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Studies in effect of in-vitro digestion of some of the *Dravyas* with respect to their *Vipaka* - A Research Article

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ABSTRACT

Vipaka is a unique concept of *Ayurveda*. It is the post digestive effect of any ingested substance. These can be in either of the two forms: *Ahara Dravya* (food) or *Aushadh Dravya* (medicine). Once the digestion of these substances takes place in the gastro-intestinal tract, it is metabolized and transformed into an absorbable form which is called *Vipaka*. In general understanding *Vipaka* is the final bio-transformation of digested food/drug. The term *"Vi"* (of *Vipak*) is *'Vishishta'* means specific or special, and *"Paka"* refers to digestion or the function of *Agni* (digestive power or biological power). Any substance when ingested, it is digested and metabolized by the action of different specific *Agnis* (biological fire) i.e., *Jatharagni*, *Bhutagni*, and *Dhatwagni* of the body. During the entire process, the ingested substance decomposes and re-synthesizes several times for further absorption and assimilation process. This can also be referred to life experiences. In this study we will discuss and concluded different *Dravya* and their *Vipaka*.

Key words: *In Vitro Digestion, Dravyas, Shunti, Haridra, Vipaka, Research Study.*

INTRODUCTION

According to one of the greatest scholars of *Ayurveda*, *Acharya Charak, 'Vipaka'* is referred to as *"Karma Nishthaya,"* which means the *Vipaka* of any herb could be defined by the *Karma* (action) of that particular herb (food/drug). It determines the specific action of the food/drug on the *Doshas* of the body. He explains that the six *Rasas* (the basic constituents of any substance) further produce three kinds of *Vipaka* i.e., *Madhura, Amla* and *Katu*, which determines the specific action of that herb on *Dosha*, *Dhatu* and *Mala*. The relation could be related as below:

1. ***Madhura Vipaka* (sweet) -** *Madhura* and *Lavana* (salty) *Rasa Dravya* produces *Madhur Vipaka*.
2. ***Amla Vipaka* (sour) -** *Amla Rasa Dravya* produces *Amla Vipaka*.
3. ***Katu Vipaka* (acrid, pungent) -** *Katu*, *Tikta* (bitter), *Kasaya* (astringent) *Rasa Dravya* produces *Katu Vipaka*.

However, one must remember that it is not necessary that all *Rasas* produce similar corresponding *Vipaka*. Depending upon the usage or combination of the food/drug, the *Vipaka* may differ. A *Katu Rasa* food may result in *Madhura Vipaka*. Therefore, an understanding of the interaction of different foods/ drugs substances while pairing of food is important.

The tentative action of different types of *Vipaka* could be:

1. *Madhura Vipaka*

- Increases the *Kapha*

- Eliminates the excreta (urine & stool)

- Increases the *Shukra Dhatu* (Reproductive potency)

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2. *Amla Vipaka*

- Increases the *Pitta*

- Eliminates the excreta (urine & stool) smoothly

- Decreases the *Shukra Dhatu* (Reproductive potency)

3. *Kaṭu Vipāka*

- Increases the *Vata*.

- Suppresses the excreta (urine & stool)

- Decreases the *Shukra Dhatu* (Reproductive potency)

In view of the foregoing, it could be concluded that *Vipaka* plays a very major role in digestion and post digestion processes in the body. In *Ayurveda* to study *Dravya* and it properties, different types of *Prmanas* were mentioned, such *as Apta, Anuman, Pratyaksha* etc.

Sholka, Drvyagat, Rasa understand by direct contact with *Rasanedrya, Virya* by *Adhivas* (*Dravya* stay in body for some time and then gives somewhat hot or cold sensation) and *Nipate*. As that *Vipaka* get understand by its *Karma* on *Sharirasta Dosh-Dhatu-Mala*. Due to "*Karmanishtyaya*" nature of *Vipaka*, it has not get easy to understand. Therefor it is necessity to the day to develop an experimental method for the knowledge of *Dravyagat Vipaka*. It is a sincere effort to study the effect of in-vitro digestion of some the *Dravyas* with respect to their *Vipaka* as mentioned in text.

Aims and Objectives

1. To develop a laboratory method for in-vitro digestion of *Dravya* with respect to context of experiment.
2. To study the effect of in-vitro digestion of some of the *Dravyas*.
3. To compare in vitro digestion and *Vipaka*.

