MONTH: JULY: AUG -2015

VOLUME: 3, ISSUE: 2

ISSN: 2348-1846

PunarnaV

TITLE

A CLINICAL STUDY OF SUDDHA PUGA (ARECA CATECHU LINN.) IN MADHUMEHA VIS-Á-VIS DIABETES MELLITUS

RAMA KRISHNA ALLAM, DIXIT RENU, REDDY K.V.V.BHASKARA,SAI PRASAD AJV

AN INTERNATIONAL PEER REVIEWED AYURVED JOURNAL
ON LINE BI-MONTHLY AYURVED JOURNAL

www.punarnav.com

Email: explore@punarnav.com, punarnav.ayu@gmail.com

PunarnaV ISSN: 2348 1846
AN INTERNATIONAL PEER REVIEWED AYURVED JOURNAL

A CLINICAL STUDY OF SUDDHA PUGA (ARECA CATECHU LINN.) IN MADHUMEHA VIS-Á-VIS DIABETES MELLITUS

RAMA KRISHNA ALLAM[1], DIXIT RENU [2], REDDY K.V.V.BHASKARA[3],SAI PRASAD AJV[4]

[1] SRF, Dr. A. Lakshmipathi Research Centre for Ayurveda, CCRAS Chennai, Tamilnadu, India, [2] P.G. Lecturer, Department of Dravyaguna,
[3] P.G. Lecturer, Department of Shalya, S.V.Ayurvedic Medical College, Tirupati, A.P, India,
[4] Research officer, Dr. A. Lakshmipathi Research Centre for Ayurveda, CCRAS Chennai, Tamilnadu, India.

ABSTRACT:

Ayurveda is the "science of life", it is one of our richest heritage gifted to us by our ancestors. Through countless transmission from generation to generation it has not lost its original lustre, it is indeed the original natural healing system of India. It is playing a key role for better human health in many incurable, chronic and degenerative diseases by its effectiveness. According to International Diabetes Federation Diabetes Atlas 6, published in November 2013, India has estimated 65 million people are suffering from diabetes with prevalence rate of 6 percent and nearly 77 million people are pre-diabetics. Diabetes mellitus is correlated with Madhumeha due to similar symptomatology in respect etiology, pathogenesis, chemical features & prognosis.

A single blind clinical study was conducted on 30 patients at Department of Dravyaguna of T.T.D's S.V.Ayurvedic Hospital, Tirupati, with Suddha puga (Areca catechu Linn.) within the time frame of 3 months, in all subjects, history taking, clinical examination and laboratory investigations was done, which included screening for DM II as per Proforma advocated by CCRAS, New Delhi. Clinical assessment was carried out with improvement in subjective and objective parameters. The Suddha Puga shows extremely significant ($p<0.001$) results on statistical evaluation in Tingling & burning sensation and Numbness. It shows is very significant ($p<0.01$) reduction in polyurea and weakness and significant in case of cramps on walking ($p<0.05$). Reduction in FBS in successive follow up is very significant ($p<0.01$) and PPBS is extremely significant ($p<0.001$).

***KEYWORDS**: Areca catechu Linn., Diabetes mellitus, Madhumeha, Suddha puga*

INTRODUCTION

CORRESPONDENT:
Dr. Rama Krishna Allam
Senior research fellow
Dr. A. Lakshmipathi Research Centre for Ayurveda,
CCRAS Chennai,
Tamilnadu,
India.

INTRODUCTION

The ancient medical science, the *Ayurveda*, which is experiencing a renaissance at present, is perhaps the most sophisticated and comprehensive approach to health care the world has known. Among the life style disorders Diabetes Mellitus is said to be Worlds second damaging and killer disease mainly for Asian and African countries mainly due to their genetic make-up. The WHO Expert Committee on Diabetes recommended further evaluation of traditional methods of managing this disease, because of high mortality and morbidity arising from its attendant complications and problems associated with the use of conventional anti-diabetic agents.

