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A REVIEW ON THE THERAPEUTIC ROLE OF *VADAM TAILA* THROUGH NASYA (*PRUNUS AMYGDALUS* BATSCH) IN *AVABAHUKA* AS A SINGLE DRUG

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ABSTRACT

The concept of using only one herb for the purpose of treatment of diseases or as health supplements is very rapidly spreading all over the world. *Ayurveda* takes into account the action of drug in it's entirely. It holds that the action of the whole drug is often different from that anyone of its constituents considered separately. And is using single drug as primary aspect of treatment in different forms to increase the efficacy of the medicines according to the feasibility of the patient i.e. according to patient's *agni*, *bala*, *dosha-dushya* status, disease status etc. Now- a- days single drug therapies are preferred because:- the non-availability of reliable & standardised drugs, their high cost & ambiguity in the identity of the ingredients used are few of the major problems encountered today in the utilisation of compound drugs in *Ayurveda*. There is, thus an urgent need to re-emphasize the use of single plant drug formulations recorded in the classical texts.

KEYWORDS: *Ayurveda*, single drug, *vadam taila*, *avabahuka*, etc.

INTRODUCTION

The concept of using only one herb for the purpose of treatment of diseases or as health supplements is very rapidly spreading all over the world.

Single herb therapy is one such simple method which has already been followed from decades together as tradition in households for mild ailments.

Single Drug Appreciation in *Ayurvedic* Classics

Acharaya CHARAKA states – "*a single drug may have many applications owing to its diverse actions just as a man is able to perform various actions".*

Also there is description on single drugs by the name *AGRYA DRAVYAS,* which means the best drugs for diseases in particular.

In *CHARAKA. SU. 25*th chapter

In *ASTANGA HRIDYAM.U. 40*th chapter

In *ASTANGA SUTRA. SU. 13*th chapter

Acharaya Charaka mentioned a unique concept of *Trisutra* which consists of *hetugyan*, *lingagyana* and *ousadhigyana*.

In *Kayachikitsa hetu*, *linga*, and *ausadhi gyan* is also mandatory. So before going to clinical study a clinician should go through the vivid study of his weapon that is Drug.

In present study *vadama taila* has been considered as a weapon that is drug introduced through reputed therapy named '*Nasyakarma'*. It is clearly mentioned by *Charaka* that there are four limbs of therapy means *Visak* (Physician), *Dravya* (Medicine), *Paricharaka/Upasthata* (Attendent), *Rogi* (Patient).

So the second most important limb (*dravya*/Medicines) to be studied vividly and carefully. Otherwise the *chikitsa karma* (treatment) could not be successful. What is drug, where it came from, what is its' nature, how it is collected, what properties does it have and how will it work should be known by Researcher who will introduce the same in a treatment project to throw a clear light to the scientific world as well as to the scholar of the field.

Now- a- days single drug therapies are preferred because:- the non- availability of reliable & standardised drugs, their high cost & ambiguity in the identity of the ingredients used are few of the major problems encountered today in the utilisation of compound drugs in *Ayurveda*.

The *Acharayas* of *Ayurveda* were well versed in the name, form & properties of herbs & herbal formulations & also the principles of governing the application of single drug formulations.

Aims and Objectives of This Study

1. To analyse the therapeutic effect of *vadaam taila* in *avabahuka* as a single drug.
2. To prove single drugs as convenient and user friendly.

MATERIALS AND METHODS

Classical texts and commentaries were studied to compile the properties and actions of *vadaam taila* in *avabhauka.*

***Vadama*[1]**

- Botanical Name - *Prunus amygdalus* Batsch
- Family – *Rosaceae*
- Synonyms – *Vatada, Vatavairi, Netrapamaphala, Suphala*

Vernacular Names

Hindi – *Vadam, Vdam*

Bengali – *Bilati vadam*

Mar – *Vdam*

Guj – *Vdam*

Tel – *Vdam*

Tam – *Vadumai*

Pha- *Vdam*

Ara- *Lozal*

Eng – Almond

Parts used: Kernel, Oil extracted from the seeds.