Material and Methods

A) Literary method

1. Collection and study of reference regarding *Prapakakriya, Prapaka, Awasthapaka* and *Vipaka*. The *Brahatriyi, Nighantus* were read along with available *Tika* for the reference.
2. Collection and study of references of *Sunthi, Adraka* and *Haridra* were collected from *Bhrahatriyi, Nighntus*.
3. Collection and study of research from physiology, chemistry text books and other reference books.

Sample Preparation

1. ***Shunthi*** - Raw drug collected from local market were grind to fine power.

S1) 1. 50gm of *Sunthi* powder + (50ml of HCl+450ml Distil water {1N} Digested for 3 hrs. on heating mental. 2. After Digestion it was neutralize and distilled by the Clevenger apparatus. 3. Volatile oil was collected and residue was extracted with diethyl ether. 4. The matter does obtain was given to individuals for taste.

S2) 1. 50 gm of *Sunthi* powder + 500ml distil water digested for 3 hrs. on heating mental. 2. after digestion it was distillated by the Clevenger apparatus and oil was collected. 3. Residue was extracted with diethyl ether and ether extract evaporated. 4. The matter does obtain was given to individuals for taste.

S3) Raw *Sunthi* powder **Adaraka* A1) 1. 100 gm of *Ardrak Kalka* + (50 ml of Hcl+450 ml of distil water {1N}) digested for 3 hrs. on heating mental. 2. After digestion neutralize it and distillated by the Clevenger apparatus. 3. Volatile oil was collected and residue was extracted with diethyl ether. 4. The matter does obtain was given to individuals for taste. A2) 1. 100gm of *Adraka Kalka* + 500ml distil water digested for 3 hrs. On heating mental. 2. Digested material was distillated by the Clevenger apparatus. 3. Volatile oil was collected and residue was extracted with diethyl ether. A3) Raw *Ardraka Kalka.*

2. *Haridra*

H1) 1. 50gm of *Haridra* powder + (50ml of HCl+450ml Distil water {1N} Digested for 3 hrs. on heating mental. 2. After Digestion it was neutralize and distilled by the Clevenger apparatus. 3. Volatile oil was collected and residue was extracted with diethyl ether. 4. The matter does obtain was given to individuals for taste.

H2) 1. 50 gm of *Haridra* powder + 500ml distil water digested for 3 hrs. On heating mental. 2. after digestion

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it was distillated by the Clevenger apparatus and oil was collected. 3. Residue was extracted with diethyl ether and ether extract evaporated. 4. The matter does obtain was given to individuals for taste.

H3) Raw *Haridra* powder - #S1 – Digested *Sunthi* #S2 – Undigested *Sunthi* #A1 – Digested *Ardraka* #A2 – Undigested *Adraka* # H1 - Digested Haridra #H2 – Undigested *Haridra.*

OBSERVATION AND RESULTS

1. Volatile oil quantity

SN	Sample	Quantity
1.	S1	0.05 ml
2.	S2	0.1 ml
3.	A1	0.3 ml
4.	A2	0.32 ml
5.	H1	0.2 ml
6.	H2	1.25 ml

2. pH of water saturated volatile oil

SN	*Dravya*	pH
1.	*Shunthi*	Neutral (About 7)
2.	*Adraka*	Neutral (About 7)
3.	*Haridra*	Slightly Alkaline (near about 7.5)

3. Taste of Residue

SN	Sample	Taste
1.	S1	Pungent Absent
2.	S2	Pungent Present
3.	A1	Pungent Absent
4.	A2	Pungent Present
5.	H1	Bitter Absent
6.	H2	Bitter Present

Powder #S1 – Digested *Sunthi* #S2 – Undigested *Sunthi* #A1 – Digested *Ardraka* #A2 – Undigested *Adraka* # H1 - Digested *Haridra* #H2 – Undigested *Haridra*

4. Taste of Ether Extract

SN	Sample	Taste	Taste
1.	S1	On tongue	On lips
2.	S2	Pungent Present	Pungent Absent
3.	A1	Pungent Present	Pungent Present
4.	A2	Pungent Present	Pungent Present
5.	H1	Pungent Present	-
6.	H2	Bitter Present	-

