

Journal of Ayurveda Case Reports

A Journal of All India Institute of Ayurveda

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DOI:

10.4103/JACR.JACR_1_20

Efficacy of *Vachadi vati* in the management of childhood obesity

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Abstract:

Childhood obesity is on the rise. Unaddressed situation may lead to various complications. It needs to be intervened at the appropriate level. *Sthaulya* (~obesity) and *Medoroga* (~disorder of fat metabolism) explained in the Ayurvedic texts are comparable with obesity. Acharya Charaka has described *Sthaulya* among the eight most *Nindita purusha* (~despicable personalities). A 10-year-old, school-going female child was brought to the outpatient department, I. P. G. T. and R. A. Hospital, Gujarat Ayurved University, Jamnagar, Gujarat, by her parents with complaints of excess weight gain for 2–3 years. On clinical examination, the child had 58 kg body weight with Body Mass Index (BMI) $>30 \text{ kg/m}^2$. *Vachadi vati* (an Ayurvedic formulation) was given in a dose of 3.5 g in three divided doses before meal with luke warm water for eight weeks along with diet and lifestyle modification. Anthropometric assessment and laboratory investigations were done before and after the treatment. After eight weeks of intervention, there was 10% reduction in body weight and BMI, reduction in chest circumference and waist-hip ratio. As per this case study, it can be said that *Vachadi vati* could be used in the management of childhood obesity along with some diet and lifestyle modification.

KEYWORDS: Childhood obesity, *Sthaulya*, *Vachadi vati*

INTRODUCTION

Obesity is a leading preventable cause of death worldwide with the increasing prevalence in adults and children; authorities view, it as one of the most serious public health problems of the 21st century.^[1] Due to the rising prevalence of obesity in children and its numerous adverse health effects, it is being recognized as a serious public health concern. The most frightening aspect of obesity is that it shortens the lifespan. According to the Centers for the Disease Control and Prevention (CDCP), childhood obesity has more than doubled in children and quadrupled in adolescents in the past 30 years. Poor dietary intake, physical inactivity, and life style patterns are found to be the major reasons for obesity.^[2]

Guidelines for obesity and overweight based on Body Mass Index (BMI) for Asian Indians were revised based on the consensus developed through discussions by a prevention and management of obesity and metabolic syndrome group.^[3] The revised guidelines categorize overweight as a BMI of 23.0–24.9^[4] and obesity as a BMI ≥ 25 using values lower than the ethnic specific BMI previously advocated for Asian Indians.^[3] In the modern science, there are three main treatment modalities for obesity, namely lifestyle interventions, medications, and bariatric surgery. Except lifestyle interventions, other two have side effects. Lifestyle modification needs to be intensive (i.e., calorie restriction, individual and family counseling, and regular exercises) and continued to be effective, which is challenging to maintain in children and adolescents.^[5]

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How to cite this article: Prajapati V, Bhaskar CL, Kori VK, Patel KS. Efficacy of *Vachadi vati* in the management of childhood obesity. J Ayurveda Case Rep 2020;3:35–40.

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Submitted: 07-Aug-2019

Revised: 21-Apr-2020

Accepted: 08-May-2020

Published: 14-Jul-2020

In Ayurveda, *Sthaulya* has been described as *Ashtanindita* (~one of the eight disgraceful persons) in the context of the body.^[6] The conventional concept of etiopathogenesis, prognosis, and management of obesity is very similar and equally advanced in *Medoroga/Sthaulya* in Ayurveda. Acharya Sushruta has elaborated the etiopathogenesis based on an endogenous entity due to *Dhatvagnimandya*.^[7] Overweight or obesity is mostly found in people with predominantly *Kapha* (~phlegm) type constitutions. Ayurveda has holistic approach in the management of obesity as Ayurveda does not recommend any weight losing pills or fast weight loss programs such as modern science. *Shodhana* (~bio-purificatory) and *Shamana* (~pacificatory measures) are the important tools of Ayurvedic therapeutics. Beside this, it advocates dietary restrictions, moderate physical activities, practices of *Yogasanas*, *Pranayama*, and certain effective Ayurvedic formulations in the management. Ayurvedic formulations with *Kapha vata hara* (~reduce *Kapha* and *Vata*) and *Medo hara* (~anti-obesity) properties improve fat metabolism in an obese individual and thus helps in maintaining the weight. In the present case, *Vachadi gana* containing *Vacha* (*Acorus calamus* Linn.), *Shunthi* (*Zingiber officinale* Roxb), *Musta* (*Cyperus rotundus* Linn.), *Devadaru* (*Cedrus deodara* Roxb.), *Ativisha* (*Aconitum heterophyllum* Wall.), and *Abhaya* (*Terminalia chebula* Retz.) were administered in *Vati* form.^[8]

