

Kalyanaka ghrita: an example of intertextuality among the *Bower* manuscript, *Charak samhita*, *Susruta samhita*, *Astangahrdayam samhita* and *Ayurvedic Formulary of India (AFI)*

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This critical and careful study aimed to gather information on the common formulation(s) found in the following ancient medical texts: the *Bower Manuscript* (*Bower Ms.*), *Charak Samhita* (*CS*), *Susruta Samhita* (*SS*), *Astangahrdayam Samhita* (*AHS*) and *Ayurvedic Formulary of India (AFI)*. We found that only one formulation, *Kalyanaka ghrita*, had the same formula in all the texts. *Kalyanaka ghrita* was prepared according to the formula provided in the *AFI* and in the ancient classical texts. The prepared *ghrita* was examined by high performance thin layer chromatography and then compared with commercial *Triphala Churna* with respect to chemical markers. We identified a connection among the *Bower Ms.*, *CS*, *SS*, *AHS* and *AFI*.

Keywords: *Bower Manuscript*, *Astangahrdayam samhita*, *Ayurvedic Formulary of India*, *Kalyanaka ghrita*, *Traditional medicines*, *Medical texts*

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Traditional system of medicine

According to the World Health Organization (WHO), "Traditional medicine is the sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness". Traditional use of herbal medicines is well established and normally considered to be safe and effective¹. Since ancient times, traditional knowledge about herbs has been a fundamental element of medication. *Charak Samhita* (*CS*)², *Susruta Samhita*, (*SS*)³ and *Astangahrdayam Samhita* (*AHS*)^{4,5} are commonly known as the three great works of Ayurvedic literature from ancient India and are collectively known as *vrddha-trayi*. The *Bower Manuscript* (*Bower Ms.*)^{6,7} contains similar medical writings as found in the formulations given in these works of Ayurvedic literature, and the second part of the *Bower Ms.*, which is called the *Navanitaka*, is a standard manual of the foremost medical formulae⁸.

From the viewpoint of current Ayurvedic treatment, quality control and standardization of

herbal medicines involves several steps. The source and quality of raw materials play a pivotal role in ensuring the quality and stability of herbal preparations. Other important factors to consider include the freshness of the plants used; temperature; light and cold exposure; insect bites; water availability; nutrients; periodicity, time and method of collection; conservation; Drying; packaging, storage and transportation of raw material; age (maturity) and the part of the plant collected, all of which can greatly affect the quality and therapeutic value of an herbal medicine. This explains why the composition of herbal drugs is quite variable. Thus, proper standardization and quality control of raw materials and herbal preparations are necessary⁹⁻¹³.

Ancient Indian medicine and the Bower Manuscript

The *Bower Ms.* is an ancient Indian manuscript consisting of 56 leaves of birch bark bound together by a string passing through a round hole near one end of each leaf. The manuscript was discovered in 1890 in the ruins of an old sand-buried city at Kuchar in Eastern Turkestan. It was purchased for a small sum by L H Bower who was there on an Indian government sponsored mission. He had a unique ethnological interest in the manuscript. The historical

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importance of this pioneering manuscript was revealed by Dr Hoernle, a learned Principal of the Calcutta Madrasah and a well known Sanskrit scholar. He estimated that the Bower Ms. was written around 350–375 AD; this was subsequently confirmed by conclusive Palaeographic evidence. Central Asia, which was once distinguished for its Buddhist activity, now aroused a keen interest throughout Europe for the possibilities of literary studies. More importantly, the manuscript formed a medium of communication between India and China regarding Buddhist matters. It is considered to be one of the earliest Indian medical texts.

Navanitaka in the Bower Manuscript

The main portion of the Bower Ms. consists of 31 leaves describing *Navanitaka*, which means butter extracted out of milk. This work contains 16 chapters of essential formulae written in the Gupta script by Buddhist monks. The English translation of each verse is enriched with subsequent notes referring to later work in Indian medicine. Apart from such references, some of these formulae also appear to be developed by the authors themselves. These formulae are of a most elaborate kind. *Navanitaka* is thus a compilation of various Indian medical texts including CS, SS and AHS.