The disease Diabetes is known as *"Madhumeha"* or *"Kshaudrameha"* in *Ayurveda*. It is one of twenty types of *Prameha*. The etiological factors which are responsible for the development are said to be sedentary life style, excess sleep, intake of excess curd and non-vegetarian food, preparations of milk, freshly harvested grains (like rice) and freshly prepared alcohol, preparations of jaggery etc[1]. Which aggravates *Kapha* associated with *Vata, Pitta* and *Medas* responsible for causation of *Prameha*, but aggravated Vata associated with *Kapha, Pitta* and *Medas* draws *Ojjas, Majja* and *Lasika* in the urinary tract leading to *Madhumeha* [2].

In *Ayurvedic* treatises and *nighantus* there is mention of many anti-diabetic drugs, among them *Puga* is one, *Puga* is not fully established as anti-diabetic drug, it is mainly used as *Mukhadaurgandhanasaka, Krimighna*[3] and recent studies showed that it has Ant diabetic Activity[4], Hepatoprotective activity[5] etc. Ethno pharmacological relevance showed that *Areca catechu* Linn. nut is popular folk remedy for the treatment of Diabetes in Kerala and borders of Tamilnadu.

Puga is mentioned in Vedas by the name *Kramuka* and in ancient *ayurvedic* literature viz. *Brihattrayi, Laghutrayi*. There are many references in A*yurvedic* literature where Puga is prescribed in Prameha, like; *it was* mentioned in *Salasaradi gana* of *Susruta Samhita* and

Asanadi gana of *Astanga Hridayam*, these are *ganas* are indicated in *prameha* and have *Medo-Kaphahara karma* as *Kapha* and *Meda* are the causative factors of *Madhumeha*[6,7]**.** *Kadhira-Kadra-Kramuka kasaya* advised to use in the treatment of *Madhumeha* by *Susruta*[8], *Bhaishajya Ratnavali*[9] and *Cakrada*tta [10]. *Yogaratanara* mentioned *Pugapaka* in *prameharogadhikara*[11].

AIMS AND OBJECTIVES

The present study is carried out to study the anti-diabetic activity of *Puga*, which may help in development of new formulations, chemical entities or as a dietary adjunct to present existing therapy. To evaluate *guna-karma* of *Suddha Puga* (*Areca catechu* Linn.) in *Madhumeha* and to establish appt procedure for *shodhana* of *Puga*.

MATERIAL AND METHOD

A single blind clinical study was conducted on 41 cases of *Madumeha* (Type 2 Diabetes Mellitus) selected from the O.P.D. of Department of *Dravyaguna* of T.T.D's S.V.Ayurvedic Hospital, Tirupati. Out of these, 11 cases did not turn up for follow up, thus the present study include only 30 patients. Some of these cases were already known diabetics more than 4 years and they were reliable on modern medication but the blood sugar was not in control with modern medication, in these cases trail drugs are given along with modern medication and slowly it was tapered off and the patient was brought on trail drugs. While some cases were diagnosed for the first time when they visited with other complaints in our O.P.D., in these cases trail drugs are given directly. All the cases were registered as O.P.D. cases.

INCLUSION CRITERIA

- Patient's in the age group of 25 – 70 years.
- Patients suffering from *Madumeha* (Type II Diabetes) (both Sthula and Krisha) were taken up for the study to evaluate efficacy of present combination.

EXCLUSION CRITERIA

- Patients suffering from Juvenile Diabetes.
- Patients having Chronic Renal Failure and severe Cardio-Vascular Diseases.
- Patients suffering from Diabetic foot ulcer and Diabetes induced complications.

In all subjects, history taking, clinical examination and laboratory investigations was done, which included screening for DM II as per Proforma.

DIAGNOSTIC CRITERIA

All the patients were examined clinically for signs and symptoms of *Madhumeha* (type II Diabetes mellitus) like polyurea, polyphagia, polydypsia, weakness, numbness of limbs, tingling and

burning sensation in sole and palm, cramps in legs and weight loss over few months etc. However new diagnostic criteria given by WHO, was adopted as anchoring diagnostic criteria.