CASE REPORT

A 10-year-old, female child was brought by her parents to *Kaumarbhritiya* outpatient department (OPD), (Registration no. PG18052479), I. P. G. T. and R. A. Hospital, Gujarat Ayurved University, Jamnagar, Gujarat on July 04, 2018 with the main complaint of progressive weight gain for 2–3 years and associated complaints of hair fall for the last two months. There was no any past history of psychological or endocrinal illness or any history of long-term medication. She had a positive family history. Her mother and younger brother both were obese. She had a normal birth history, i.e., full-term normal vaginal delivery with birth weight of 2.75 kg and no any significant postnatal history. There was a complete immunization history, growth, and development of the child was also proper with age. She had a history of faulty dietary habits and sedentary life style. She used to take non-vegetarian diet one to two times per week, and also she used to take one to two extra meals to fulfil her satiety level. She had not taken any treatment for the above complaints. Her parents visited the OPD enquiring Ayurvedic solutions for her condition. The treatment was started from July 07, 2018 with parent's consent and child's assent.

Clinical findings

She had 58 kg of body weight, 137 cm height with 30.9 Kg/m² of BMI (>95th percentile of CDC growth chart 2006), fat 34%, chest circumference 88 cm, waist/hip ratio 0.91, built-wise obese. She had complaint of *Daurgandha* (~offensive body odor), and acanthosis nigricans was present over the neck region. Pulse rate was 80/min, respiratory rate was 20/min, and blood pressure was 110/70 mmHg. No abnormality was noticed in the functioning of respiratory, circulatory, or digestive systems.

Dashavidha pareeksha (~Ten fold examination)

Child was having *Sharirika prakriti* (~physical constitution) as *Pitta-kapha* and *Manasika prakriti* (~mental constitution) as *Rajasika-tamasika*; *Vikriti* (~morbidity) was *Kapha dosha*; *Rasa, Rakta, Mamsa, Meda* were *Dooshya*; *Rasa-rakta-medasveda sarata* (~essence of all *Dhatus*); *Madhyama samhanana* (~compactness); *Pravara pramana* (~anthropometry); *Madhyama satmyata* (~suitability or homologation); *Madhyama satva* (~psyche); *Ahara shakti* (~intake of food) with *Pravara abhyavaharan shakti* (~increased intake of food) and *Pravara jarana shakti* (~increased digestive fire); *Agni* was *Tikshna* (~overheated digestion); *Avara Vyayama shakti* (~decreased capacity of exercise).

Ashtavidha pareeksha (~Eight fold examination)

Ashtavidha pareeksha showed that her *Nadi* (~pulse rate) was 80/Min, passing of hard stool occasionally; *Mutra* (~urine frequency) was regular, *Jivha* (~tongue) was *Sama* (~coated tongue), *Shabda* was *Guru swara*, *Sparsh* (~touch) was *Snigdhnga*; *Drika* (~eye) was *Pandura* (~pallor), *Akriti* (~built) was *Sthoola* (~obese).

Sroto pareeksha (~Examination of body channels)

Tandra, Ayathakala palita symptoms were associated with *Rasavaha srotodushti*, *Vyanga* (~acanthosis nigricans) with *Raktavaha srotas*, *Pipasa, Alasya, Visbrasharirgandha, Sarvakala tandra-nidra* with *Medovaha srota* and *Atiswedanam* with *Swedavaha srotodushti*.

Investigations

Hemoglobin percentage, total leukocyte count, red blood counts, fasting blood sugar, lipid profile, and apolipoprotein-B were done before and after the treatment. Thyroid stimulating hormone (TSH) and stool-urine routine were investigated before therapeutic intervention.

