taila* (Oilation of scalp), and *Nasya* (nasal administration of medicines) are some of the routine procedures told in the text for the maintenance of skin and hair.

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*Nasya*[5] has been practically one of the most preferred choices for the management of *Khalitya* for its prime role in maintaining hair growth and preventing *Khalitya*. If *Nasya* is done with the *Taila* (oil) which is medicated by *Keshya dravya* (hair growing promoting drugs), more efficacy can be obtained for this rapidly growing problem. Considering all the above facts and challenges in the beauty industry, it has been thought to have a revalidation regarding the *Yashtimadhukadi taila* (as told in *Chakradatta*)[6] as an effective therapy, which has been claimed in *Chakradatta* to possess a definite curative effect and also as a preventive remedy on this worldwide problem. In the present investigation, an attempt was made to assess the quality of the *Yashtimadhukadi Taila* using standard protocols.

## MATERIALS AND METHODS

Pharmacognostically original and authentic ingredients were used for the preparation of *Yashtimadhukadi Taila.* All the constituents including raw drugs (both *Yashtimadhu* and *Amlaki*) were also procured from Jaipur drug market and were authenticated for their botanical identity from Raw Material Herbarium and Museum, Delhi (RHMD), National Institute of Science Communication And Information Resources (NISCAIR), Delhi. *Glycyrrhiza glabra* L. was authenticated under the reference number NISCAIR/RHMD/Consult/2017/3131-80-1 and *Emblica officinalis* Gaertn. was authenticated under the reference number NISCAIR/RHMD/Consult/2017/3131-80-2.

### Preparation of the Drug

*Yashtimadhukadi taila* is one of the medicated oils consists of 4 ingredients [Table 1] prescribed in *Chakradutta* as a remedy for hair fall.

*Yashtimadhukadi taila* was prepared in Pharmacy of National Institute of Ayurveda Jaipur, following the guidelines as given in Ayurvedic Formulary of India.[7]

### Evaluation of Organoleptic Properties and Physicochemical Parameters

Organoleptic properties (color, odor, appearance, and taste), and physicochemical parameters (specific gravity, saponification value, unsaponifiable matter, refractive index, relative density, viscosity, mineral oil, free fatty acids, rancidity, acid value, and iodine value), and thin-layer chromatography (TLC) were determined in *Yashtimadhukadi taila* according to the standard protocols.[8]

### Chromatography[8]

TLC is a tool for separation and identification of chemical constituent. TLC is a technique in which a solute undergoes distribution between two phases, a stationary phase acting through adsorption and a mobile phase in the form of a liquid. The adsorbent is a relatively thin, uniform layer of dry finely powdered material applied to a glass, plastic or metal sheet or plate. Glass plates are most commonly used. Separation may also be achieved on the basis of partition or a combination of partition and adsorption, depending on the particular type of support, its preparation and its use with a different solvent.

**Table 1:** Ingredients of *Yashtimadhukadi taila*

| Name of the constituent | Botanical identity | Part used |
|---|---|---|
| *Yashtimadhu* | *Glycyrrhiza glabra* L. | Root |
| *Amlaki* | *Emblica officinalis* Gaertn. | Fruit |
| *Tila Taila* | *Sesamum indicum* L. | Oil |
| *Godugdha* | Cow's milk | Milk |

Identification can be effected by observation of spots of identical Rf value and about equal magnitude obtained, respectively, with an unknown and a reference sample chromatographed on the same plate. A visual comparison of the size and intensity of the spots usually serves for semi-quantitative estimation.

### Chromatography Plates

TLC plate coated with 0.25 mm layer of silica gel 60 $F_{254}$ with fluorescent indicator was used (Each plate dimension is 10 cm long and 2 cm width).

### Activation of Pre-Coated Silica Gel 60 $F_{254}$

Plates were dried in a hot oven at 105°C for 1 and ½ h.

### Preparation of Mobile Solution (constituents of mobile solution)

#### *Yashtimadhukadi taila*

Toluene: Ethyl Acetate: hexane: Chloroform (4:2:1:3)

### Sample Application

Sample was applied with the help of capillary 1(one) cm above the base of TLC plate. Then, it was dipped in the mobile solution. TLC plate was removed from the mobile solution immediately after the spot reached the 1 cm below the top of the TLC plate.

