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Original Article

ANALYSIS OF VIPAKA (METABOLIC TRANSFORMATION) OF AN EXTRA-PHARMACOPOEIAL DRUG-BRIDELIA STIPULARIS (L.) BLUME

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ABSTRACT

Objective: The objective of the present study is to explore the *vipaka* of an extra-pharmacopoeia drug *Bridelia stipularis* (L.) Blume belongs to the Euphorbiaceae family.

Methods: 12 Wistar strain albino rats were selected and divided into 2 groups; Group A-Control, Group B-Test group. Each rat was kept in separate metabolic cages provided with a constant amount of water and food per day. Assessment of *vipaka* was done based on the consumption of food, consumption of water, the quantity of faecal matter, urine output, and quantity of water content of expelled faecal matter per day. Assessment of Vipaka was done on the basis of consumption of food; consumption of water; the quantity of faecal matter, urine output and quantity water content of expelled faecal matter per day. Assessment of Vipaka was done on the basis of consumption of food; consumption of water; the quantity of faecal matter, urine output and quantity water content of expelled faecal matter per day.

Results: Absolute values of Group B or test group exhibited significant increase in water consumption ($p<0.01$), wet faecal matter ($p<0.05$), dry faecal matter ($p<0.001$), and food conversion ratio ($p<0.05$), and non-significant increase in food consumption, urine output, faecal water, and body weight.

Conclusion: Based on the preliminary analysis it may be concluded that the drug *Bridelia stipularis* (L.) Blume possess *Madhura vipaka* (Sweet metabolic transformation).

Keywords: *Bridelia stipularis*, *Vipaka, Vipaka assessment*

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INTRODUCTION

Ayurvedic science has got an immense database of herbal drugs. It is becoming increasingly popular worldwide with many chronic conditions responding to it well. On the other hand, the scarcity of popular herbs makes a hindrance to meet this demand. Here arises the need for exploring extra-pharmacopoeial drugs. *Bridelia stipularis* (L.) Blume is one of the extra-pharmacopoeial drugs having wide uses. It is a large woody evergreen climber or straggling shrub belonging to the family Euphorbiaceae and is distributed in South-east Asia like the central and eastern parts of Bangladesh, India, and Myanmar (Kritikar K R *et al.*,1975). Different parts of this plant are applicable for various treatments. Bark decoction is given to children for cough, fever, and asthma and as a gargle for sores in the mouth. Fresh tender leaves are used for the treatment of jaundice and anemia due to pregnancy [1]. Root extract along with the combination of other plant is used to treat herpes [2]. The decoction of wood is used in the treatment of Malaria disease [3].

Ayurvedic pharmacological properties or *rasapancakas* are the fundamental principles of Ayurveda based on which drug actions can be explained. So, for utilizing a new drug in Ayurveda based on Ayurvedic fundamental principles, the knowledge of *Rasa* (Taste), *Guna* (Property), *Vīrya* (Active potency), *Vipaka* (Metabolism) of the drug is mandatory. Since the ayurvedic pharmacological properties of *Bridelia stipularis* not yet been explored, the present study was conducted to assess the *vipaka* of the drug. Vipaka can be defined as the outcome of the biotransformation of the rasa (taste) of a dravya through the action of *jatharagni* [4]. Acarya Caraka well explained the action of *vipāka* on *dośa, dhatu, and mala* [5]. On this footing, an experiment was carried out and assessment of *vipāka* was done based on the consumption of food, consumption of water, the quantity of faecal matter, urine output, and quantity of water content of expelled faecal matter per day.

MATERIALS AND METHODS

Plant material

Bridelia stipularis (L.) Blume was collected from Chelari, Malappuram district, Kerala and authenticated from CMPR (Centre for Medicinal Plant Research), Aryavaidyasala, Kottakkal, Kerala, India (specimen no. CMPR10961).

Preparation of leaf decoction

The decoction was made by the conventional method of *kwātha* preparation as per *Śārngadhara Saṃhita* by taking 16 times water and reduced to 1/8th. The *kwātha* sieved and filtered to remove all the drug particles and reduced in low flame with 15% of talc (IP grade) to get a uniform dried solid mass. Then it was powdered and stored in an airtight container.

Animal

Wistar strain albino rats of either sex between 150–250g body weights were obtained from the animal house attached to the Department of Pharmacology, SDM Centre for Research in Ayurveda and Allied Sciences, Udupi, Karnataka, India following approval of synopsis on 29/05/2017 (Approval No: SDMCRA/IAEC/KT-DG-01). The animals were fed with normal rat diet and water ad libitum throughout the study period. They were acclimatized in the laboratory condition for two weeks before the study. The housing conditions: controlled lighting of 12:12h light and dark cycle, the temperature of 25 °C and relative humidity of about 50%.

