Scientific review on *Katukaskandhaya* (group of pungent drugs) and its medicinal importance

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Abstract

Dravyaguna vinjnana of Ayurveda which can be correlated with modern Pharmacology, is an area with a wide spectrum of knowledge regarding substances that are used in treatment and preventive care. The study of *Dravya* with their properties and actions helps in the proper utilization of drugs for different diseases. Classification based on the dominancy of taste (*Rasa*) is mentioned under the term *Skandha* in *Charaka Samhitha* and drugs with pungent taste come under the *Katukaskandhaya*. In this scientific review, ten drugs mentioned in *Katukaskandhaya* were evaluated based on *Rasadi panchakaya*, chemical composition and therapeutic efficacy with reference to Ayurveda, Traditional, Allopathic medical texts and research articles published in validated databases. Among the selected drugs, majority (>60%) were having *Laghu*, *Ruksha*, *Thekshna Guna*, 80% with *Ushna Veerya* and 70% with *Katu Vipaka*. These drugs were prominent with Alkaloids, Terpenes, Phenols, and Flavonoids recorded with Antioxidant, Anti-microbial and Anti-carcinogenic properties. According to therapeutic effectiveness and efficacy mentioned in Ayurveda and Traditional medical texts, these are mainly indicated for the treatment of diseases caused due to vitiated *Kapha-Vata dosha*. Vitiation of *Kapha dosha* leads to impairment of *Agni* resulting formation of *Ama* which is a causative factor for many disorders. *Trikatu* is one of the drug formulae mentioned for vitiated *Kapha dosha* which includes drugs mentioned in *Katukaskandhaya* such as *Zingiber officinale, Piper longum* and *Piper nigrum*. Further studies on this group of drugs can be conducted with phytochemical analysis and clinical trials to analyze the efficacy of drug formulae with drugs of *Katukaskandhaya* in disease management.

Keywords: *Katukaskandhaya*, Pungent taste, *Ushna veerya*, Chemical composition, Pharmacological actions

Introduction

Ayurveda is an Indian philosophy that mainly focuses on maintaining good health by balancing physical, mental and spiritual well-being in order to treat and get prevented from diseases[1]. This is a medical field of holistic approach with use of herbal medicines. *Dravyaguna Vignana*[2] is the area that mainly focuses on the *Guna* (properties) and *Karma* (actions) of herbal materials. This can be correlated with modern pharmacology and proper understanding of this area is advantageous in selecting and prescribing suitable medicines for different disease conditions. In Ayurveda, *Panchamahabhuta*[3] (*Akasha, Vayu, Agni, Jala, Prithivi*) are regarded as physicochemical basis of the materials and *Tridosha*[4] (*Vata, Pitta, Kapha*). *Tridosha* have specific functions of movement, assimilation and growth respectively which have derived from the qualities of these *Panchamahabhuta*.

According to Charaka Samhitha, both the *Guna* and *Karma* reside or are in concomitant with *Dravya*[5]. Five properties residing in *Dravya* are mentioned in

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Bhavaprakasha[2] and they are, *Rasa* (taste), *Guna* (properties), *Veerya* (potency), *Vipaka* (final transformed state after digestion) and *Prabhava* (special potency). The word *Rasa* can be attributed in different contexts such as, *Rasa Dhatu* which circulates all over the body, *Parada* (Mercury) mentioned in Alchemy and the taste that can be perceived through taste buds[6]. There are six tastes mentioned in Ayurveda which is known as *Shadrasa*. They are, *Madhura* (sweet), *Amla* (sour), *Lavana* (salty), *Katu* (pungent), *Tikta* (bitter) and *Kashaya* (astringent)[7]. Knowledge about the classification of *Dravya* in Ayurveda is important in prescribing the best drug for a disease. Classification based on the dominancy of taste (*Rasa*) is mentioned under the term *Skandha* in Charaka Samhitha[7] and drugs with pungent taste come under the *Katukaskandhaya*[8]. This group of drugs is commonly present with *Katu rasa* (pungent taste), *Laghu*, *Ruksha*, *Theekshna guna* (light, rough, sharp properties) and hot potency (*Ushna veerya*).