Vadam* in *Vruhatrayis

Charaka Samhita[2]

- *Guru, Usna, Snigdha*
- *Madhura rasa, kaphapittakara*
- *Balya, Vatasamaka, Mamsavardhak*

***Susruta samhita*[3]**

- *Snigdha, Usna, Guru*
- *Madhura, Pitta kapha nasaka, Vatanasaka*
- *Vrumhana, Valakarak*

***Astanga Hrudaya*[4]**

- *Sara, Usnavirya*
- *Kaphapittakara*

Quality of *Vatada Tailam* (acc to *Atreya Samhita*)

- *Mridukarak*
- *Vajikarak*
- *Vayupittanasak*

Different *Nighantus*

- **Table showing properties of *VADAMA* as per different *Nighantus.***

	***BPN*[5]**	***KaN*[6]**	***Ma N*[7]**	***ShaN*[8]**	***NA*[9]**	***SnkN*[10]**
Guna Madhura	+	+	+	+	+	+
Snigdha	+	+	+	+	+	+
Guru	+	+	-	+	-	-
Virya Usna	+	+	+	+	+	+
Vipaka Madhura	-	+	-			

Table showing *Dosika karma* of *VADAMA* as per different *Nighantus.*

	BPN	***KaN***	***Ma N***	***ShaN***	***NA***	***SnkN***
Vatashamak	+	+	+	+	+	+
Pittashamak	-	-	-	-	-	-
Kaphashamak	-	-	-	-	-	-
Vata kopaka	-	-	-	-	-	-
Pitta Kopaka	+	+	-	+	+	+
Kapha kopaka	-	+		+		+

Table showing therapeutic uses of *VADAMA* as per different *Nighantus.*

	BPN	***KaN***	***Ma N***	***ShaN***	***NA***	***SnkN***
Dhatuvardhak	-	+	-	-	-	-
Valakarak	-	+	+	-	-	-
Dahanasak	-	+	-	-	-	-
Kshayanasak	-	+	-	-	-	-
Sukrakarak	+	-	+	+	+	+
Vajikarak	+	-	-	-	+	-
Lavanyavardhak	-	-	-	+	-	+
Siraroganasak	-	-	-	-	-	+
Mehanasak	-	-	-	-	-	+
Poustik	-	-	-	+	-	+
Raktapittanasak Raktavikarnasak	-	+	-	+	-	+
Raktapittakarak	+	-	-	-	-	-
Saraka	-	-	-	+	-	+

In *Shaligram Nighantu* the qualities have been expressed as below:

- It is included in *Phalavarga*;
- *Vadama* In general:
- *Saraka*
- *Usna*
- *Guru*
- *Amla*
- *Kaphaprada*
- *Snigdha*
- *Kasaya*
- *Sukrajanaka*
- *Vatanasaka*
- *Usnavirya*

- **Qualities of *Ama vadama***
- *Saraka*
- *Guru*
- *Pittala*
- *Kaphapittakara*
- *Vatanasaka*

- **Qualities of *Pakva Vadama***
- *Madhura*
- *Vrisya*
- *Snigdha*
- *Poustika*
- *Sukrala*
- *Kaphakari*
- *Raktapittanasak*

- **Qualities of *Suska*(Dried) *Vadama***
- *Madhura*
- *Dhatuvardhak*

- *Snigdha*
- *Vrisya*
- *Valakari*
- *Poustik*
- *Kaphakari*
- *Vatapittanasak*

Sweet and Bitter almonds

The sweet almond is more popular for obvious reasons. Like the olive, the almond provides food and oil, and both are produced with little effort from the former. A compound which is called 'Amygdaline' differentiates the bitter almond from the sweet almond. In the presence of water (hydrolysis), amygdaline yields glucose and the chemicals, benzaldehyde and hydrocyanic acid (HCN). HCN, the salt of which is known as cyanide, is poisonous.[11]

Nutritional value/ Pharmacology

The edible portion of the *Prunus amygdalus* is it nuts, which are commonly known as almonds or *badam*, and it is a popular, nutritious food. The almond, which is known as the king of nuts, is a highly nutritious food. Almonds are rich in healthy fats, proteins, minerals and vitamins. In addition to its nutritional values, it has some medicinal values that may be helpful for treating certain diseases and health problems. The almond is an effective health building food, both for the body and the mind; it is also a valuable food remedy for several common ailments. The nuts of *Prunus amygdalus* are found to possess various pharmacological properties, such as anti-stress[12] antioxidant[13] immunostimulant[14] lipid lowering[15] and laxative.[16] The almond is highly beneficial in preserving the vitality of the brain, strengthening the muscles and prolonging life. Almonds are a useful food remedy for anaemia, as they contain copper, iron and vitamins.