Study design

Twelve rats were selected, which were separated into 2 groups. Each rat was kept in separate metabolic cages after proper labeling for identity. The rats were weighed and the group was named as Group A-Control group, Group B–Test group. Each rat from two groups was kept in separate cages provided with a constant amount

of water and food per day. To each rat 200 ml of water and 100g food were provided in the food hopper and bottle holder per day. After 24h the amount of left-over water and food was measured to obtain the quantity of water and food consumed per day, this was recorded for consecutive 5 d without administering the drug to the rats in both groups. On the sixth day onwards the test drug was administered at the dose of 200 mg/kg body weight to the test group and the same procedure was repeated for 10 more days. Quantity of stool and urine was measured every day. On every alternative day, the weight of each rat from all the groups was noted. The parameters recorded for each rat on a day were, food consumption, water ingestion, faecal output (wet fecal-immediate after collection and dry fecal-after keeping in hot air oven for 105 °C temperature for 4 h), faecal water (wet faecal weight-dry faecal weight), urine output and food conversion ratio [Food consumption (divided by) dry faecal weight per day] both in Absolute value and relative value.

Statistical analysis

All the values were expressed as MEAN±SEM (standard error of the mean) and the data were analyzed by the unpaired-test and paired-test. A level of P<0.05 was considered statistically significant. The level of significance was noted and interpreted accordingly.

RESULTS

Table 1: Effect of *Bridelia stipularis* (L.) Blume on food consumption with data presented in terms of absolute value

Group	Food consumption in g/100 g body weight (absolute value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% change
Control	18.14±0.79	15.23±0.60	--
Test drug	15.68±0.52	16.67±0.36	9.46↑

n=6, The expressions were calculated by taking mean±standard error to the mean p-value less than 0.05 was counted as significant in comparison to control

Table 1 shows after administering the test drug, food intake in gm/d was increased by 9.46% in the test group when compared to the control group; however, that increased data were statistically not significant.

Table 2: Effect of *Bridelia stipularis* (L.) blume on food consumption with data presented in terms of relative value

Group	Food consumption in g/100 g body weight (relative value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	7.06±0.28	6.30±0.17	--
Test drug	6.13±0.26	6.60±0.35	4.76↑

n=6, The expressions were calculated by taking mean±standard error to the mean p-value less than 0.05 was counted as significant in comparison to control

Table 2 shows after administering the test drug, food intake in gm/d was increased by 4.76% in the test group when compared to the control group; however, that increased data were statistically not significant.

Table 3: Effect of *Bridelia stipularis* (L.) blume on water consumption with data presented in terms of absolute value

Group	Water consumption in ml/100 g body weight (absolute value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	31.80±0.96	21.58±0.91	--
Test drug	26.7±0.64	26.27±1.03**	21.73↑

n=6, the expressions were calculated by taking mean±standard error to the mean **p-value less than 0.01 was counted as highly significant in comparison to control

Table 3 shows after the administration of the test drug, water intake in ml/d were increased by 21.73% in the test group when compared to the control group; the observed increase was statistically significant at the level of P<0.01.

Table 4: Effect of *Bridelia stipularis* (L.) blume on water consumption with data presented in terms of relative value

Group	Water intake in ml/100 g body weight (relative value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	12.46±0.31	8.63±0.53	--
Test drug	11.04±0.56	10.44±0.74	20.97↑

n=6, The expressions were calculated by taking mean±standard error to the mean p-value less than 0.05 was counted as significant in comparison to control

Table 4 shows after the administration of the test drug, water intake in ml/d were increased by 20.97% in the test group when compared to the control group; however, that increased data were statistically not significant.

Table 5: Effect of *Bridelia stipularis* (L.) blume on urine output with data presented in terms of absolute value

Group	Urine output in ml/100 g body weight (absolute value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	6.68±0.52	4.22±0.46	--
Test drug	5.47±0.38	5.56±0.70	31.75↑

n=6, the expressions were calculated by taking mean±standard error to the mean p-value less than 0.05 was counted as significant in comparison to control

Table 5 shows after the administration of the test drug urine output in ml/d were increased by 31.75% in the test group when compared to the control group; however, that increased data were statistically not significant.