The *Katu rasa* or the pungent taste is made with *Vayu* (air) and *Agni* (fire) elements[5] and is present with hotness, lightness, dryness and sharpness[9]. These properties help in balancing and reducing vitiated *Kapha dosha* while slightly increasing *Pitta dosha* due to sharp property (*Theekshna guna*). Hot potency (*Ushna veerya*) helps in pacifying both *Kapha* and *Vata dosha*[10]. A pungent taste is said to be felt by the central region of the tongue and blood, and reproductive tissues are said to be most affected by this taste[6]. There are three *Vipaka* (final transformed states after digestion) mentioned in Ayurveda as *Madhura vipaka* (sweet), *Amla vipaka* (sour) and *Katu vipaka* (pungent). Pungent taste conversion is considered as *Katu vipaka* and food or medicines that are with sharp, hot, dry final transformation after digestion can be classified under *Katu vipaka*[11]. The majority of the drugs of *Katukaskandhaya* are present with *Katu vipaka* (final transformed state after digestion) which is one of the three *Vipaka* mentioned in Ayurveda.

Pungent taste is said to be having carminative, diaphoretic, and vasodilatory properties. Vegetables, radishes, turnips, raw spinach, leeks, onions, garlic, Grains, Nuts, Seeds, Mustard seeds, most spices, especially black pepper, cardamom, cloves, ginger are some examples for food with pungent taste[6]. In Susrutha Samhitha, *Katu rasa* (Acrid taste) is mentioned as an appetizer, and digestive agent, that eliminates *Dosha*, and alleviates obesity, laziness, expectoration, worms and poisons. It also mentions that the excess can cause negative effects like intoxication, dryness, giddiness and burning sensation as well[12].

In Ayurveda, *Katukaskandhaya* is the category consisting of drugs having a Pungent taste. There are 39[13] drugs mentioned in this classification and the *Surasadi*[14] and *Pippalyadi gana*[15] mentioned in Susrutha Samhitha are also included in this *Katuka* group of drugs. Many of the drug recipes used by Ayurveda and Traditional medical practitioners include these drugs mentioned under *Katukaskandhaya*. Commonly these drugs have been used in treating diseases caused by *Agnimandya* that occurred due to malfunctioning of *Kapha dosha*. Other than that, drug recipes have been mentioned for the management of diseases caused by *Kapha-Vata* origin as well.

The general objective of the study was to provide a clear and comprehensive analysis of the pharmacological actions and medicinal importance of *Katukaskandhaya*. Specific objectives were to analyze the chemical nature, therapeutic indications, benefits, and importance of these drugs with reference to Ayurveda, the Traditional medical system and the Allopathic system of medicine.

Materials and Methods

This review was conducted with refence to Ayurveda authentic texts such as Charaka Samhitha, Susrutha Samhitha, Bhaisajya Rathnavali, Sharangadhara Samhitha, Dravya Guna Vignana, A text book of Dravyaguna Vignana and Dravya Muladharma. Traditional medical texts like Vaidyaka Sarasankshepaya, Kashaaya Sangrahaya, Kashaya Sagaraya, Ayurveda Aushada Sangrahaya were also referred to in order to check the applications, indications and analysis on *Rasadi panchakaya* of this group of drugs mentioned under

the *Katukaskandhaya*. Published research articles, Journal articles from valid websites and databases like PubMed, Google Scholar and other sources were also used to collect information about the chemical nature and medicinal importance of the drugs mentioned under the *Katukaskandhaya*.

In the present study, the pharmacological properties, therapeutic indications and chemical nature of 10 selected drugs mentioned under the *Katukaskandhaya* were analyzed. Ten drugs of *Katukaskandhaya* were selected based on their utility in the therapeutic aspect. Selected drugs have been included in many of the drug formulae commonly used in the management of diseases caused due to vitiated *Kapha* and *Vata doosha*. *Piper longum* L. (Long Pepper), *Piper nigrum* L. (Pepper), *Zingiber officinale* Roscoe. (Ginger), *Plumbago zeylanica* L. (Wild White Leadwort/ Ceylon Leadwort), *Elettaria cardamomum* L. (Cardamom), *Apium graveolens* L., (Wild Celery), *Brassica alba Boiss* L. (White Mustard), *Ferula assafoetida* L. (Asafoetida), *Embelia ribes* L. (False-black pepper) and *Allium sativum* L. (Garlic) were the ten selected drugs. A comprehensive analysis was conducted with reference to the above-mentioned sources regarding the pharmacological aspects, medicinal importance and the chemical nature of the selected set of drugs mentioned in *Katukaskandhaya* of Ayurveda.

Results and Discussion

According to *Charaka Samhitha*, drugs having similar *Rasa*, *Guna*, *Veerya*, *Vipaka* and *Prabhava* are categorized under 6 *Skandhas*, which are named according to the 6 tastes mentioned in Ayurveda[8]. It has stated that *Katukaskandhaya* contains 39 drugs [13]. Some drugs mentioned in *Surasadi gana* [14] which contains 21 drugs and *Pippalyadi gana* which contains 22 drugs[15] have also been included in *Katukaskandhaya*. From the drugs and other ingredients mentioned in the text, some of the ingredients cannot be identified and cannot be seen today. Therefore, this literature study was conducted based on 10 drugs mentioned under the *Katukaskandhaya* which can be clearly identified and commonly used today.