Haritaki and Triphala in the Bower Manuscript

The 11th chapter of the *Navanitaka* is a monograph of *haritaki* (*Haritaki-kalpa*), which is botanically known as *Terminalia chebula* Retz. Seven types of *haritaki* including *vijaya*, *chetaki*, *rohini*, *putana*, *amrtā*, *jīvantī* and *abhayā* are existent. It also has 32 formulations of *Triphala*, which is considered to be a combination of the *Terminalia chebula* Retz., *Terminalia bellirica* Roxb. and *Phyllanthus emblica* (*Emblca officinalis* Gaertn).

In Ayurveda, 'ghrita' is keyed as an important lipid medium, as it assists the active medicaments in penetrating the blood brain barrier thereby enhancing the drug efficacy. In India, it is also consumed in diet or as an adjuvant for drugs. It is generally used for extraction and absorption of any medicine¹⁴. In *Pancha-karma* therapy, a daily oil massage alleviates toxins from fatty tissues, followed by steam therapy to bring toxins to the surface. After several days, these are eliminated with different techniques such as emesis (vomiting), purgatives, enemas and nasal therapy to cleanse the body. Further, the daily dose of ghee promotes dissolution of the lipid soluble

toxins and then further helps in elimination of these toxins by purification procedures¹⁵.

Kalyanaka ghrita in classic medical texts and the Ayurvedic Formulary of India

The formulations for *Kalyanaka ghrita* compiled in the Bower Ms. are described in the fifth leaf (119–127a). *Kalyanaka*, which means the superior one, describes 30 medicinal herbs. *Kalyanaka ghrita* is an Ayurvedic herbal formulation mentioned in the Ayurvedic Formulary of India (AFI; Part 1, 6:7)¹⁶ and is a medical preparation of herbs with *ghrita* as the basic ingredient. A comparative study of formulations containing *Triphala* revealed that *Kalyanaka ghrita* was the only common formulation among the Bower Ms., CS, SS, AHS and AFI (Tables 1&2).

Methodology

Ancient medical texts including the Bower Ms., CS, SS, AHS and AFI were examined to identify common formulation(s) containing *Triphala*. As described above, *Kalyanaka ghrita* was found to be the common formulation and hence was selected for the experiment. It was then prepared according to AFI¹⁶ and subsequently analysed qualitatively by high performance thin layer chromatography (HPTLC) according to chemical markers (Gallic acid and curcumin). In addition, the therapeutic indications of *ghrita* from various classic medical texts were compared.

The plant materials used for formulation were purchased from a local market in Chandigarh. A voucher specimen of each plant was deposited with a specimen number (NIP-NPH-CD-130 to NIP-NPH-CD-155) at the Department of Natural Products, NIPER, SAS Nagar Mohali, Punjab and standardized as per AFI¹⁰. Chromatographic techniques like HPTLC system equipped with a Camag TLC Visualizer and Linomat 5 sample applicator were used to analyse the sample on aluminium coated TLC plates (10 × 10 cm) pre-coated with silica gel 60F₂₅₄ (Merck, Germany). All chemicals and reagents used in the study were of analytical grade.

Kalyanaka ghrita was prepared as per the AFI. All ingredients were cleaned, dried, coarsely powdered and then mixed in equal proportions. The mixture was soaked overnight in water; a decoction was prepared and filtered. The retained liquid (*kvatha*) was added to the processed *ghrita* along with water, as per the general method of *ghrita* preparation.

Table 1—*Kalyanaka ghrta* formulation composition mentioned in the Bower Ms., CS, SS, AHS and AFI