1. Patients having classical symptoms like Prabhutavilamutrata (Polyurea), Karapada daha (Burning sensation in hands and feet) of diabetes with random plasma glucose ≥200 mg/dl (≤400 mg/dl).
2. Increased fasting blood glucose ≥ 126 mg/dl, more than two occasions in different days.
3. Increased post-prandial glucose ≥ 200 mg/dl.

A patient filling any two of the above this criterion was confirmed having diabetes.

INVESTIGATIONS

Hematological Investigations	Urine Analysis	Biochemical Examinations
• TC • DC • Hb% • ESR	• Routine – Microscopic	• Fasting Blood sugar • Postprandial Blood sugar

Shodhana of Puga:

Sharangadhara mentioned *kramuka* as an example of *vikasi guna* in the *karma paribhasha* chapter [12]. After going through the different *nighantus*, **it was found that *vikasi, ojonashaka*** property seen only in ***apakva- adrapuga***[13, 14] as it said to be *visha samana*. *Acharyas* have indicated use of *Puga* in *Madhumeha*, which is one of the *vataja prameha* manifestation due to *shaithilya abaddhatva* of *dhatus* and *Ojas kshaya.*

In *Bhavaprakash Nighantu* mentioned that *Puga* should be boiled in ***"Chooghar"*** [15] **(***Decoction of* Jambupatra *and bark, Manjista Khadira sara, Raktachadana, Guda and Eranda taila*) for *shodhana* purpose. So the *Puga* was purified in *Choughar* before using for treatment. The raw form of trail drugs *Saptacakra* and *Puga* were taken for the studies and were pounded to powder form in the department of *Dravyaguna*. Asuddha Puga was purified in department of *Rasashastra*, T.T.D's S.V.Ayurvedic College, Tirupati.

DRUG ADMINISTRATION

Dose: 5 g given in two divided doses i.e 2.5 g twice a day

Anupana: Water

Drug Intake: 12 hourly with empty stomach

Duration: 3 Months

Diet and life style- All the patients during the treatment were directed to follow the

dietary restrictions and to perform mild exercise.

Parameters of assessments

Criteria to assess the effect of the trial drug

All the selected patients were advised to come for follows up at every 15 days interval up to three 3 months.

SUBJECTIVE ASSESSMENT

This is completely depended upon symptomatology and grading depending on symptoms told by patient. In each follow-up, patients were assessed for the subjective improvement. This clinical symptomatology was divided into four grades (0-3) and changes in gradations of each symptom were assessed. The clinical grade was decided a follows.

TABLE NO: 1 - SCALE OF SYMPTOMS OF CASES

Symptoms	Score	Grade	Grading Criteria of Symptoms
Polyurea	0	Absent	Normal frequency 1-4 times in a day, 0-2 times at night and normal volume.
	1	Mild	Frequency 5-7 times/day, 3-5 times/night with normal volume
	2	Moderate	Frequency 8-10 times/day, 3-5 times/night with excessive volume
	3	Severe	Frequency > 10 times/day, > 8 times/night and with excessive volume
Polydypsia	0	Absent	Normal 1.5-3 L/day
	1	Mild	Increased but controlled; 3-4 L/day
	2	Moderate	Increased but uncontrolled ; 4.5 L/day
	3	Severe	Very much increased ; > 5 L/day
Polyphagia	0	Normal	Main meal 2, light breakfast 1/day
	1	Mild	Main meal – 2 light breakfast 2-3/day
	2	Moderate	Main meal 2 , but light breakfast 3-5/day
	3	Severe	Main meal 2 Or 3 light breakfast > 5/days
Weakness	0	Absent	No feeling of weakness
	1	Mild	Mild feeling of weakness
	2	Moderate	Routine activities disturbed
	3	Severe	Severe weakness leading to bed ridden.
Loss of weight	0	Absent	0-2 Kg /year
	1	Mild	Above 2-4 Kg / year
	2	Moderate	Above 4-6 Kg/year
	3	Severe	>6 kg/year
Other Complications			
Cramps on walking	0	Absent	No Cramps
	1	Mild	Cramps after walking 1 km
	2	Moderate	Cramps after walking ½ km
	3	Severe	Inability to walk even up to ½ km
Tingling and burning sensation	0	Absent	No tingling and burning sensation
	1	Mild	Sense of burning and tingling in palm and soles of mild degree.
	2	Moderate	Sensation like crawling of ants all over the body and burning that hampers patient's routine work.