Among the drugs mentioned in *Pippalyadi gana*, 13 are mentioned in the *Katukaskandhaya* as well. They are, *Pippali, Pippali mūla, Chavya, Chithraka*, *Nagara*, *Maricha*, *Gaja pippali*, *Harenuka*, *Ela*, *Ajamoda, Sarshapa, Hingu* and *Vidanga* [15]. Both the dried and fresh ginger (*Zingiber officinale* Roscoe) has been mentioned in *Katukaskandhaya,*[13] but fresh ginger (*Ardraka*) has not been mentioned in the *Pippalyadi gana*. Most of the drugs mentioned in *Surasadi gana* are unknown and 8-9 drugs are called as varieties of *Tulasi* or appear to be different species of the family LABIATEAE (LAMIACEAE)[16]. *Vidanga* is mentioned in all these three groups of drugs.

Other than the herbal drugs mentioned in the classification, different materials and constituents like *Mutra* (urine), *Kshara* (alkaline) and *Pitta* (bile) have also been mentioned in *Katukaskandhaya*. In identifying and describing the pungent taste, it has been described as an alkaline taste in some of the authentic texts. In order to analyze the pharmacological features and functions on body tissues, *Panchapadartha* or the *Rasadi panchakaya* [17] was also analyzed. Term *Panchapadartha* has been introduced by Acharya Bhavamisra, in his text named, Bhavaprakasha[2].

According to the analysis of these ingredients (Table 1 and Figure 1), it was clear that among the selected 10 drugs, 2 drugs (13.3%) belong to the family PIPERACEAE, two drugs belong to the ZINGIBERACEAE family (13.3%) and two drugs belong to the APIACEAE or the UMBELLIFERAE family [18].

PIPERACEAE, the pepper family in the order Piper ales is commercially important because of *Piper nigrum*, the source of black and white pepper. The family comprises about 5 genera, of which Piper (about 2,000 species) and Peperomia (about 1,600 species) are the most important. The plants grow as herbs, vines, shrubs, and trees and are widely distributed throughout the tropics and subtropics[19].

Table 1: Nomenclature and details of the selected ten drugs [17]

	Botanical name and English name	Family name	Sanskrit name	Sinhala name	Used part
1	*Piper longum* L. (Long Pepper)	PIPERACEAE	*Pippali*	*Thippili*	Fruits
2	*Piper nigrum* L. (Pepper)	PIPERACEAE	*Maricha*	*Gammiris*	Seeds
3	*Zingiber officinale* Roscoe (Dried Ginger)	ZINGIBERACEAE	*Nagara*	*Wiyali Inguru*	Rhizome
	Zingiber officinale Roscoe (Fresh Ginger)		*Ardraka*	*Amu inguru*	
4	*Plumbago zeylanica* L. (Wild White Leadwort/ Ceylon Leadwort)	PLUMBAGINACEAE	*Chithraka*	*Elanitul*	Roots, Stem
5	*Elettaria cardamomum* L. (Cardamom)	ZINGIBERACEAE	*Ela*	*Enasahal*	Seeds
6	*Apium graveolens* L. (Wild Celery)	APIACEAE [18]	*Ajamoda*	*Asamodagam*	Seeds
7	*Brassica alba Boiss* L. (White Mustard)	BRASSICACEAE	*Sarshapa*	*Ela Aba*	Seeds
8	*Ferula assafoetida* L. (Asafoetida)	APIACEAE	*Hingu*	*Perumkayam*	Resin
9	*Embelia ribes* L. (False-black pepper)	PRIMULACEAE	*Vidanga*	*Walanga sahal*	Seeds
10	*Allium sativum* L. (Garlic)	AMARYLLIDACEAE	*Lasuna*	*Sudu lunu*	Bulbs

Fig. 1: Selected Ten drugs of *Katukaskandhaya*

ZINGIBERACEAE commonly known as the ginger family, is a family of flowering plants comprising more than 1300 species divided into about 52 genera of aromatic perennial herbs with creeping horizontal or tuberous rhizomes, distributed throughout tropical Africa, Asia, and America[20]. The APIACEAE or UMBELLIFERAE, commonly known as the celery, carrot, or parsley family, is a family of mostly aromatic plants with hollow stems. Many plants of this family are condiments or vegetables with some of them having medicinal properties[18].