S. No.	Botanical name	Bower Ms.	CS	SS	AHS	AFI
1	<i>Terminalia chebula</i>	Haritaki	Haritaki	Haritaki	Haritaki	Haritaki
2	<i>Terminalia bellirica</i>	Vibhitaka	Vibhitaka	Vibhitaka	Bibhitaka	Bibhitaka
3	<i>Phyllanthus emblica</i>	Amalakai	Amalaki	Amalaki	Amalaki	Amalaki
4	<i>Citrullus colocynthis</i>	n.m.	Visala	n.m.	Visala	Visala
5	<i>Amomum subulatum</i>	n.m.	n.m.	n.m.	Bhadraaila	Bhadraaila (Sthalaila)
6	<i>Cedrus deodara</i>	Devadaru	Devadaru	Devadaru	Devadaru	Devadaru
7	<i>Prunus cerasus</i>	Elavaluka	Elavaluka	Elavaluka	Elavaluka	Elavaluka
8	<i>Hemidesmus indicus</i>	Sariva	Sariva	Sariva	Sariva	Sveta sariva
9	<i>Cryptolepis buchanani</i>	Sariva	Krsna sariva	Krsna sariva	Sariva	Krsna sariva
10	<i>Curcuma longa</i>	Rajani	Rajani	Rajani	Haridra	Haridra
11	<i>Berberis aristata</i>	Rajani	Daru haridra	Daru haridra	Rajani	Daru haridra
12	<i>Desmodium gangeticum</i>	Sthira	n.m.	Parnini	Sthiraphalini	Salaparni (sthira)
13	<i>Uraria picta</i>	n.m.	Prsniparni	n.m.	n.m.	Prsniparni
14	<i>Callicarpa macrophylla</i>	Priyangu	Priyangu	Priyangu	n.m.	Phalini (Priyangu)
15	<i>Valeriana wallichii</i>	Nata	Nata	n.m.	Nata	Nata (Tagara)
16	<i>Solanum indicum</i>	Brhati	Brhati	n.m.	Brhati	Brhati
17	<i>Solanum xanthocarpum</i>	Kantakarika	n.m.	n.m.	n.m.	n.m.
18	<i>Saussurea lappa</i>	Kustha	Kustha	Kustha	Kustha	Kustha
19	<i>Rubia cordifolia</i>	Manjista	Manjista	Manjista	Manjista	Manjista
20	<i>Mesua ferrea</i>	n.m.	Kesara	Kesara	NagaKesara	Nagakesara
21	<i>Punica granatum</i>	Dadima	Dadima	Dadima	Dadima	Dadima-Phala tvak
22	<i>Embelia ribes</i>	Vella	Vidanga	Vidanga	Vella	Vella (Vidanga)
23	<i>Abies webbiana</i>	Talisa	Talisa patra	Talisa	Talisa patra	Talisa patra (Talisa)
24	<i>Elettaria cardamomum</i>	n.m.	n.m.	n.m.	Ela	Ela (Suksmaila)
25	<i>Jasminum officinale</i> var. <i>grandiflorum</i>	Jati	Malati	Malati	Malati	Jati
26	<i>Nymphaea stellata</i>	Nilotpala	Nilotpala	Utpala	Utpala	Nilotpala
27	<i>Baliospermum montanum</i>	Danti	Danti	Dañi	Danti	Danti
28	<i>Prunus cerasoides</i>	n.m.	Padmaka	n.m.	Padmaka	Padmaka
29	<i>Pterocarpus santalinus</i>	n.m.	n.m.	n.m.	Rakta candana	Rakta candana
30	<i>Santalum album</i>	Candana	Candana	Candana	n.m.	n.m.
31	Clarified butter from cow's milk	Ghrta	Ghrta	Ghrta	Sarpi	Sarpi (Goghrta)
	Total	24	26	22	27	29

‘o’: having the same name; n.m.: not mentioned

High performance thin layer chromatography

High performance thin layer chromatography (HPTLC) system (Muttentz, Switzerland) equipped with a Camag TLC Visualizer and Linomat 5 sample applicator was used to analyse the sample on aluminium coated TLC plates (10 × 10 cm) of 0.2 mm thickness layered with silica gel 60F₂₅₄ (Merck, Germany). Two gm of *Kalyanaka ghrta* was extracted with 95 % ethanol for 15 min in an ultrasonication bath, and this process was repeated three times. The extracted solution was filtered using Whatman filter paper and dried in a rotary vacuum evaporator to get methanolic extract of *Kalyanaka ghrta*. Markers are also dissolved in MeOH. A working

(100 µg mL⁻¹) solution was prepared for the standards, gallic acid and curcumin and 2–5 µL of this solution with Camag Linomat V sample applicator was applied to the plates 1 cm above the edge. Distance between tracks was kept 1 mm, and bandwidth was 5 mm. The chromatogram was developed under chamber saturation conditions with toluene: ethylacetate: glacial acetic acid: formic acid (4:5:4:1 v/v/v/v) for gallic acid and chloroform: methanol (19:1 v/v) for curcumin in a Camag twin trough chamber. After development, the plate was visualized under ultraviolet (UV) light for the presence of standards. The plate was then scanned using a Camag TLC scanner 3 at λ_{max} 254 and 366 nm¹⁷.