	3	Severe	Loss of sensation

Objective Assessment:

Fasting and post prandial blood sugar test before treatment and after each follow up.

OBSERVATION AND RESULTS

1. Demographic Profile

TABLE NO: 2 - Demographic of general profile and personal profile

PROFILE		NO. OF PATIENTS (%)
Age group	25-35	3 (10%)
	36-45	9 (30%)
	46-55	8 (26.6%)
	56-65	9 (30%)
	66-75	1 (3.33%)
Sex	Female	8 (2.66%)
	Male	22 (73.33%)
Marital status	Married	30 (100%)
	Unmarried	0 (0%)
Religion	Hindu	26 (86.66%)
	Muslim	4 (13.33%)
Occupation	H/W	6 (20%)
	Unemployed	0 (0%)
	Labour	8 (26.66%)
	Business	6 (20%)
	Employee	4 (13.33%)
	Retired	3(10%)
	Agriculture	3(10%)
Habitat	Urban	20 (66.66%)
	Rural	10 (33.33%)
Socio-economic status	Lower	15 (50%)
	Middle	12 (40%)
	Upper	3(10%)
Education	Illiterate	7 (23.33%)
	Primary school	41 (3.33%)
	High school	10 (33.33%)
	Intermediate	3 (10%)
	College	6 (20%)
Dietary habit	Veg. Diet	6 (20%)
	Mixed Diet	24 (80%)
Digestive power	Good	10 (33.33%)
	Average	12 (40%)
	Poor	8 (26.66%)
Addiction	No addiction	10 (33.33%)
	Tobacco	1 (3.33%)
	Smoking	5 (16.66%)
	Alcohol	9 (30%)
	Tobacco + Smoking	0 (0%)
	Smoking + Alcohol	5 (16.66%)
Bowel habit	Regular	14 (46.66%)

	Irregular	16 53.33%)

TABLE NO: 3 - Demography of Clinical Profile

PROFILE		NO. OF PATIENTS (%)
Total duration of illness	**0-3 yrs**	12 (40%)
	4-6 yrs	5 (16.66%)
	>6yrs	13 (43.33%)
Family history	**Present**	17 (56.66%)
	Absent	13 (43.33%)
BMI	**Normal**	8 (26.66%)
	Over weight	8 (26.66%)
	Obese	14 (44.66%)
Physical activity	**Active**	9 (30%)
	Moderately active	13 (43.33%)
	Sedentary	8 (26.66%)

TABLE NO: 4- Chief Complaints

Chief Complaints	Polyurea	Polydypsia	Polyphagia	Weakness	Loss of weight	Cramps on walking	Tingling and burning sensation	Numbness
No. of patients	13 (43.33%)	7 (23.33%)	7 (23.33%)	17 (56.66%)	**6 (**20%**)**	9 (30%)	20 (66.66%)	18 (60%)

TABLE NO: 5- Associated complains

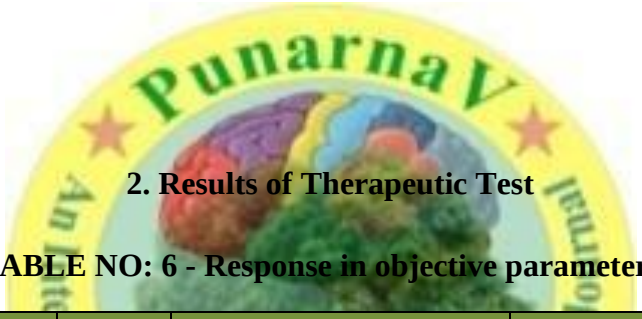
Associated complains	Not any	HTN	UTI	HTN + UTI	HTN + Other	UTI + Other	Other
No. of patients	6 **(**20%**)**	9 (30%)	2 (6.66%)	2 (6.66%)	8 (26.66%)	2 (6.66%)	1 (3.33%