Specific features of these drugs can be understood by studying the *Rasadi panchakaya*[2,21] which includes *Rasa, Guna, Veerya, Vipaka* and *Prabhava.* The study of pharmacology is important in understanding the pharmacological features, and actions of medicines with the integrated knowledge from multiple scientific disciplines including chemistry, biochemistry, molecular biology and physiology, providing a significant positive impact on human health. The scientific knowledge gained through pharmacological studies provides a foundation for a number of medical treatments[22]. In Ayurveda, this analysis helps in understanding the specific actions of drugs on body tissues and systems.

There are six tastes mentioned in Ayurveda which is known as *Shad rasa* such as *Madhura, Amla, Lavana, Katu, Thiktha, Kashaya*[7] and there are 41 *Guna* (properties) of *Dravya*. Among these, 20 *Gurvadi guna*[2] are important in analyzing the pharmacological actions of drugs. Mainly there are 2 types of *Veerya* (potencies) as *Ushna* (hot), *Sheetha* (cold) and three types of final state after digestion/transformation as *Madhura* (sweet), *Amla* (sour) and *Katu* (pungent) *Vipaka*. The special potency of drugs is known as *Prabhava* and this is not commonly seen in most drugs. The following table (Table 2) describes the *Pancha Padartha*[2] mentioned in Ayurveda of the ten selected drugs of *Katukaskandhaya*.

Analysis of the Ayurveda pharmacological properties of selected ten drugs revealed that all the selected drugs were present with *Katu rasa* (100%). 80% of the ingredients were having *Laghu guna,* 90% were having *Theekshna guna,* and 70% were having *Ruksha guna. Ushna veerya* was present in most of the drugs (80%) and dried ginger was recorded to have hot potency whereas fresh ginger was reported to have cold potency. *Piper longum* L. was reported as *Anushna veerya* and it was present with the *Madhura vipaka* as well[20]. 70% of drugs having *Katu vipaka* and *Madhura vipaka* was reported in three drugs including *Piper longum* L., *Zingiber officinale* Roscoe. and *Elettaria cardamomum* L. *Embelia ribes* L. (*Vidanga*) is the only drug that was reported with a special potency and *Krimighna Prabhava*[23] (Anti-helminthic activity) has been recorded in it.

Effects on *Dosha* and effects on five body systems were also analyzed. They were Central Nervous System (CNS), Gastrointestinal Tract (GIT), Cardiovascular System (CVS), Respiratory System (RS) and Genitourinary System (GUS). Common therapeutic indications of these drugs were also analyzed based on the actions of the *Dosha* and its effects on body systems (Table 3).

Analysis of Effects on *Dosha*, body systems and therapeutic indications it was showed that 90% of the selected drugs of *Katukaskandhaya* were having *Kapha shamaka* and *Kapha nashaka guna* which means the ability to pacify vitiated or aggravated *Kapha dosha.* This may be due to the presence of properties like *Laghu* (light), *Ruksha* (rough) which are opposite to the properties of *Kapha dosha.* 90% showed the *Vata shamaka* properties which may be due to the presence of hot potency. 60% of the selected 10 drugs showed *Pitta vardhaka* properties as well. This may be due to the presence of *Theekshna* (sharp/penetrating) property and *Elettaria cardamomum* L. showed *Tridoshahara* properties.

These drugs with the ability in pacifying *Kapha – Vata dosha* are present with beneficial actions on GIT such as *Deepana, Pachana* activities which may be due to the presence of *Katu rasa, Laghu, Ruksha guna* and *Katu vipaka.*

Table 2: *Rasadi Panchakaya* of selected 10 drugs of *Katukaskandhaya* [21]