Table 2—Comparison of the descriptions of therapeutic uses of *Kalyanaka ghrta* mentioned in Bower Ms., CS, SS, AHS and API

S. No.	Description	Bower Ms.	CS	SS	AHS	AFI
1	Cough	<i>Kasa</i>	<i>Kasa</i>	<i>Kasa</i>	<i>Kasa</i>	<i>Kasa</i>
2	Morbid pallor	<i>Pandu</i>	n.m.	n.m.	<i>Pandu</i>	<i>Pandu</i>
3	Antidote	<i>Gara visa</i>	<i>Visha vikar</i>	n.m.	<i>Gara visa</i>	<i>Gara visa</i>
4	Disorders of the semen	<i>Reto dosha</i>	n.m.	<i>Nashtha-shukra</i> and <i>Retomargaruja</i>	<i>Areta</i>	<i>Areta</i>
5	Tertian and quartan fevers	<i>Tritiya, caturtha</i>	<i>Jvara</i>	<i>Visham Jvara</i>	<i>Jvara</i>	<i>Jvara</i>
6	Mania	<i>Unmada</i>	<i>Unmad</i>	<i>Unmad</i>	<i>Unmad</i>	<i>Unmad</i>
7	Spleen	<i>Plihesu</i>	n.m.	n.m.	n.m.	n.m.
8	Strength promoter	<i>Bala</i>	n.m.	n.m.	<i>Balya</i>	<i>Balya</i>
9	Erysipelas	<i>Visarpa</i>	<i>Visarpa</i>	n.m.	n.m.	n.m.
10	Morbid and frequent secretion of urine	<i>Prameha</i>	<i>Prameha</i>	n.m.	<i>Prameha</i>	<i>Prameha</i>
11	Vaginal disorders	<i>Yoni dosha</i>	n.m.	n.m.	n.m.	n.m.
12	Promoting appetite	<i>Dipaniya</i>	n.m.	n.m.	n.m.	n.m.
13	Ulceration	<i>Kshata</i>	n.m.	n.m.	n.m.	n.m.
14	Poisoning	n.m.	n.m.	<i>Gara visa</i>	<i>Gara visa</i>	<i>Gara visa</i>
15	Epilepsy	n.m.	<i>Apasmara</i>	<i>Apasmara</i>	<i>Apasmara</i>	<i>Apasmara</i>
16	Memory	n.m.	n.m.	n.m.	<i>Smrti</i>	<i>Smrti</i>
17	Pregnancy	<i>Garbham</i>	n.m.	<i>Garbhadam</i>	<i>Punsavan</i>	<i>Punsavan</i>
18	Swelling	<i>Svayathu</i>	n.m.	n.m.	n.m.	n.m.
19	Dysuria	<i>Mutrani Graham</i>	<i>Mutrakrichchha</i>	n.m.	n.m.	n.m.
20	Asthma	<i>Svasa</i>	n.m.	<i>Svasa</i>	n.m.	n.m.
21	Leprosy	<i>Vatasonita</i>	n.m.	n.m.	n.m.	n.m.
22	Catarrh	<i>Pratisyaya</i>	n.m.	n.m.	n.m.	n.m.
23	Piles	<i>Arsa</i>	<i>Arsa</i>	n.m.	n.m.	n.m.
24	Hiccough	<i>Hikka</i>	n.m.	n.m.	n.m.	n.m.
25	Vomiting	<i>Chharddi</i>	<i>Chharddi</i>	n.m.	n.m.	n.m.
26	Abdominal tumours	<i>Gulma</i>	n.m.	<i>Gulma</i>	n.m.	n.m.
27	Complexion	<i>Varna kara</i>	<i>Alaxmi</i>	<i>Alaxmi</i>	n.m.	n.m.
28	Possession by an evil spirit	n.m.	<i>Sarvagrah vinashak</i>	n.m.	<i>Daivauphrichit</i>	<i>Daivauphrichit</i>
29	Intelligence	n.m.	n.m.	n.m.	<i>Medhasi</i>	<i>Medhasi</i>
30	Aphasia	n.m.	<i>Gadgad Vani</i>	n.m.	n.m.	n.m.
31	Seizures in children	n.m.	n.m.	n.m.	n.m.	n.m.
32	Muscular dystrophy	n.m.	<i>Shosha</i>	n.m.	<i>Shosha</i>	<i>Shosha</i>
33	Dyspepsia	n.m.	<i>Agnimand</i>	<i>Agnimand</i>	<i>Mandagni</i>	<i>Mandagni</i>
34	Tuberculosis	n.m.	<i>kshaya rog</i>	n.m.	n.m.	n.m.
35	Gout	n.m.	<i>Vat-rakta</i>	n.m.	n.m.	n.m.
36	Itching	n.m.	<i>Kandu</i>	n.m.	<i>Kandu</i>	<i>Kandu</i>
37	Anaemia	n.m.	<i>Pandurog</i>	n.m.	n.m.	n.m.
38	Psychosomatic disorders	n.m.	<i>Bhutounmad</i>	<i>Bhutagraha</i>	<i>Bhutagraha</i>	<i>Bhutagraha</i>
39	Female infertility	n.m.	<i>Bandhyatva</i>	<i>Bandhyatva</i>	<i>Apraja</i>	<i>Apraja</i>
40	Memory enhancer	n.m.	n.m.	<i>Medhya</i>	<i>Medhya</i>	<i>Medhya</i>
41	Delusions	n.m.	n.m.	n.m.	<i>Moha</i>	<i>Moha</i>
42	Anti-ageing	n.m.	n.m.	<i>Ayushya</i>	<i>Ayushya</i>	<i>Ayushya</i>
Total		24	21	15	22	22