5. Taste of Volatile oil

SN	Sample	Taste or Sensation
1.	S1	Oily sensation without Pungency
2.	S2	Pungent Taste
3.	A1	Oily sensation without Pungency
4.	A2	Pungent without oily sensation
5.	H1	Pungent, pinching sensation
6.	H2	Bitter

Thin layer Chromatography (TLC)

Thin layer Chromatography gives information regarding chemical components present in sample. Thus, here changes in the chemical composition due digestion with respect to undigested *Dravya* can be ascertained by TLC by comparing various band present in their TLC pattern. The ether extract and volatile oil (1 drop of oil dissolved in Ethyl acetate) were spotted on silica. Gel 60 F 254(Merck) plates were run using solvent systems. 1) Toulence 93 : Ethyl Acetate 7 (solvent system used for *Sunthi* and *Adraka*) 2) Chlorofrom 94:ethanol 5:acetic acid 1 (for *Haridra*) RF value of various sample of *Shunthi*, *Adraka* and *Haridra*

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are shown in table . Spray Reagent:- Anasldichyde is used as spraying reagent.

Table 1: TLC of *Sunthi* (Ether extract)

RF	Undigested (S2)	Digested (S1)
0.08	Dull Blue	-
0.1	Dark Blue	Brown
0.16	-	Yellow
0.26	Brown	Brown
0.28	Violet	Violet
0.30	-	Dull Yellow
0.42	Dull Yellow	-
0.46	Dull Blue	Yellow
0.50	Yellow	-
0.62	Pink	-
0.63	Blue	-
0.65	Blue	-

Table 2: TLC of Volatile oil of Digested and Undigested *Adraka*

RF	Undigested (A2)	Digested (A1)
0.06	Blue	Blue
0.09	Dark brown	Brown
0.16	Green	Green
0.18	Brown	Brown
0.21	Blue	Dark Blue
0.24	-	Brown
0.31	Blue	-
0.34	Blueish grey	-
0.36	-	Elongated Blue

Table 3: TLC of Ether extract of Digested and Undigested *Haridra*

RF	Undigested (H2)	Digested (H1)
0.09	Blue	-
0.14	Blue	-
0.19	-	Very Dull Brown
0.02	Broad Brown	Very thin Brown
0.26	Big size Brown	Small size Brown
0.28	Brown inverted arrow	Brown
0.31	-	Brown
0.33	-	Blue
0.36	Very pink	Pink
0.38	Orange	-
0.39	Very Dull Blue	Orange
0.41	-	Blue

DISCUSSION

Jatheragnipaka means the digestion of food under the influence of *Jatharagni*. The term *Jatharagni* was shown earlier to be a synonym of *Pachakpitta*(agni). It may be mentioned here that even through the *Aharpachana* or the digestion of food, under the heading *Avasthapaka - Madhur, Amla, Katu* forms part of the processes comprehended by *Jatheragnipaka*. The outcome of this aspect of *Paka* or digestion has been described as *Vipaka*, which are three, according to *Charaka* and *Vagbhata* viz. *Madhur, Amla, Katu* and according to *Sushruta* there are two *Madhur* and *Katu*.

Vipaka of *Rasa*

Rasa	*Charaka*	*Sushruta*	*Ashtang Samgrah*	*Ashtang Hridya*	*Parashar*	*Yogendranath*
Madhur	*Madhur*	*Madhur*	*Madhur*	*Madhur*	*Madhur*	--

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Amla	*Amla*	*Amla*	*Amla*	*Amla*	*Amla*	--
Lavana	*Madhur*	*Lavana*	*Madhur*	*Lavana*	*Lavana*	---
Katu	*Katu*	*Katu*	*Katu*	*Katu*	*Katu*	*Lavana*
Tikta	*Katu*	*Tikta*	*Katu*	*Tikta*	*Tikta*	*Madhur*
Kashaya	*Katu*	*Kashaya*	*Katu*	*Kashaya*	*Kashaya*	*Amal*