	Drug	*Rasa* (Taste)	*Guna* (Properties)	*Veerya* (Potency)	*Vipaka* (Taste of final digested product)	*Prabhava* (Special potency)
1	*Piper longum* L.	*Katu* (Pungent)	*Laghu* (Light), *Snigdha* (Oily), *Theekshna* (Sharp/ Penetrating)	*Anushna* (Mild hot potency)	*Madhura* (Sweet)	-----
2	*Piper nigrum* L.	*Katu* (Pungent), *Thiktha* (Bitter)	*Laghu* (Light), *Rūksha* (Rough), *Theekshna* (Sharp/ Penetrating)	*Ushna* (Hot potency)	*Katu* (Pungent)	-----
3	*Zingiber officinale* Roscoe. (Dried)	*Katu* (Pungent)	*Laghu* (Light), *Snigdha* (Oily)	*Ushna* (Hot potency)	*Madhura* (Sweet)	-----
	Zingiber officinale Roscoe. (Fresh)		*Guru* (Heavy), *Ruksha* (Rough), *Theekshna* (Sharp/ Penetrating)	*Sheetha* (Cold potency)		
4	*Plumbago zeylanica* L.	*Katu* (Pungent)	*Laghu* (Light), *Ruksha* (Rough), *Theekshna* (Sharp/ Penetrating)	*Ushna* (Hot potency)	*Katu* (Pungent)	-----
5	*Elettaria cardamomum* L.	*Katu* (Pungent), *Madhura* (Sweet)	*Laghu* (Light), *Ruksha* (Rough)	*Sheetha* (Cold potency)	*Madhura* (Sweet)	-----
6	*Apium graveolens* L.	*Katu* (Pungent), *Thiktha* (Bitter)	*Laghu* (Light), *Ruksha* (Rough) *Theekshna* (Sharp/ Penetrating)	*Ushna* (Hot potency)	*Katu* (Pungent)	-----
7	*Brassica alba Boiss* L.	*Katu* (Pungent)	*Laghu* (Light), *Theekshna* (Sharp/ Penetrating)	*Ushna* (Hot potency)	*Katu* (Pungent)	-----
8	*Ferula assafoetida* L.	*Katu* (Pungent), *Thiktha* (Bitter)	*Theekshna* (Sharp/ Penetrating), *Rūksha* (Rough), *Snigdha* (Oily)	*Ushna* (Hot potency)	*Katu* (Pungent)	-----
9	*Embelia ribes* L. [23]	*Katu* (Pungent), *Kashaya* (Astringent)	*Laghu* (Light), *Ruksha* (Rough), *Theekshna* (Sharp/ Penetrating)	*Ushna* (Hot potency)	*Katu* (Pungent)	*Krimighna*
10	*Allium sativum* L.	*Katu* (Pungent)	*Snigdha* (Oily), *Theekshna* (Sharp/Penetrating), *Pichchila* (Slimy), *Guru* (Heavy), *Sara* (Fluidity)	*Ushna* (Hot potency)	*Katu* (Pungent)	-----

Table 3: Effects on *Dosha*, body systems and therapeutic indications [21]

	Drug (Botanical name)	Effect on *Dosha*	Effect on body systems	Therapeutic indications
1	*Piper longum* L.	*Kapha-Vata shamaka, Pitta vardhaka*	**CNS** – *Medhya,* **GIT** – *Deepana, Thrupthighna, Vatanulomana, Shula prashamana, Mrudu virechana, Krimighna* **CVS** – *Rakthawardhaka, Hrida-utthejaka* **RS** – *Kaphagna* **GUS** – *Vrushya, Muthrala*	*Masthishka-daurbalya, Vataroga, Aruchi Ajeerna, Agnimandya, Vibandha, Arshas, Daurbalya, Pāndu, Amavātha, Shvasa, Kasa, Hikka, Shukra-dhaurbalya*
2	*Piper nigrum* L.	*Kapha-Vata nashaka*	**CNS** – *Utthejaka, Balya* **GIT** – *Lalasrava janaka, Deepana, Pachana, Anulomana, Krimighna, Yakruth- utthejaka* **CVS** – *Utthejaka* **RS** – *Kaphaghna, Kaphanissaraka* **GUS** – *Muthrala, Arthavajanaka*	*Vataja roga, Agnimandya, Ajeerna, Adhmana, Krimi roga, Yakruth vikara, Shvasa, Kasa, Prathishya, Muthrakruchcha, Rajorodha*
3	*Zingiber officinale* Roscoe.	*Kapha-Vata shamaka*	**CNS** – Stimulant, *Vata shamaka* **GIT** – *Thrupthighna, Rochana, Deepana, Pachana, Vatanulomana, Shula prashamana* **CVS** – *Raktha shodhaka, Shothahara* **RS** – *Kaphaghna, Shvasahara* **GUS** – *Vrushya, Vajeekarana*	*Vataja roga, Aruchi, Hrillasa, Ajeerna, Agnimaandya, Adhmana, Kamala, Shvasa, Kasa, Hikka, Prathishya*
4	*Plumbago zeylanica* L.	*Kapha-Vata shamaka, Pitta vardhaka*	**CNS** - In moderate doses, it acts as a stimulant and in excess acts as a toxin **GIT** – *Deepana, Pachana, Krimighna* **CVS** – *Raktha-pitta kopaka, Shothahara* **RS** – *Kaphaghna, Kantaghna* **GUS** - *Garbhasha shasankochaka, Vajeekarana*	*Vataja roga, Agnimandya, Ajeerna, Udara shula, Arshas, Grahani, Yakruth roga, Prathishya, Kasa, Muthrakruchcha, Rajorodha,*
5	*Elettaria cardamomum* L.	*Tridōshahara*	**CNS** – --- **GIT** – *Mukha shodhana, Durgandha nashaka, Chardhi, Thrushna nigrahana, Rochana, Deepana, Pāchana, Anulomana,* **CVS** – *Hridya* **RS** – *Kapha nissaraka* **GUS** – *Muthrajanana*	*Tridoshaja roga, Hriddaurbalya, Vamana, Mukha roga, Hrillasa, Thrushna, Aruchi, Agnimandya, Adhmana, Arshas, Shvasa, Kasa, Muthrakruchcha*
6	*Apium graveolens* L.	*Kapha-Vata shamaka, Pitta vardhaka*	**CNS** – *Masthishka balakaraka* **GIT** – *Deepana, Vatanulomana, Krimighna, Shula prashamana* **CVS** – *Hridaya-Utthejaka* **RS** – *Kaphaghna* **GUS** – *Garbha utthejaka, Muthra pravarthaka, Vajeekarana*	*Vamana, Agnimandya, Adhmana, Udarashula, Krimiroga, Shvasa, Kasa, Hikka, Muthrashula, Muthraghatha, Kashtarthava*