n.m.: not mentioned

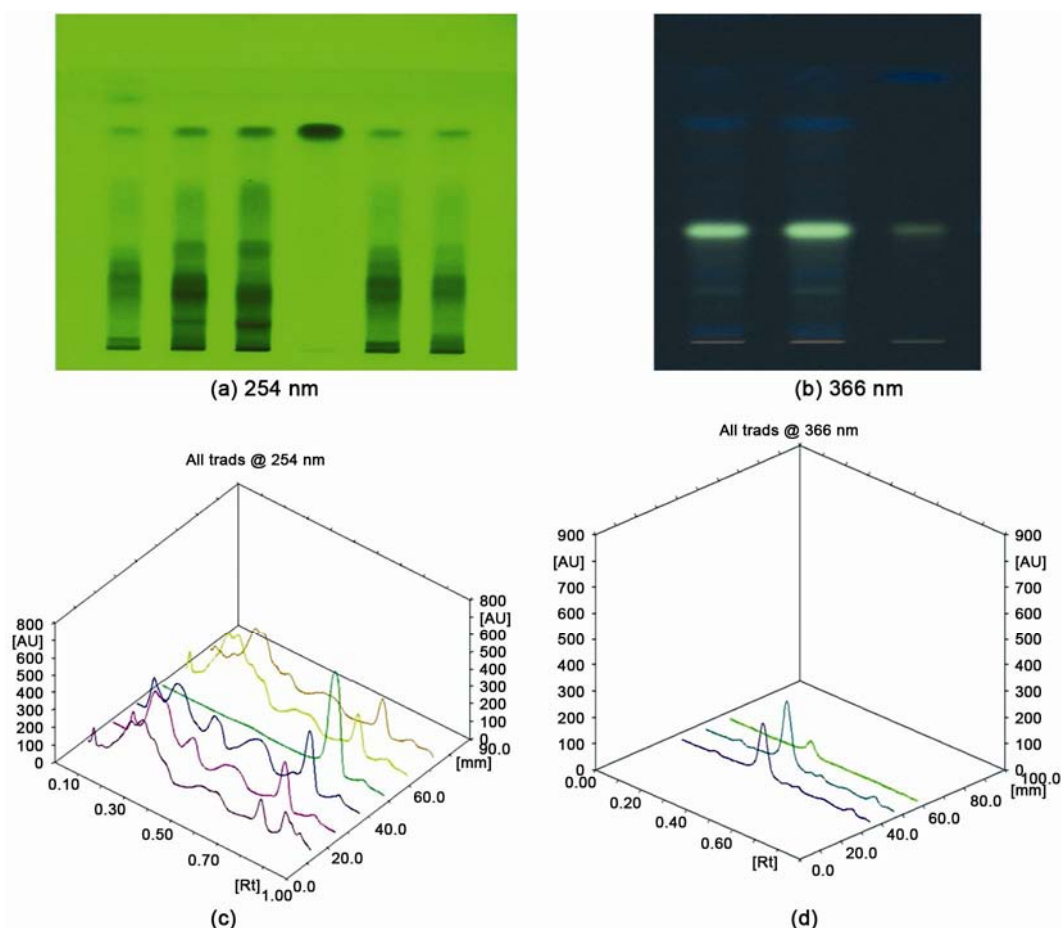


Fig. 1—Comparison of *Kalyanaka ghrita* and commercial *Triphala Churna* using HPTLC; HPTLC chromatogram of *Kalyanaka ghrita* and marketed *Triphala Churna*, (A) Peaks 1, 2, 3, 4, 5 and 6 from left to right, (C) Peaks 1–6 from bottom to top represents *Kalyanaka ghrita* (2 μL), *T. chebula* methanolic extract (2 μL), *E. officinalis* methanolic extract (2 μL), gallic acid (3 μL), *T. bellirica* methanolic extract (2 μL) and marketed *Triphala Churna* (2 μL), respectively, (B) Peaks r1, 2 and 3 from left to right, (D) Peaks 1–3 from bottom to top represents *Kalyanaka ghrita* (3 μL), *Kalyanaka ghrita* (4 μL) and curcumin (1 μL), respectively.

Results and discussion

On careful observation and critical examination, a total of 32 formulations containing *Triphala* are found in *Navanitaka*. *Kalyanaka ghrita* contains 30 medicinal herbs mentioned in the Ayurvedic Formulary of India (AFI; Part 1, 6:7) and is a medical preparation of herbs with *ghrita* as the basic ingredient. A comparative study of formulations containing *Triphala* revealed that *Kalyanaka ghrita* was the only common formulation among the Bower Ms., CS, SS, AHS and AFI. It is estimated that out of 30 medicinal herbs, more than 24 herbs are mentioned in the Bower Ms., CS, SS, AHS and AFI bearing similar names (Table 