Table 6: Effect of *Bridelia stipularis* (L.) Blume on urine output with data presented in terms of relative value

Group	Urine output in ml/100 g body weight (relative value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	2.75±0.29	2.26±0.56	--
Test drug	2.26±0.20	2.19±0.28	3.09↓

n=6, The expressions were calculated by taking mean±standard error to the mean p-value less than 0.05 was counted as significant in comparison to control.

Table 6 shows after the administration of the test drug urine output in ml/d were decreased by 31.75% in the test group when compared to the control group; however, decreased data were statistically not significant.

Table 7: Effect of *Bridelia stipularis* (L.) blume on the faecal matter (wet) with data presented in terms of absolute value

Group	Faecal matter (wet) in g/100 g body weight (absolute value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	7.47±0.33	7.09±0.54	--
Test drug	9.32±0.72	9.22±0.52*	30.04↑

n=6, The expressions were calculated by taking mean±standard error to the mean *p-value less than 0.05 was counted as significant in comparison to control

Table 7 shows after the administration of the test drug wet faecal output in gm/d was a 30.04% increase in the test group compared to the control group. The increased data were statistically significant ('P' value less than 0.05).

Table 8: Effect of *Bridelia stipularis* (L.) blume on the faecal matter (wet) with data presented in terms of relative value

Group	Faecal matter (wet) in g/100 g body weight (relative value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	3.48±0.18	3.3±0.11	--
Test drug	3.83±0.33	3.64±0.24	10.30↑

n=6, the expressions were calculated by taking mean±standard error to the mean p-value less than 0.05 was counted as significant in comparison to control.

Table 8 shows after administration of the test drug wet faecal output in gm/d was a 10.30% increase in the test group compared to the control group; however, that increased data were statistically non-significant.

Table 9: Effect of *Bridelia stipularis* (L.) blume on the faecal matter (dry) with data presented in terms of absolute value

Group	Dry faecal matter in g/100 g body weight (absolute value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	4.29±0.23	3.79±0.14	--
Test drug	4.96±0.30	4.79±0.15***	26.39↑

n=6, the expressions were calculated by taking mean±standard error to the mean ***p-value less than 0.001 was counted as extremely significant in comparison to control

Table 9 shows after the administration of the test drug, dry faecal output in gm/d was a 26.39 % increase in the test group when compared to the control group. The increased data were statistically significant at the level of P<0.001.

Table 10: Effect of *Bridelia stipularis* (L.) blume on the faecal matter (dry) with data presented in terms of relative value

Group	Dry faecal matter in g/100 g body weight (relative value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	%Change
Control	1.78±0.09	1.56±0.06	--
Test drug	2.04±0.13	1.88±0.12*	20.51↑

n=6, the expressions were calculated by taking mean±standard error to the mean, *p-value less than 0.05 was counted as significant in comparison to control

Table 10 shows after the administration of the test drug, dry faecal output in gm/d was a 20.51 % increase in the test group compared to the control group. The increased data were statistically significant.

Table 11: Effect of *Bridelia stipularis* (L.) blume on faecal water with data presented in terms of absolute value

Group	Faecal water in ml/100 g body weight (absolute value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	4.23±0.16	4.29±0.24	--
Test drug	4.46±0.46	4.47±0.0.24	4.20↑

n=6, the expressions were calculated by taking mean±standard error to the mean p-value less than 0.05 was counted as significant in comparison to control

Table 11 shows after the administration of the test drug, faecal water in ml/d was a 4.2% increase in the test group compared to the control group. The increased data were statistically non-significant.

Table 12: Effect of *Bridelia stipularis* (L.) blume on faecal water with data presented in terms of relative value

Group	Faecal water in ml/100 g body weight (relative value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	1.66±0.06	1.74±0.08	--
Test drug	1.80±0.21	1.79±0.14	2.87↑

n=6, the expressions were calculated by taking mean±standard error to the mean p-value less than 0.05 was counted as significant in comparison to control

Table 12 shows after administration of the test drug, faecal water in ml/d was a 2.87% increase in the test group compared to the control group. The increased data were statistically non-significant.

Table 13: Effect of *Bridelia stipularis* (L.) blume on food conversion ratio with data presented in terms of absolute value

Group	Food conversion ratio (absolute value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	4.28±0.36	4.29±0.18	--
Test drug	3.17±0.08	3.62±0.13*	15.62↓

n=6, the expressions were calculated by taking mean±standard error to the mean *p-value less than 0.05 was counted as significant in comparison to control

Table 13 shows after the administration of the test drug, the food conversion ratio in absolute value was significantly (15.62%↓) decreased in the test group compared to the control group.