### Visualization

The plate was sprayed with p-Anashaldehyde sulfuric acid reagent and heated at 105° for 5–10 min. Rf value and color of the resolved bands are recorded.

### Rf Value

Measured and recorded the distance of each spot from the point of its application and calculated Rf value by dividing the distance traveled by the spots by the distance traveled by the front of the mobile phase.

Calculation of Rf Value

$$Rf = \frac{\text{Distance travelled by solute from origin line}}{\text{Distance travelled by solvent from origin line}}$$

### Determination of Weight per Milliliter and Specific Gravity[9]

#### *Weight per milliliter*

The weight per milliliter of a liquid is the weight in g of 1 ml of a liquid when weighed in air at 25°, unless otherwise specified. It is expressed in g/L.

#### *Specific gravity[9]*

The specific gravity of a liquid is the weight of a given volume of the liquid at 25° (unless otherwise specified) compared with the weight of an equal volume of water at the same temperature, all weighings being taken in air. It can be expressed in kilograms per meter cubed ($kg/m^3$)

### Determination of Refractive Index[10]

The refractive index (n) of a substance with reference to air is the ratio of the sine of the angle of incidence to the sine of the angle of refraction of a beam of light passing from air into the substance. It varies with the wavelength of the light used in its measurement. Unless otherwise prescribed, the refractive index is measured at 25°(±0.5) meters per second with reference to the wavelength of the D line of sodium (=589.3 nm). The temperature should be carefully adjusted and maintained since the refractive index varies significantly with temperature.

The Abbe refractometer is convenient for most measurements of refractive index, but other refractometer of equal or greater accuracy may be used. Commercial refractometers are normally constructed for use with white light but are calibrated to give the refractive index in terms of the D line of sodium light.

### Determination of Saponification Value[11]

The saponification value is the number of mg of potassium hydroxide required to neutralize the fatty acids, resulting from the complete hydrolysis of 1 g of the oil or fat, when determined by the prescribed method.

### Determination of Iodine Value[12]

The iodine value of a substance is the weight of iodine absorbed by 100 part by weight of the substance when determined by one of the following methods:-

#### *Apparatus*

Iodine Flasks - The iodine flasks have a nominal capacity of 250 ml.

#### *Reagent*

Iodine monochloride solution - The solution may be prepared by either of the two following methods:

1. Dissolve 13 g of iodine in a mixture of 300 ml of carbon tetrachloride and 700 ml of glacial acetic acid. To 20 ml of this solution, add 15 ml of a solution of potassium iodide and 100 ml of water, and titrate the solution with 0.1 N sodium thiosulfate. Pass chlorine, washed and dried, through the remainder of the iodine solution until the amount of 0.1 N sodium thiosulfate required for the titration is approximately, but more than, doubled.
2. Iodine trichloride 8 g, Iodine 9 g, carbon tetrachloride 300 ml, glacial acetic acid, and sufficient to produce 1000 ml. Dissolve the iodine trichloride in about 200 ml of glacial acetic acid, dissolve the iodine in the carbon tetrachloride, mix the two solutions, and add sufficient glacial acetic acid to produce 1000 ml/ iodine monochloride solution should be kept in a stoppered bottle, protected from light and stored in a cool place.

#### *Reagent*

Pyridine bromide solution - Dissolve 8 g pyridine and 10 g of sulfuric acid in 20 ml of glacial acetic acid, keeping the mixture cool. Add 8 g of bromine dissolved in 20 ml of glacial acetic acid and dilute to 100 ml with glacial acetic acid. Pyridine bromide solution should be freshly prepared.

### Determination of Acid Value[13]

The acid value is the number of mg potassium hydroxide required to neutralize the free acid in 1 g of the substance when determined by the prescribed method.

### Determination of Unsaponifiable Matter[14]

The unsaponifiable matter consists of substances present in oils and fats, which are not saponifiable by alkali hydroxides and are determined by extraction with an organic solvent of a solution of the saponified substance being examined.