Vipaka also called as *Nishta Paka*. Significant description is as following:-

1. *Karmnishtha* is the completion of actions. The term *Karma* refers to action; *Pari* means fullness or entirely and *Samapti* means conclusion. *Vipaka* refers to the completion of actions of their entirety
2. Even though *Rasa* consumed and undergo transformative changes, the contribution they make by virtue of their special action due to further transformative changes they undergo described as *Vipaka*.
3. *Vipaka* refers to their actions or effects produced by *Rasa* in the *Anna* or *Ahara Rasa*. The outcome of the action of *Jatharagni* on food substance after their *Parinamas* or transformation. As stated By *Acharyas*; three types of *Vipaka* viz. *Madhur, Amla, Katu Rasas* i.e., *Madhur Vipaka* has *Snigdha*, *Shit*, *Guna* like *Madhur Rasa. Sneha, Meda, Pravardhan* seen by the *Madhur Rasa Sevan*. While as *Katu Vipaka* has *Ruksha, Ushana, Guna Jevagra Udvegati* i.e., Pinching sensation on the tip of tongue.

In the experimental study three *Dravyas* were used - *Shunthi, Ardraka, Haridra*.

1) *Shunthi - Zingiber officinale* (Zingiberacceae)

Rasa	*Katu*
Virya	*Madhura*
Vipaka	*Ushna*
Guna	*Laghu, Singdha*

As per modern text *Shunti* have described in following manner

Moisture	8.5 - 16.5
Crude Fiber	4.8 - 9.8
Crude Protein	4.8 - 9.8
Starch	40.4 - 59
Total ash	5.1 - 9.3
Water soluble ash	4 - 8.8
Water extract	14.4 - 25.8
Cold Alcohol extract	3.6 - 9.3
Acetone extract	3.9 - 9.3
Volatile oil	1 - 2.7

After digestion of *Shunti* the total starch present in it was converted in to glucose. Hydrolysis of starch gives n+18 molecules of glucose. (n - no. of glucose molecules) 59% starch present in *Shunti* is converted into huge no. of glucose molecules, which finely gives the sweet taste. In the context of experiment obtain ether extract of digested *Shunti* did not given pungent taste on lips, while as undigested, ether extract was given pungent taste and burning sensation on lips and tongue. The residue of digested *Shunti* does not give any taste while as undigested *Shunti* residue gives pungent taste. The volatile oil of digested *Shunti* gives oily sensation without pungent taste. While as undigested *Shunti's* volatile oil gives rough sensation and pungent taste on tip of tongue. TLC plate also showed remarkable difference in digested and undigested ether extract of *Shunti*. Hence, it can be concluded that the digestive end product *Shunti* has more % of starch (about 59%). Experimental results resemble with the textual references.

Taste of Residue

SN	Sample	Taste
1.	S1	Pungent Absent

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2.	S2	Pungent Present

Taste of Ether Extract

SN	Sample	Taste on tongue	Taste on lip
1.	S1	Pungent present	Pungent Absent
2.	S2	Pungent present	Pungent present

Taste of Volatile oil

SN	Sample	Taste or sensation
1.	S1	Oily sensation without pungency
2.	S2	Pungent taste

TLC of *Sunthi* (Ether extract)

RF	Undigested (S2)	Digested (S1)
0.08	Dull Blue	-
0.1	Dark Blue	Brown
0.16	-	Yellow
0.26	Brown	Brown
0.28	Violet	Violet
0.30	-	Dull Yellow
0.42	Dull Yellow	-
0.46	Dull Blue	Yellow
0.50	Yellow	-
0.62	Pink	-
0.63	Blue	-
0.65	Blue	-

2) *Ardraka - Zingiber officinale* (Zingiberaceae)

Rasa	*Katu*
Virya	*Madhur*
Vipaka	*Ushna*
Guna	*Guru,Ruksha,Tikshna*

Adraka having chemical composition as

Moisture	80.9
Protein	2.3
Fat	0.9
Fiber	2.4
Carbohydrates	12.3
Minerals	1.2 %
Ca	20 mg/100mg
P	60 mg/100mg
Fe	2.6 mg/ 100mg
I	0.82 ppm
F	2 ppm