7	*Brassica alba Boiss* L.	*Kapha-Vata nashaka, Pitta vardhaka*	**CNS** – *Vata shamaka,* **GIT** – *Deepana, Vidahi, Krimighna* **CVS** – *Hridaya-utthejaka* **RS** – *Kaphahara* **GUS** – *Garbhasha utthejaka, Vaajeekarana, Muthrakaraka*	*Ardhitha, Pakshaghatha, Sandhivata, Katee shula, Agnimandya, Krimiroga, Shvasa, Kasa, Hikka, Muthrashula, Muthraghatha, Kashtarthava*
8	*Ferula assafoetida* L.	*Kapha-Vata nashaka, Pitta vardhaka*	**CNS** – *Uttejaka, Vedanasthapana, Sanjasthapana, Akshepahara* **GIT** – *Deepana, Pachana, Rochana, Vatanulomana, Shula prashamana, Krimighna* **CVS** – *Hridya* **RS** – *Kapha nissaraka, Shvasahara* **GUS** – *Muthrajanaka, Arthavajanaka, Vajeekaraka*	*Pakshaghatha, Ardhitha, Gudrasi, Akshepa, Agnimandya, Adhmana, Gulma, Krimi roga, Shvasa, Kasa, Hikka, Muthrashula, Vasthishula, Muthrala, Kashtarthava*
9	*Embelia ribes* L. [23]	*Kapha-Vata shamaka*	**CNS** – *Vata shamaka,* **GIT** – *Deepana, Vidahi, Krimighna* **CVS** – --- **RS** – *Kasahara* **GUS** – *Garbhasha utthejaka, Vajeekarana, Muthrakaraka*	*Agnimaandya, Krimiroga, Shvasa, Kasa, Muthrashuula, Muthraghatha, Kashtarthava*
10	*Allium sativum* L.	*Kapha-Vata shamaka, Pitta vardhaka*	**CNS** – *Uttejaka, Vedanasthapana, Medhya* **GIT** – *Deepana, Paachana, Anulomana, Shula prashamana, Krimighna, Yakruth - Uttejaka* **CVS** – *Shothahara* **RS** – *Kapha nissaraka, Khantya* **GUS** – *Muthrajanaka, Shukrajanaka, Arthavajanaka*	*Sandhivata, Gudrasi, Ardhitha, Pakshaghaatha, Urusthambha, Agnimandya, Aruchi, Ajeerna, Krimi roga, Gulma, Hrida roga, Shvasa, Kasa, Muthrakruchcha, Shukradosha, Kashtarthava*

All these features can be directed to the *Pancha-bhautic* nature of the drugs in the *Katukaskandhaya. Shula prashamana* is another action on GIT which may be due to the presence of *Ushna veerya* of ingredients that helps in pain relief by pacifying *Vata dosha*. *Utthejaka, Vedanasthapana, Sanjasthapana* properties can also be seen as the actions of the Central Nervous System. In the Respiratory system, *Kaphaghna, Kaphanissaraka* actions were also reported. These drugs of *Katukaskandhaya* were prominent with *Hridya* and *Shothahara* actions on the Cardiovascular system. *Vajeekarana* (aphrodisiac) effects were also reported in most of these drugs.