Out of 30 patients 9 cases each are between the age group of 36- 45 years and 56-65 years respectively. This is considered to be most vulnerable group of this disease, but the trend of 3 patients of diabetes between age group of 25-35 years shows early onset of disease due to modernization. 22 male patients were seen having diabetes; it seems that males are more prone to develop diabetes due to the family burdens and stress. In the study of BMI, 14 patients show the overweight is also the cause of Diabetes Mellitus because of change in food habits and sedentary life style. (Table No-2)

It was noted that 13 patients suffering with *Madhumeha* had no family history. This is inexcusable surprise of Diabetes

Mellitus being acquired to the patients who don't have any family history, though it is said to be *Bijadoshaja vyadhi* (i.e., genetically in nature) in *Ayurveda* [16].This may be due to stressful condition. It is also observed that 13 patients among 30 having moderately active life style were found more prone to diabetes. This is one of the *nidana* mentioned by *car*aka (*Asyasukham)* [17]. (Table No-3)

Polyurea, polydypsia, polyphagia, weakness, loss of weight, cramps on walking, tingling and burning sensation of limbs and numbness were the common symptoms mainly reported by the patients. In associated complaints maximum patients were seen to suffer from hypertension. It was observed that there was the increased tendency of irregular bowel habits in 16 patients of *Madhumeha*. This was relieved significantly by *Puga* as it is said to have *Sara* and *Bhedana guna*[18]. (Table No-4 & 5)



2. Results of Therapeutic Test

TABLE NO: 6 - Response in objective parameters

OBJECTIVE PARAMETERS	BT Mean + S.D.	AT			Within the group Paired' t' test value BT-F3	Mean difference
		F1	F2	F3		
Fast Blood Sugar	155 ± 25.760	147.3 ± 17.205	137.8 ± 22.009	133.2 ± 17.048	t = 3.560 p = 0.0061 very significant	21.8 ± 19.367
Post Prandial Blood Sugar	261 ± 48.325	243.4 ± 43.648	230.9 ± 45.18	207 ± 50.235	t = 5.007 p = 0.0007 extremely significant	53.4 ± 33.725

TABLE NO: 7 - Response in subjective parameters

SUBJECTIVE PARAMETERS	BT Mean + S.D.	AT			Within the group Paired' t' test value BT-F3	Mean difference
		F1	F2	F3		
Polyurea	1.1 ± 1.101	0.9 ± 1.1005	0.6 ± 0.6992	0.4 ± 0.6992	t = 3.280 p = 0.0095 Very significant	0.7 ± 0.6749
Polydypsia	0.4 ± 0.9661	0.6 ± 1.075	0.4 ± 0.6992	0.5 ± 0.8498	t = 0.5571 p = 0.5911 Not significant	0.1 ± 0.5676
Polyphagia	0.5 ± 0.7071	0.6 ± 0.9661	0.7 ± 1.0593	0.4 ± 0.6992	t = 1.000 p = 0.3434 Not significant	0.1 ± 0.3162
Weakness	1.1 ± 1.101	1 ± 1.0541	0.8 ±1.0328	0.5 ± 0.7071	t = 3.6742 p = 0.0051 Very significant	0.6 ± 0.5164
Loss of weight	0.8 ± 0.9189	0.8 ± 0.9189	0.6 ± 0.6992	0.8 ± 1.033	t = 0.000 p = >0.999 Not significant	0 ± 0.4714
Cramps on walking	0.9 ± 1.101	0.6 ± 0.8433	0.3 ± 0.6749	0.3 ± 0.4830	t = 2.714 p = 0.0239 significant	0.6 ± 0.6992
Tingling and burning sensation	1.6 ± 1.075	1 ± 1.0541	0.6 ± 0.8433	0.3 ± 0.6749	t = 4.993 p = 0.0007 extremely significant	1.3 ± 0.8233
Numbness	1.8 ± 1.135	1.4 ± 1.1738	1.2 ± 1.0328	1 ± 0.8165	t = 6.000 p = 0.0002 extremely significant	0.8 ± 0.4216