### Detection of Mineral Oil (Holde's Test)[13]

Take 22 ml of the Alcoholic KOH solution in a conical flask and add 1 ml of the sample of oil to be tested. Boil in a water bath using air or water cooled condenser until the solution becomes clear, and no oily drops are found on the sides of the flask. Take out the flask from the water bath, transfer the contents to a wide-mouthed warm test tube and carefully add 25 ml of boiling distilled water along the side of the test tube. Continue shaking the tube lightly from side to side during the addition. The turbidity indicates the presence of mineral oil, the depth of turbidity depends on the percentage of mineral oil present.

### Rancidity Test (Kreis Test)

The test depends on the formation of red color when oxidized fat is treated with conc. HCl and a solution of phloroglucinol in the ether. The compound in rancid fats responsible for the color reaction is epihydrin aldehyde. All oxidized fats respond to the Kreis test, and the intensity of the color produced is roughly proportional to the degree of oxidative rancidity.

### Determination of Viscosity[15]

Viscosity is a property of a liquid, which is closely related to the resistance to flow. In C.G.S. (Centimeter–gram–second) system, the dynamic viscosity (n) of a liquid is the tangential force in dryness per square centimeter exerted in either of the two parallel planes placed, 1 cm apart when the space between them is filled with the fluid and one of the plane is moving in its own plane with a velocity of 1 cm per second relatively to the other. The unit of dynamic viscosity is the poise (abbreviated p). The centipoise (abbreviated cp) is 1/100$^{th}$ of one poise. While on the absolute scale, the viscosity is measured in poise or centipoise, it is not convenient to use the kinematic scale in which the units are stokes (abbreviated S) and centistokes (abbreviated CS). The centistokes are 1/100$^{th}$ of one stoke. The kinematic viscosity of a liquid is equal to the quotient of the dynamic viscosity and the density of the liquid at the same temperature, thus:

$$\text{Kinematic Viscosity} = \frac{\text{Dynamic Viscosity}}{\text{Density}}$$

Viscosity of liquid may be determined by any method that will measure the resistance to shear offered by the liquid. Absolute viscosity can be measured directly if accurate dimensions of the measuring instruments are known, but it is more common practice to calibrate the instrument with a liquid of known viscosity and to determine the viscosity of the unknown fluid by comparison with that of the known.

## OBSERVATIONS AND RESULTS

The organoleptic characters of *Yashtimadhukadi taila* are shown in Table 2, and physicochemical parameters of *Yashtimadhukadi taila* are shown in Table 3.

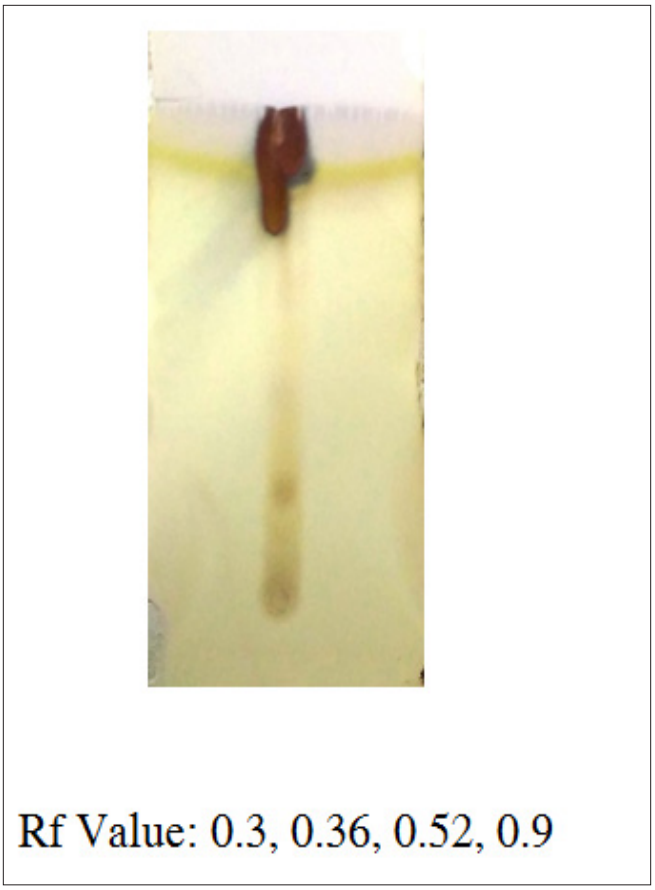


**Figure 1:** TLC of *Yashtimadhukadi taila*

Figure 1 shows TLC of *Yashtimadhukadi taila*

## DISCUSSION

Various parameters for analysis are available in Ayurvedic Pharmacopoeia of India, Protocol for Testing Ayurvedic, Siddha and Unani Medicines (PLIM), Laboratory guide for the analysis of *Ayurveda* and *siddha* formulations (CCRAS) for generating the identification tool and assessment of the quality of the herbal oil.