According to Ayurveda, *Agni* is considered one of the important concepts and malfunctioning of *Agni* results in the formation of *Ama* which causes diseases [24]. *Agnimandya* is caused due to the reduced function of *Agni* and multiple diseases like *Ajeerna* (indigestion), *Aruchi* (anorexia), *Anaha* (flatulence), *Adhmana* (bloating) are caused due to this. *Samagni* is considered as the best type of *Agni.* Drugs mentioned under the *Katukaskandhaya* are prominent with *Kapha-vata shamaka guna* and it's effective in pacifying and balancing the vitiated *Kapha-vata dosha* and normalizing the function of *Agni.*

Drug groups such as *Deepaneeya Dashakaya, Pippalyadi ghanaya*[25] include many of the drugs mentioned in *Katukaskandhaya* and drug formulae such as *Trikatu,* and *Panchakola*[25] also comprise the drugs mentioned in the *Katukaskandhaya.* These are effective in the management of diseases caused due to vitiated *Kapha dosha*. Traditional texts like *Vaidyaka Sarasanksheepaya*[26] and *Kashaya*

Sagaraya,[25] mention various drug recipes indicated for *Agnimandya* and other disorders caused due to vitiated *Kapha dosha*. Many of these drug recipes include drugs mentioned in the *Katukaskandhaya*.

The chemical nature of the selected 10 drugs was also evaluated in this study and the following table shows the commonly found chemical compositions and their therapeutic effects (Table 4).

The pungent taste is stimulating, invigorating and penetrating, making it an effective way to clear areas of excess moisture that built up stagnation. It also increases circulation, encourages sweating, cleanses blood, muscles and opens internal channels[10]. The pungent properties of medicines, herbs, and spices may be due to the presence of aromatic volatile oils, resins and phytochemicals like glycosides which

Table 4: Analysis of chemical composition and pharmacological actions of selected ten drugs

	Drug (Botanical Name)	Chemical composition	Pharmacological action
1	*Piper longum* L.	1-Piperoylpiperidine (Piperine) is present.	Antioxidant, Anti-inflammatory, immunomodulatory, Anti-asthmatic, Anti-convulsant, Anti-mycobacterial, Anti-amoebic and Anti-cancer activities [27].
2	*Piper nigrum* L.	Terpenoids like α-pinene, β-Pinene, δ3-Carene, Limonene, α-Terpinene-4-ol, p-Cymene. Alkaloids like Piperine [28].	Antioxidant, Antimicrobial
3	*Zingiber officinale* Roscoe	Phenolic compounds like Gingerols, Shogaols, Terpenes, Polysaccharides, Lipids, Organic acids [29].	Antioxidant, Anti-inflammatory, Antimicrobial, Anti-cancer, Neuroprotective, Cardiovascular protective, Respiratory protective, Anti-obesity, Anti-diabetic, Anti-nausea, and Anti-emetic activities.
4	*Plumbago zeylanica* L.	Naphthoquinones, Flavonoids, Alkaloids, Glycosides, Steroids, Tri-terpenoids, Tannins. Plumbagin acid is the most potent and rest are, β sitosterol, 2, 2-dimethyl-5-hydroxy-6-acetylchromene, Sapo-naretin, isoaffinetin [30].	Anti-cancer, Anti-diabetic, Anti-malarial, Anti-microbial activities. Used in Rheumatoid arthritis, Dysmenorrhea, Injury and Cancer [31].
5	*Elettaria cardamomum* L.	α-Terpinol acetate (54.46%) [32]. 1,8-Cineole (20.66 %), Camphene (18.09 %), Camphor (10.02 %), Tricyclene (7.36 %) [33].	Antioxidant Activities
6	*Apium graveolens* L.	Glycosides, Steroide, Furanocoumarin, Flavones, K, Ca and Iron [34]. Caffeic acid, Chlorogenic acid, Apiin, Apigenin, Rutaretin, Ocimene, Bergapten, Seslin, Isoimperatorin, Osthenol, Gravebioside A and B, Umbelliferone [35].	Antibacterial, Antioxidant, Analgesic, Anti-inflammatory and Cytotoxic activities [35].
7	*Brassica alba Boiss* L.	Phenols, Polyphenols, Phenolic acids, Flavonoids, Carotenoids (zeaxanthin, lutein, β-carotene), Alkaloids, Phytosterols Chlorophyll, Glycosylates, Terpenoids, Glycosides [36]..	Antioxidant potential in terms of Metal reducing, Metal chelating, Lipid reducing and Free radical scavenging activities [36].
8	*Ferula assafoetida* L.	It consists of three main fractions, including Resin (40–64%), Gum (25%) and Essential oil (10–17%) [37]. 68% of Carbohydrates, 4% Protein, 1% of Fat, 7% of Minerals, 4% of Fiber.	Relaxant, Memory enhancing, Digestive enzyme, Antioxidant, Antispasmodic, Hepato-protective, Antimicrobial, Anticarcinogenic, Anti-helminthic Antagonistic effect [37].