Phytochemistry

Almonds are a good source of nutrients which are associated with the health of the heart, such as vitamin E, mono unsaturated fatty acids, poly-unsaturated fatty acids (PUFA), arginine, and potassium.[17] Almonds are among the richest food sources of vitamin E, as RRR-α-tocopherol. Almonds also contain a variety of phenolic compounds which are localized principally in their skin, including flavonols (isorhamnetin, kaempferol, quercetin, catechin and epicatechin), flavanones (naringenin), anthocyanins (cyanidins and delohinidin),

procyanidins, and phenolic acids (caffeic acid, ferulic acid, P-coumaric acid and Vanillic acid).[18]

The active constituents of almonds are globulins such as amandine and albumin and amino acids such as arginine, histidine, lysine, phenylalanine, leucine, valine, tryptophan, methionine and cystine. Almonds contain proteins and certain minerals such as calcium and magnesium. They are also rich in dietary fiber, B vitamins, essential minerals and mono unsaturated fat. Almonds also contain phytosterols which are associated with cholesterol-lowering properties. The phytosterol content of almonds is 187 mg/100mg.[19] Almonds contain approximately 49% oils, of which 62% is mono-unsaturated oleic acid (an omega-9 fatty acid), 24% is linoleic acid (a poly unsaturated omega 6 essential fatty acid) and 6% is palmitic acid (a saturated fatty acid).[20] A trace of arachidic acid has also been found. Oleum amygdale, the fixed oil, is prepared from either variety of almonds and it is a glyceryl oleate, with a slight odour and a nutty taste. It is insoluble in alcohol, but it is readily soluble in chloroform.

Almond oil is produced by pressing the almonds without their peels. The sweet almond contains about 26% carbohydrates (12% dietary fiber, 6.3% sugars, 0.7% starch and the rest are miscellaneous carbohydrates); and can therefore be ground into flour to make cakes and cookies for low carbohydrate diets. The sweet almond oil contains fatty acids like palimitic acid, palmitoleic acid, stearic acid, oleic acid, linoleic acid, alpha linoleic acid, arachidic acid, eicosanoic acid, behenic acid, and erucic acid. Sweet almond oil is obtained from the dried kernels of the almond tree and it has excellent emollient properties.

Why this oil *(VATADA TAILA)* selected

Avabahuka is a disease caused by *kupita vata dosa* localizing around the *amsa pradesa* causing the *shosana* of *amsa sandhis*, thereby leading to *akunchana* of *sira* at that site and giving rise to *bahupraspandana harastwam.*

According to *Acharya Bagbhatta, vrumhaniya nasya* is indicated in *avabahuka*.

Vruhatrayis and *Nighantus* advocated that *Vadama / Vatada* is a *vrumhaniya dravya*.

According to *Bhavamisra/ Bagbhatta* the *Guna* of the oil and the *Guna* of the original *dravya (swayoni)* are same *(Bhavaprakash, tailavarga).* So it can easily be inferred that the *Vatada taila* is also *vrumhaniya*. That is why this *Vadama* oil is choosen for the present study.

So in present work an effort has been taken through literary study to assess the role of *Vadama/Vatada taila* in the case of *avabahuka* in the form of *nasya*.

Researches already done on *vadam*

Pharmacological action

The Cholesterol Lowering Action

CE Berryman et al have found that almonds have a consistent LDL-cholesterol lowering effect in healthy individuals and in individuals with high cholesterol and diabetes, in the controlled and free – living settings. Almonds are low in saturated fatty acids and rich in unsaturated fatty acids and contain fiber, phytosterols, plant protein, α-tocopherol, arginine, magnesium, copper, manganese, calcium and potassium. The mechanism which is responsible for the LDL-cholesterol reduction which is observed with almond consumption is likely to be associated with the nutrients which are provided by the almonds, i.e., decreased absorption of cholesterol and bile acid, increased bile acid and cholesterol excretion and an increased LDLcholesterol receptor activity. The nutrients which are present in almonds regulate the enzymes which are involved in cholesterol synthesis and bile acid production.[21]

David J.A. et al shown that almonds reduced the biomarkers of lipid per oxidation in hyper lipidaemic patients.[22] The dose response effects of whole almonds which are considered as snacks, were compared with low saturated fat (<5% energy), whole –wheat muffins (control) in the therapeutic diets of hyperlipidaemic subjects. In a isoenergetic (mean 423 kcal/d or 1770 kj/d) supplements, each for 1 month. The supplements consisted of full randomized cross over study, 27 hyperlipidaemic men and women consumed 3 -dose almonds (73 ± 3g/d), half-dose almonds plus half- dose muffins (half dose almonds), and full dose muffins (control). were not affected by the treatments. The anti-oxidant activity of almonds was demonstrated by their effect on 2 biomarkers of lipid peroxidation, serum MDA and urinary isoprostances, and this finding supported the previous finding that almonds reduced the oxidation of LDL-C.