1). The therapeutic indications of *Kalyanaka ghrita* are also common in these ancient medical texts (Table 2). HPTLC was performed for qualitative analysis of *Kalyanaka ghrita* and *Triphala churna*. As shown in Fig. 1; 1 A & C), the R_f of gallic

acid was 0.79 in all the tested samples. Gallic acid can be used for comparisons between *E. officinalis*, *T. bellirica*, *T. chebula*, *Triphala churna* (marketed formulation) and *Kalyanaka ghrita* (containing *Triphala*). Curcumin also was used as a marker for *Kalyanaka ghrita* (Fig. 1 B & D), which had an R_f of 0.45. Because of the oily consistency of *ghrita*, some of the markers were not clearly observed and hence were not detected.

The present study was designed to discover the inter-textuality among the ancient medical texts, *viz.* the Bower Ms., CS, SS, AHS and API. On critical examination and observation, one formulation, *viz.* *Kalyanaka ghrita* was found to have the same formula in all these texts. Hence, *Kalyanaka ghrita* was selected for a detailed comparative study. *Kalyanaka ghrita* was chemically examined by HPTLC and compared with commercially available *Triphala*

Churna for chemical markers. Overall, the present observations revealed a link among ancient medical texts, including the Bower Ms., CS, SS, AHS and AFI.

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