Vitamins Present

1. Thiamine	0.06mg/100mg
2. Riboflavin	0.03 mg/100mg
3. Niacin	0.06 mg/100mg
4. Vit.C	6 mg/100mg
5. Carotene	40ug/100mg

After digestion of *Ardraka* the total carbohydrate present in it was converted into glucose. Hydrolysis of carbohydrate given n+18 molecules of glucose. The principal carbohydrate of rhizome is starch. The ether extract of digested *Adraka* gives a pungent taste on lips and tip of tongue. While as compare to digested *Adraka* ether extract; undigested *Adraka* ether extract gives more pungent taste and burning sensation on lips and tip of tongue. The residue of digested *Adraka* does not gives any taste; while undigested *Adraka* residue gives a pungent taste. The Volatile oil obtains from the distillation of digested *Adraka* gives oily sensation but doesn't have pungent taste. Volatile oil obtains from

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undigested *Adraka* gives a pungent taste with a rough sensation on tongue. The above description shows resemblance with the textual reference of *Adraka*.

Taste of Residue

SN	Sample	Taste
1.	A1	Pungent absent
2.	A2	Pungent present

Taste of Ether Extract

SN	Sample	Taste on tongue	Taste on lips
1.	A1	Pungent Present	Pungent Present
2.	A2	Pungent Present	Pungent Present

Taste of volatile oil

SN	Sample	Taste or sensation
1.	A1	Oily sensation without Pungency
2.	A2	Pungent without oily sensation

TLC of Volatile oil of Digested and Undigested *Adraka*

RF	Undigested (A2)	Digested (A1)
0.06	Blue	Blue
0.09	Dark brown	Brown
0.16	Green	Green
0.18	Brown	Brown
0.21	Blue	Dark Blue
0.24	-	Brown
0.31	Blue	-
0.34	Blueish grey	-
0.36	-	Elongated Blue

3) *Haridra - Curcuma longa* Zingiberaceae)

Rasa	*Katu, Tikta*
Virya	*Ushna*
Vipaka	*Katu*
Guna	*Laghu, Ruksha*

Haridra contains chemical composition as

Moisture	13.1
Protein	6.3
Fat	5.1
Mineral matter	3.5
Fiber	2.6
Carbohydrate	28
Vit. A	50 IU /100 mg

Ether extract of 1) Digested *Haridra* gives a pinching sensation on tongue. 2) Undigested *Haridra* gives a bitter taste. Volatile oil of digested and undigested *Haridra* gives a bitter taste. In textual reference *Katu Rasa* having a property, *Jevhegra Udvgati*. Curcumin which is the main bitter compound *Haridra* was not seen in TLC Of digested ether extract and volatile oil, but it markly noticeable in undigested volatile oil and ether extract of TLC. Haridra contains nearly half of carbohydrate as compare to *Shunti*. Hence it is concluded that digestive end product of Haridra gives pungent taste and pinching sensation. Experimental results show resemblance with the textual reference.

Taste of residue

SN	Sample	Taste
1.	H1	Bitter Absent
2.	H2	Bitter Present

Taste of Ether extract

SN	Sample	Taste on tongue	Taste on lip
1.	H1	Pungent Present	---
2.	H2	Bitter Present	---

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Taste of volatile oil

SN	Sample	Taste or sensation
1.	H1	Pungent, pinching
2.	H2	Bitter

TLC of Ether extract of Digested and Undigested *Haridra*

RF	Undigested (H2)	Digested (H1)
0.09	Blue	-
0.14	Blue	-
0.19	-	Very Dull Brown
0.02	Broad Brown	Very thin Brown
0.26	Big size Brown	Small size Brown
0.28	Brown inverted arrow	Brown
0.31	-	Brown
0.33	-	Blue
0.36	Very pink	Pink
0.38	Orange	-
0.39	Very Dull Blue	Orange
0.41	-	Blue

CONCLUSION

In-vitro digestive end product of *Shunthi* gives glucose and oily sensation on tongue with the absence of pungent taste. In-vitro digestive end product of *Adarka* gives glucose and oily sensation on tongue as that of undigested *Adraka* gives a rough and burning sensation on tongue with a pungent taste. In-vitro digestive end product of *Haridra* gives pinching sensation on tongue like *Aakarakarbha* (*Anacyclus pyrethrum*) as that of undigested *Haridra* gives a bitter taste. Hence, it can be concluded the end product of in-vitro digestion of *Shunthi, Adraka*, and *Haridra* parallel to the *Vipaka* mentioned in texts.

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