Their anti-oxidant activityprovides an additional possible mechanism, in addition to lowering cholesterol, that may account for the reduction in CHD risk with nut consumption.

Hepato protective action[23]

Manoj Soni et al reported the hepato protective activity of the *Prunus* extract against Paracetamol and Ccl4 induced hepatitis in rats. The extract of methanol: ethanol (70:30) of

Prunus was prepared and tested for its hepato-protective effect against Paracetamol and CCl4 induced hepatitis in rats. An alteration in the levels of the biochemical markers of hepatic damage like SGPT, SGOT, ALP, total bilirubin, direct bilirubin and tissue LPO, GSH, catalase and SOD were tested in both the treated and untreated groups. Paracetamol (2g/kg) and CCl4 (1.5ml/kg) enhanced the SGPT, SGOT, ALP, total bilirubin, direct bilirubin and the tissue levels of GSH. The treatment with the extract of the Prunus fruits (150mg/kg and 300mg/kg) brought back the altered levels of the biochemical markers to near normal levels in a dose dependent manner.

In Amnesia

Kulkarni, et al, in their study, suggests that almonds possess a memory enhancing activity in view of its facilitatory effect on the retention of special memory in scopolamine induced amnesia. They concluded that almonds lowered the serum cholesterol in rats. They were also found to elevate the Ach level in the brain and ultimately improve the memory (special and avoidance) of rats. In the light of the above findings, it may be worthwhile to explore the potential of this plant in the management of cognitive dysfunction[24] biochemical parameters like total cholesterol, total triglycerides and glucose were evaluated. It was observed that PA, at the above mentioned doses, after 7 and 14 days of administration in the respective groups, significantly reversed scopolamine (1 mg/kg i. p.)- induced amnesia, as was evidenced by a decrease in the transfer latency in the EPM task and in the step-down latency in the passive avoidance task. PA reduced the brain Ch E activity in rats. PA also exhibited a remarkable cholesterol and triglyceride lowering property and slight increase in the glucose levels in the present study. Kulkarni concluded that because the diminished cholinergic transmission and an increase in the cholesterol levels appeared to be responsible for the development of the amyloid plaques and the dementia in Alzheimer's patients, PA could be a useful memory-restorative agent. It would be worthwhile to explore the potential of this plant in the management of Alzheimer's disease.

Antioxidant property[25]

Ali Jahanban Isfahan, et al demonstrated that the methanolic extracts of almonds possessed anti-oxidant and anti radical activities and that their phenolic extract may be helpful in preventing or slowing the processes of various oxidative stress related diseases. On the basis of the comparison between the anti-oxidant and the anti radical activity of wild almond hull and shell phenolic extracts, 4 almond species were selected. The fruits of these almonds were

collected, their hulls and shells were dried and ground, and methanolic extracts were prepared from these hulls and shells. The total phenolic content was determined by using the Folin-Ciocalteu (F-C).

The results showed that the anti-oxidant and the anti-radical activities of the almond hull were higher than those of its shell phenolic extract among correlated with the phenolic content and radical scavenging capacities of wild almond hull and shell extracts in different species were positively correlated with phenolic content and reducing power.