Differential diagnosis

1. Exogenous (due to faulty diet and lifestyle): The patient had a history of frequent consumption of high calorie diet, day sleeping, and no/less physical activity.
2. Endogenous (Endocrinal disorders such as Hypothyroidism) – TSH-1.6 mU/L (Normal).

- Psychological disorders: The child was a class five student and had normal Intelligence Quotient (IQ) level, No history of any psychological disorders.

Diagnosis

As per above history, BMI, anthropometric and laboratory parameters; child was diagnosed as grade 2 obesity due to exogenous causes, i.e., faulty diet and lifestyle.

TREATMENT PROTOCOL

Therapeutic intervention

The drugs from *Vachadi gana* were selected and given in *Vati* (~tablet) form to the patient. *Vachadi vati* was prepared by taking mentioned ingredients in proposed proportions in the Gujarat Ayurved University Pharmacy [Table 1].^[8]

Posology of Vachadi vati

Seven *vati* (each of 500 mg) were given orally, *Pragbhakta* (~before meal) in three divided doses (3-2-2) with *Usnodaka* (~luke warm water) as *Anupana* (~vehicle) for eight weeks with weekly follow-up. Dose of *Vachadi vati* was calculated as per age on the basis of *Sharangdhar's* rule.^[9] Physical assessments were done every week for eight weeks. During weekly follow-up, daily food pattern and physical activity were noted for 24 hr. by diet recall method. The patient was advised to follow the diet and lifestyle changes along with medication,^[10-12] as shown in Table 2.

Assessment criteria

Improvement was assessed on the basis of percentage relief observed in the presenting complaints. Standard grading criterion^[13] was adopted to assess the effectiveness of the therapy [Table 3].

FOLLOWUP, OUTCOME AND DISCUSSION

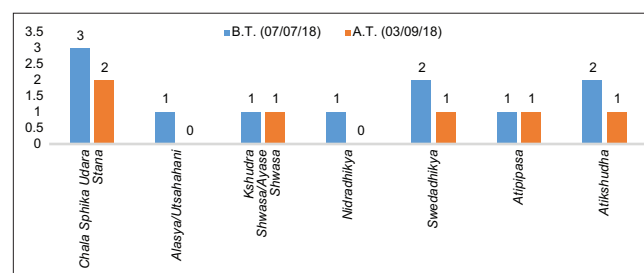
Sthanulya is defined as a metabolic disorder stemming from lack of exercise, poor diet, stress, genetic predisposition, and ultimate increase in *Kapha dosha* (~bio-element) leading to the excessive accumulation of adipose tissue, associated with accumulation of *Prithvi* and *Jala mahabhoota* (~earth and water elements) in the body mind, poor digestive fire, and accumulation of toxins in the digestive tract.^[14-16] Overeating

and sedentary lifestyle contribute to the accumulation of *Prithvi* and *Jala mahabhoota* in the body, as does excess sleep, steroid medications, and psychoemotional conditions such as depression and anxiety.^[17] *Prithvi* and *Jala mahabhoota* are associated with the heavy, dense, slow, and cold qualities and are antagonistic to *Dhatvagni* (~metabolic fire), which is sharp, light, and hot; thus contributing to slow metabolism and obesity.^[17] The ingredients of *Vachadi vati* have *Tikta-katu rasa* (~bitter-pungent taste), *Ruksha-laghu guna* (~dry-light properties), *Ushna veerya* (~hot potency), *Katu vipaka* (~catabolic bio-transformation); hence, they together have *Kapha-medo hara* (~removes and dries up excess *Meda*) properties along with *Lekhaniya* (~scrapes excess *Meda*) and *Deepaniya* (~increases the *Dhatvagni*) action.^[8,18-23] They work by the principle of *Guru cha apatarpana* (~heavy and nonnourishing diet) which regulates the hunger and satiety center, thereby regulating the energy intake of a person. This aids in the proper utilization of stored fat to fulfill the energy needs. As drug is in *Vati* form; its intake is very easy and does not create any difficulty for its consumption.