Table 14: Effect of *Bridelia stipularis* (L.) blume on food conversion ratio with data presented in terms of relative value

Group	Food conversion ratio (relative value)		
	Preliminary phase mean±sem	Therapeutic phase mean±sem	% Change
Control	3.51±0.19	4.40±0.19	
Test drug	3.18±0.08	3.71±0.21**	15.68↓

n=6, the expressions were calculated by taking mean±standard error to the mean **p-value less than 0.01 was counted as highly significant in comparison to control

Table 15: Effect of *Bridelia stipularis* (L.) blume on body weight

Group	Change in body weight (mean±sem)	% change
Control	1.34±1.13	--
Test drug	3.96±1.74	1.96↑

n=6, the expressions were calculated by taking mean±standard error to the mean p-value less than 0.05 was counted as significant in comparison to control.

Table 14 shows after the administration of the test drug, the food conversion ratio in relative value were significantly (15.68%↓) decreased in the test group compared to the control group.

Table 15 shows after the administration of the test drug, an increase in body weight were observed in the test group compared to the control group. However, the increased data were statistically not significant.

DISCUSSION

The quality or attributes obtained after the completion of the digestion of food or drug are known as *vipaka.* There is a difference in opinion about the number of v*ipākas*. The most accepted one is *Trividha Vipākavāda* (three types of v*ipāka*) which includes *Madhura vipāka, Amla vipāka* and *Katu vipāka* [6]. The effect of v*ipāka* on the body is elaborately explained by Ācarya Caraka. He clearly explained the effect of each *vipāka* on *dośa, dhātu, and mala. At dośa* level, *madhura vipaka is kapha vardhaka*, *amla vipāka* is *pitta vardhaka* whereas *kaṭu vipāka* is *vātā vardhaka in nature*. A*t dhatu* level, *madhura vipāka* may act as *śukravardhaka* and *amla* and *kaṭu vipāka act* as *sukranaśana.* In the formation of *mala, madhura* and *amla vipāka* causes *sruṣṭavinmutrata* whereas *kaṭu vipāka* results in *badhavi ṭmutrata* [7].

During the experimental study, food intake, water intake, faecal wet, faecal dry, faecal water, and urine output were noted as increased. A significant increase in the faecal wet and dry matter along with an increase in faecal water shows the easy evacuation of faeces. This total effect may be considered as *srisṭaviṇmūtrata* (loose and easy evacuation of the bowel) which is the action of both *Madhura vipāka* and *Amla vipāka. Madhura vipāka* is *guru* and *śukrala* i. e Responsible for an increase in body weight and increased spermatogenesis. On the other hand; *Amla vipāka* is just the opposite of it, responsible for decreased spermatogenesis and body weight. In this study in the test drug group, the bodyweight of the rats also increased suggests the action of sweet metabolic transformation.

On a preliminary analysis of *rasa* (Taste) and *vīrya* (active potency) as per available method (SC Dhyani; 2003), it was observed that leaves of the drug *Bridelia stipularis* have *Kaṣāya pradhāna Tikta rasa* (astringent and bitter taste) and *śita vīrya* (cold potency). This indicates that the leaves of the test drug may be a *vicitrapratyayārabdha* (an unusual combination of *pancamahābhūtas*). However, according to Parāśara Acharya, *Kaṣāya* and *Tikta* rasa can be *Madhura vipāka* [8]. Hence it cannot be taken as *vicitrapratyayarabdha* (an unusual combination of *pancamahābhūtas*). *Pittaghna* property of the leaves of *B. stiplaris* also suggests the probability of *Madhura Vipāka.*

The increase in food intake noted as 4.76% and that of faecal dry matter was 20.51%. i.e. the percentage increase in food intake is less when compared with the faecal output. This shows that the drug has some *dīpana* effect and has no *pācana* property. This is also clear from the status of food conversion ratio and change in body weight. Because bodyweight increased only by 2% and FCR (food conversion ratio) was decreased by 15% which means faecal output is greater than food consumption.

CONCLUSION

It is high time to explore the ayurvedic pharmacological properties of extra-pharmacopoeial drugs using available methods which will lend a hand to fend off the problems faced by the Ayurveda community. Based on the preliminary assessment it may be concluded that the drug *Bridelia stipularis* (L.) Blume possess *Madhura vipaka* (Sweet metabolic transformation). To further substantiate the finding, clinical evaluation can be conducted to include it in scientific Ayurveda practice.

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AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

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