Aphrodisiac action[26]

To assess the efficacy of a polyherbal formulation, in enhancing the male sexual activity in an experimental model, the study involved virgin female rats which were in the oestrous state, which was induced by administering oestrogen, and male rats which were randomized into five groups and were classified into the control group, the sildenafil citrate reference standard group and the Almond contained medicine-treated group (125, 250 and 500 mg/kg) respectively, for 5 days. Parameters such as total sexual behaviour, mounting frequency, ejaculation frequency, ejaculation latency, serum testosterone levels and sperm count were carefully monitored. A significant improvement in all the parameters of the sexual indices was observed. in the Almond contained medicine group. The treatment with Almond contained medicine also showed an increase in the sperm count and the testosterone levels. Histological evaluation of the anterior pituitary revealed an increase in the FSH-LH-producing basophils and a decrease in the ACTH producing cells. The study revealed that Almond contained medicine improved the erectile capacity. Considering the imitations of sildenafil citrate in clinical practice, Almond contained medicine may be considered a safe and alternative treatment for the correction of erectile dysfunction So it can be inferred that Prunus amygdalus as a hepato-protective agent, an aphrodisiac and an agent for increasing the fertility have been realized. The pharmacological and medicinal significance of Prunus amygdalus is gradually increasing. Studies which involve clinical trials in human subjects remain to be performed. Therefore, it is high time to investigate the chemical composition and the bioactivities of the unexplored plants of Prunus and to devote more efforts towards understanding the mechanism of action of the bioactive constituents which are present in them.

Important formulation

- *Jivantyadi Ghritam*
- *Amritaprash Ghritam*
- *Mahamayura Ghritam*

DISCUSSION

During review of the literatures and going through the derivation it might be defined as a disease caused by *kupita vata dosa*. *Avabahuka* is a disease caused by *kupita vata dosa* localizing around the amsa pradesa causing the soshana of amsasandhis, thereby leading to akunchana of sira at that site and giving rise to bahupraspandana haratwam. In consideration to the ayurvedic etiopathogenesis of the disease it reveals that the vataprakopaka etiology in general are mainly responsible for the genesis of the disease.

The specific etiology like weight lifting, excessive movements of the hands, dukkhasajjya(mal sleeping posture) particularly hand under the head during sleeping are the main causative factors. Aggravate *vata* spreads all over the body(*prasara*) but it takes place specially at the area of *amsasandhi(sthanasamsraya)* due to the prior '*khabaigunya'* and leads to *dosa dusya sammurchana* at the said place caused by *abhighata* or other etiologies.

In *Ayurveda* there are several medications as well as purificatory therapy (*shodhana*) and *rasayana* therapy *(posana/brumhana)* are indicated in *vata* predominant diseases in general. As the disease is purely caused by affliction of *vayu* and the symptoms come due to the aggravation of *vayu* so *vatanasak* therapy may be advocated as a remedy of the same.

The line of management in the *ayurvedic* therapy are, *Brumhana nasya, paschadbhakta ghrutapana, swedana, abhyanga* etc.

It is known that *taila* is the best remedy for the *vata* afflicted diseases.

Vadam is a *sneha dravya* and *vrumhaniya dravya* having guru, *snigdha, sara, manda, drava* properties which are called as *posakaguna*, so *vadama taila* may pacify *vata* by its *posaka* and *snehana guna.*

As *Avabahuka* takes place in shoulder region (*amsasandhi*) so *vyana vayu* is mainly responsible for the genesis of the disease. So *nasyakarma* has been taken into consideration. Aggravated *vayu* dried up the *slesmak kapha* of *amsandhi* and leads to *avabahuka*. In

consideration *gunakarmayog snehanaguna* and *nasyakarma* could pacify *vata* by reducing *rukshaguna*.

CONCLUSION

In *avabahuka* aggravated *vata* spreads all over the body(*prasara*), but it takes place specially at the area of *Amsasandhi* (*sthanasamsraya*) due to the prior "*khabaigunya*" and leads to the *dosa dusya sammurchana* at the said place caused by *abhighata* or other etiologies.

- *Vadama taila* is a potent *vatanasak* and *rasayana dravya* that have the property of pacifying *vatika* disorders.
- *Nasya karma* specially *pratimarsa nasya* with *vadam taila* could cure *avabahuka* and might be effective to the other *urdhajatrugata vatika vikara*.