In subjective parameters the *Puga* shows extremely significant ($p<0.001$) results on evaluation in Tingling & burning sensation and Numbness. It shows is very significant ($p<0.01$) reduction in polyurea and weakness and significant in case of cramps on walking ($p<0.05$). Reduction in polydipsia, polyphagia and loss of weight are not significant ($P > 0.05$). (Table No-6)

While in objective parameters, reduction in FBS in successive follow up is very significant ($p<0.01$) and PPBS is extremely significant ($p<0.001$). This shows that *Suddha puga* proved better, in lowering the PPBS than FBS. (Table No-7)

DISCUSSION

Kramuka having *kasaya* and *katu rasa, guru* and *snigdha guna, katu vipaka* and *sita virya* (which is different from general and logic relation of *Rasa, Guna, Virya* and *Vipaka*) also *kaphapittasamana* properties, with *dipana, pacana, sara* and *bedana* actions [19]. According to *Madanapala nighantu and Bhavaprakash nighantu* [20, 21], *the puga* which is made *svinna* and *shodhana* at a time, said to have *snigdha guna* and *tridosahara* property, which is main action of *puga* in *Madhumeha*, as *Madhumeha* is also said to be *tridosaja.*

Most of the drugs used for *shodhana* of *puga* are of *kasaya rasa* and *sita virya*, which will pacify the *vikasi guna* of *puga* and potentiate the *puga gunas* for the treatment of *madhumeha*. So the *Puga* was purified in *Choughar* before using for treatment. After final preparation it was observed that the colour changed to reddish brown and rasa of puga was also found to be mild *Madhura* and *Kasaya rasa*. *Bhaishjayaratnavalikara* in *Shularoga Cikitsa* described *Pugakhandha* as *parama vaajikara* in which *pakva-svedita puga* is main ingredient. [22]

Kasaya rasa acts as *kleda-medovishoshaka* along with *katu rasa* and *ruksha guna* which helps to remove obstructions to *srotas*. *Bhedana guna* of *puga* breaks accumulated *dosas* and *sara, recana gunas* help in removing *dosas* from body. The *dipana* and *pacana karma* helps in improving *jatharagni* and *dhatvagni*, so, futher formation of *ama, kleda* will be prevented and impaired formation of *dhatus* will be corrected. *The kasaya, madhura rasa*, and *snigdha guna, tridosasamaka, kapha- medo-kledahara,* reduces the *bahumutratva abaddhatva* symptom of *madhumeha.*

CONCLUSION

Extremely significant ($p<0.0001$) reduction in Numbness is due to *Madhura rasa* and *Snigdha guna* of *Suddha Puga* which alleviates *Vata*. The *Suddha Puga* has *Rasayana/ Vajikarna karma*, so its shows very significant results in ($p<0.01$) in weakness. Very significant reduction in ($p<0.01$) in polyurea is due to *stambhana* property of *Kasaya rasa* of *Puga*. Results show that *Suddha puga* proved better, in lowering the PPBS than FBS, this might be due to its *dipana* and *pacana karma* and *Katu vipaka* of *Suddha Puga*, which pacifies *Kapha* and *Meda.*

This was a pilot study performed in limited time with limited resources. Exploration of its other related aspects in language of modern science is a subject of further research. We hope that this pilot study will be helpful for the researchers in year to come.