9	*Embelia ribes* L.	Rich in Essential oils, Alkaloids, Flavonoids, Steroids, Phenolics [38].	Antioxidant activity, Wound healing, Antidiabetic, CNS related disease, Antifertility activity, Antiviral, Anti-obesity, Cardio-protective, Antifungal, Antibacterial [38].
10	*Allium sativum* L.	Rich in Sulfur containing Phyto constituents such as Alliin, Allicin, Ajoene Vinyl dithiins, and Flavonoids such as Quercetin [39].	Anticarcinogenic, Antioxidant, Antidiabetic, Reno-protective, Anti-atherosclerotic, Antibacterial, Antifungal, and Antihypertensive [39].

stimulate the tissues and nerve endings of the mouth with a sensation of sharp and fiery heat. From this analysis, it was clearly understood that most of the selected drugs are present with Anti-microbial, Antioxidant, Anti-inflammatory, Anti-carcinogenic activities along with Free radical scavenging activities. Pungent taste is said to be having effects on warming the body, cleansing, clarifying the sense organs, enhancing digestive fire (*Agni*) and improving digestion, absorption and elimination [40]. *Embelia ribes* L. (*Vidanga*) is well known for its anti-helminthic/ Anti-microbial action (*Krimighna*) [23] and Ayurveda mentions this property as a special potency known as the *Prabhava.* This may be due to the presence of Phytochemicals such as Flavonoids, Phenolic compounds and Alkaloids.

In comparison with modern literature on the chemical nature and medicinal importance of these drugs, it was found that many were having Antioxidant properties. In *Brassica alba Boiss* L., the presence of enzymes such as Superoxide dismutase, Glutathione peroxidase[36] plays a biological role in protecting the organism from oxidative damage. Piperine[27] of *Piper longum* L., Terpenoids[28] (α-pinene) of *Piper nigrum* L., Polyphenols, β carotene[29] of *Zingiber officinale* Roscoe., α-Terpinol acetate[33] of *Elettaria cardamomum* L., β-Pinene, Limonene[37] of *Ferula assafoetida* L. and Alliin[39] of *Allium sativum* L. are some other examples for chemical constituents with Antioxidant activity.

Parmacological actions like Anti-asthmatic, Anti-obesity, Anti-diabetic, and Blood purifying can also be seen in drugs mentioned in the *Katukaskandhaya.*

By comparing and analyzing the pharmacological, therapeutic and chemical properties of the selected drugs, it was clear that the drugs mentioned in the *Katukaskandhaya* had many similar features in all three aspects. This gave a comprehensive analysis with reference to facts mentioned in Ayurveda, the Traditional system of medicine, Allopathic medicine and modern scientific knowledge.

Conclusion

Drugs with a pungent taste (*Katu rasa*) are critically important in balancing excess *Kapha dosha* as it is present with light, rough, sharp properties which eliminate the stagnant, heavy qualities of *Kapha dosha* from the body. These properties help to clear *Ama* (natural toxins) by stimulating the *Agni* (Digestive fire). Hot potency of these drugs also helps in pacifying both the *Kapha* and *Vata dosha*. Once the body is cleansed by removing the unwanted stagnation of vitiated *Dosha, Dhathu, Mala* and *Ama,* healthiness can be re-established and maintained. Antioxidant, Antimicrobial, Anti-inflammatory, Anti-carcinogenic, Neuroprotective, Cardioprotective, Respiratory protective, Anti-obesity, Anti-diabetic, and anti-hypertensive activities are some of the medicinal uses of the drugs of the *Katukaskandhaya.*

Results of the comprehensive analysis conducted with the ten ingredients can be utilized in gaining an overall idea about the medicinal importance and the disease conditions that can be treated by using the most appropriate drugs mentioned in the *Katukaskandhaya*.

Due to a lack of information regarding all the drugs mentioned under the group of Pungent taste

(*Katukaskandhaya*), the study was limited to the analysis of ten ingredients and in future this study will have proceeded with Phytochemical analysis and evaluation of therapeutic effect and efficacy of the compound drug formulae including the drugs of *Katukaskandhaya* in the management of *Kapha-Vataja* disorders.

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