REFERENCES

1. Sen Debendranath and Sen Upendranath; Dravyaguna, C K Sen and co. pvt. Limited, Javakusum house, kol -12.
2. Charaka samhita: Sutra 27.
3. Susruta samhita: sutra 46.
4. Astanga Hrudaya: Sutra 6.
5. Bhavamishra; Bhavaprakash nighantu purvardha, Acharya sri Bramhasankar misra, Chaukhamba Sanskrit bhavan, baranasi Sharma P V and Sharma G P, Kaiyadev Nighantu(Pathyapathya vibhodaka), Choukhamba orientalia, Varanasi, reprint edition – 2009.
6. Madanpal, Madanpal nighantu, Shastri J L N, Choukhamba orientalia, Varanasi -2010.
7. Khemraj Sri Krishnadas Sresthina, Saligram Nighantu; Edited by Sri venkateswar steem press, Bombay Pp 431.
8. Bapalal G Vaidya: Nighantu Adarsha, chaukhamba vidyabhavan, Varanasi-1, 1968, P 432.
9. Dutta Shankar: Shankar Nighantu, edited by Manager Banausadhi Bhandar, Jabbalpur, C.P. edition, 1935.
10. Daniel Z, Hopf M (2000). Domestication of plants in the old world: the origin and spread of cultivated plants in West Asia, Europe, and the Nile Valley. Oxford University Press, pp.186.

11. Bansal P, Sannd R, Srikanth N, Lavekar GS. Effect of a traditionally designed nutraceutical on the stress induced immunoglobulin changes at Antarctica. *Afr J Biochem Res.*, 2009.
12. Pinelo M, Rubilar M, Sineiro J, Nunez MJ. Extraction of anti-oxidant phenolics from almond hulls (Prunus amygdlaus) and pine sawdust (Pinus pinaster). *Food Chem.*, 2004.
13. Puri A, Sahai R, Singh KL, Saxena RP, Tan don JS, Saxena KC, Immunostimulant activity of dry fruits and plant materials which are used in the Indian traditional medical system for mothers after child birth and invalids. *J Ethanopharmacol*, 2000.
14. Spiller GA, Jenikins DA, Bosello O, Gates JE, Cragen LN. Bruce nuts and plasma lipids: An almond –based diet lowers the LDL-C while it preserves the HDL-C. *J Am Coll Nutr.*, 1998.
15. Sharma RP, Saamhita C: Agnivesha Treatise. Sutrashana. Varanasi: Chokambha Sanskrit Sansthan, 1981.
16. Nuts, almonds [online]. USDA National Nutrient Database for Standard Reference, Release 17 (2004). Agricultural Research Service, U.S. Department.
17. Frison-Norrie S, Sporns P. Identification and quantification of flavonol glycosides in almond seed coats by using MALDI-TOF. MS. J. Agric. Food CHem., 2002; 50: 2782-2787.
18. Phillips KM, Ruggio DM, Ashraf-khorassani M. The phytosterol composition of the nuts and seeds which are commonly consumed in the United States. *J Agric Food Chem.*, 2005; 53: 9436-45.
19. Berry EM, Eisenberg S, Friedlander Y. Effects of diets which are rich in monounsaturated fatty acids on the plasma lipoproteins – the Jerusalem Nutrition Study II. Mono-unsaturated fatty acids Vs Carbohydrates. *Am J Clin Nutr.*, 1992; 56: 394-403.
20. Berryman CE, Preston AG, Karmally W, Deckelbaum RJ, Kris-Either ton PM. Effects of almond consumption on the reduction of LDL-Cholesterol: a discussion of potential mechanisms and future research directions. *J Nutr. Rev.*, 2011.
21. Jenkins DJA, Kendall CWC, Marchie A, Josse AR, Nguyen TH, Fowlhner DA., Lapsley KG., Blumberg J. Almonds reduce the biomarkers of lipid per oxidation in older hyperlipidaemic subjects. *J. Nutr.*, 2008.
22. Soni M, Mohanthy PK, Jaliwala YA. Hepato protective activity of the fruits of Prunus. *International Journal of Pharma and Biosciences.* Apr 2011.
23. Kulkarni KS, Kastura SB, Mengi SA. Efficacy of the Prunus amygdalus (almonds) nuts in scopolamine induced amnesia in rats. *Indian J Pharmacol*, 2010.

24. Hari Jagannadha Rao and Lakshmi, Therapeutic Applications of Almonds www.jcdr.net Journal of Clinical and Diagnostic Research. 2012 February, Vol-6(1).
25. Gopumadhavan S, Rafiz M, Venkataranganna MV, Kulkarni K, Mitra SK. Assessment of "Almond contained medicine" for sexual activity in an experimental model. *Indian Journal of Clinical Practice*, 2003.
26. Sharma P V and Sharma G P: Dhanvantari Nighantu, Choukhamba orientalia, Varanasi, reprint edition, 2012.