Organoleptic characteristics are the preliminary identification of *Yashtimadhukadi taila*. It was brownish black in color, characteristic and sesame oil such as odor, viscous in appearance, and bitter in taste.

Refractive Index, relative density, specific gravity, and viscosity are the tools for identification and assessment of quality and strength of the sample. Data obtained from refractive index are used to measure the concentration of a solute or access purity and strength of oil (R.I. 1.466$n_D$). Relative Density, Specific gravity, and Viscosity (0.92016 gm/ml, 0.90951, and 27.98 cPA, respectively) represent the physical nature of

**Table 2:** Organoleptic characteristics of *Yashtimadhukadi taila*

| Parameters | *Yashtimadhukadi taila* |
|---|---|
| Color | Brownish black |
| Odor | Characteristic sesame oil odor |
| Appearance | Viscous |
| Taste | Bitter |

**Table 3:** Physicochemical parameters of *Yashtimadhukadi taila*

| Tests | Value |
|---|---|
| Refractive Index nD | 1.466 |
| Relative density gm/ml | 0.92016 |
| Specific gravity | 0.90951 |
| Saponification value (mg/g) | 456.65 |
| Unsaponifiable Matter (%) | 24.32 |
| Viscosity (cPA) | 27.98 |
| Acid Value (%) | 11.6127 |
| Iodine Value ($I_2$ 100/g) | 102.34 |
| Free Fatty Acid (mg/g) | 5.8374 |
| Mineral oil | Absent |
| Rancidity | Absent |

liquid. It gives the proper identification of test sample.

Saponification value is the number of milligram of potassium hydroxide required for neutralizing the fatty acids.[16] It is a measure of the average molecular weight of all the fatty acid present. The long chain fatty acids found in fats have low saponification value because they have a relatively fewer number of carboxylic functional groups per unit mass of the fat as compared to short chain fatty acids.[17] In the present test sample, the slight deviation was observed with saponification value (456.65 mg/g).

Unsaponifiable matter includes those substances frequently found dissolved in fats and oil which cannot be saponified by the alkalies but is soluble in the ordinary solvent.[18] The value for unsaponifiable matter was 24.32%, which denotes that 24.32% of the matter present in *Yashtimadhukadi taila* was not saponified by the alkalies.

The acid value is the mass of potassium hydroxide in milligrams that are required to neutralize 1 gram of chemical substance. Acid value is used to quantify the amount of acid present in an oil sample.[19] Quantity of acid present in *Yashtimadhukadi taila is* 11.6127 % and that of free fatty acid present was obtained to be 5.8374%.

The iodine value is a measure of the degree of unsaturation in oil and can be used to quantify the amount of double bonds present in the oil which reflects the susceptibility of oil to oxidation.[20] According to the present study, an iodine value of *Yashtimadhukadi taila* was 102.34 $I_2$ 100/g.

*Yashtimadhukadi taila* is free from mineral oil. Mineral oil has common side effects such as burning, stinging, or redness of skin, thereby denoting the safety profile of the sample.

Deterioration in the fat or oil portion in *Yashtimadhukadi taila* is evaluated by Rancidity and the studied test sample is free from rancid material, thus denoting the good shelf life of the oil.

Four unknown chemical constituents were separated in TLC using mobile solution toluene:ethyl acetate:hexane:chloroform (4:2:1:3) and after using visualization p-anisaldehyde sulfuric acid reagent showed phenols, sugars, steroids, and terpenes visualization showing violet, blue, red, and gray color and had $R_f$ Value: 0.3, 0.36, 0.52, and 0.9.

## CONCLUSION

The quality control parameters resulted after a scientific evaluation of *Yashtimadhukadi taila* can be used as reference standard for quality control protocols to have a proper quality check over its preparation and processing. The present study reveals the quality of *Yashtimadhukadi taila* for the first time and the values thus obtained can be taken as a reference for further analysis of this oil preparation in further studies.

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