REFERENCES

1. Sharma RK, Bhagwan Dash. Caraka Samhita (Eng. Translation) Vol. III (Chikitsasthana Chp. I-XIV). Varanasi; Chaukhamba Sanskrit Series Office; Sloke 4, p. 298
2. Sharma RK, Bhagwan Dash. Caraka Samhita (Eng. Translation) Vol. III (Chikitsasthana Chp. I-XIV). Varanasi; Chaukhamba Sanskrit Series Office; Sloke 5-6, p. 299
3. P.V.Shrama, Dravyaguna Vignanam, published by Chowkhambha vidya bhavan, Banaras, 1956, part II and III, P. 455-457.
4. Suvankar Mondal, Snjib Bhattacharya and Moulisha Biswas, Antidiabetic activity of Areca catechu leaf extract against streptozotocin induced diabetic rats, Journal of Advanced Pharmacy Education & Research, 2012;2 (1) P.10-17.
5. Pimolpan Pithayanukul, Saruth Nithitanakool and Rapepol Bavovada, Hepatoprotective potential extracts from seeds of Areca catechu and Nutgalls of Quercus infectoria, Molecules 2009,14,P.4987-5000
6. Susruta,Susruta Samhita, translation and edited by Kaviraj Kunjalal Bhishagranta; published by Chowkhambha Sanskrit series, Vol - l Sutrasthana, Sloke 10, P. 344 .
7. K.R.Krishmurthy, Ashtanga Hridaya, Vol –l, krishnadas academy, Varanasi,1992 Sutrasthana, Sloke 19-20, P. 202-203.
8. Susruta, Susruta Samhita, Enghlish translation and edited by Kaviraj Kunjalal Bhishagranta; published by chowkhambha Sanskrit series, Vol –

ll, Chikitsasthana, Sloke 7,P. 375-376.

9. Rajeshwaradutta Shastri, Bhaishajya Ratnavalli, published by Chowkambha Sanskrit series, Varanasi,1961, Prameha Chikista, Sloke 42, P. 510.
10. P.V.Sharama, Chakradatta, text with English translation published by Chowkhambha orientalia, Varanasi,1994, Prameha Chikista, Sloke 14, P. 301.
11. Yogaratanakara, Yogaratanakara, Sanskrit book, published by Chowkhambha Sanskrit series office, Banaras, 1955. Premhachiksta/ Pugapaak/ Sloke 1-2, P.569 .
12. Sri Radha Krishna Parasara, Sarangadhra Samhita, published by Vaidhyanath Ayurveda Bhavan, Calcutta,1961, Sloke 20, p. 53.
13. G.S Pandeya, Bhavaprakash , Chowkanbha vidyabhavan Varanasi, Amardi phala varga, Sloke 43-44, P.447.
14. *Dr Satish Chandra Sankhyadhara, Raj Nighantu of Sri Narhari Pandit.* , Published by *Chaukhambha* publications, New Delhi, India (*2012),* Amradi varga (phala varga), P. 627.
15. Bhavamisra, Bhavaprakasha Nighantu, with Commentary by Krishnachandra Chunekar, Edited by Gangasahaya Pandey, Chaukambha Bharati Academy, Varanasi, Reprint 1999. P.551.
16. Sharma RK, Bhagwan Dash. Caraka Samhita (Eng. Translation) Vol. III (Chikitsasthana Chp. I-XIV). Varanasi; Chaukhamba Sanskrit Series Office; Sloke 57, p. 315.
17. Sharma RK, Bhagwan Dash. Caraka Samhita (Eng. Translation) Vol. III (Chikitsasthana Chp. I-XIV). Varanasi; Chaukhamba Sanskrit Series Office; Sloke 4, p. 298.
18. P.V.Shrama, Dravyaguna Vignanam, published by Chowkhambha vidya bhavan, Banaras, 1956, part II and III, P. 455-457.
19. P.V.Shrama, Dravyaguna Vignanam, published by Chowkhambha vidya bhavan, Banaras, 1956, part II and III, P. 455-457.
20. Madanapala , Madanaplanighantu published by Krishnadoss, Bombay 1961 phaladi varga, Sloke 98-101,P. 153.
21. G.S Pandeya, Bhavaprakash, Chowkanbha vidyabhavan Varanasi, Amardi phala varga, Sloke 43-44, P.447.
22. Rajeshwaradutta Shastri, Bhaishajya Ratnavalli, published by Chowkambha Sanskrit series, Varanasi,1961, Shularoga Chikista, Sloke 227, P. 463-464.