After eight weeks of intervention of *Vachadi vati*, it was found that there was complete improvement (100%) in complaints such as *Alasya/Utsaharani* (~laziness) and *Nidradhikya* (~excess sleepiness), whereas marked improvement (50%) in complaints such as *Swedadhikya* (~excess sweating) and *Atikshudha* (~excess appetite), 33% improvement in complaints such as *Chala sphika udara stana* (~pendulous movement of buttock, abdomen, and breasts) [Graph 1]. There was 10% reduction in body weight and BMI, 2% and 2.19% improvement in chest circumference and waist hip ratio, respectively [Table 4]. Other anthropometric measurements had also shown improvements. It was noted that there was significant improvement in laboratory parameters such as 6% improvement in hemoglobin%, 5% in red blood cell, 14% in white blood cell, 25% in fasting blood sugar, serum cholesterol and serum low-density lipoprotein (LDL), 47% improvement in serum triglycerides, 48% improvement in serum very low density lipoproteins, whereas 38% improvement in apolipoprotein B [Table 5]. Decrease

Table 1: Composition of Vachadi vati

Ingredient	Botanical/English name	Part used	Ratio
Vacha	<i>Acorus calamus</i> Linn.	Dried rhizome	1 part
Musta	<i>Cyperus rotundus</i> Linn.	Dried rhizome	1 part
Devadaru	<i>Cedrus deodara</i> Roxb.	Dried heart wood	1 part
Shunthi	<i>Zingiber officinale</i> Roxb.	Dried rhizome	1 part
Ativisha	<i>Aconitum heterophyllum</i> Wall.	Dried root	1 part
Abhaya	<i>Terminalia chebula</i> Retz.	Dried fruit	1 part



Graph 1: Effect on chief complaints before and after treatment

Table 2: Diet and lifestyle modifications advised to the patient

<i>Pathya-apathya aahara</i>		
Diet component	To be followed	To be avoided
<i>Shooka dhanya</i> (~cereal grain)	Barley, millets, one year old rice, coarse wheat flour	Fine powder of wheat, refined wheat flour, rice
<i>Shami dhanya</i> (~pulses)	Green gram, bengal gram, red gram, and horse gram	Black gram
<i>Shaak varga</i> (~vegetables)	Leafy vegetables, brinjal, drum sticks, bottle gourd, bitter gourd, radish, carrot, cucumber, ridge gourd, cabbage, etc.	Potato, sweet potato, beet root
Fruits	Orange, papaya, apple, guava, pomegranate, watermelon, etc.	Banana, mango, dry fruits, etc.
<i>Drava-dravya</i> (~liquids)	Cow milk, buttermilk, honey, lukewarm water, sesame oil, mustard oil, ginger water, and coconut water	Cold water/cold drinks, milk products, sugarcane products such as refined sugar.
<i>Mamsa</i> (~nonveg)	–	Egg, chicken, mutton, pork, etc.
Others	–	Maggi, pasta, breads, cakes, cookies, pastries, chocolates, cheese, ice cream, yogurt, packaged foods, processed food, and restaurant fried foods - Pizza, burger, French fries, etc.
<i>Pathya-apathya vihara</i>		
To be followed	To be avoided	
Daily physical exercise for minimum half to one hour like <i>Surya namaskar</i> , brisk walking, cycling, skipping, swimming, playing outdoor games, etc.	<i>Avyayama</i> (~no/less exercise)	
Drink luke warm water before meal	<i>Divasvapna</i> (~day sleep)/excessive sleeping	
Take a walk after meal	Sitting in one position and on foam seat for long duration	
Drink a glass of luke warm water after waking up in the morning	Avoid watching TV while eating	
	Excess food intake	
	Bath with cold water	
	Screen time <2-3 h	

Table 3: Grading criteria

Parameters	Grade
<i>Chala sphika udara stana</i> (~visible movement in hip-abdomen-breast)	
Absence of visible movements (in the areas) with fast movement	0
Little visible movement (in the areas) after rapid movement such as running and skipping	1
Visible movement (in the areas) with brisk walking (133 steps/min)	2
Movement (in the areas) even after slow walking (75 steps/min)	3
Movement (in the areas) even after changing posture	4
<i>Alasya/Utsahahani</i> (~laziness/lack of enthusiasm)	
No <i>Alasya</i> or lack of enthusiasm (doing work satisfactorily with proper vigor in time)	0
Doing work satisfactorily with late initiation	1
Doing work unsatisfactorily under mental pressure and takes time	2
Not starting any work on his own responsibility and doing little work very slowly	3
Does not take any initiation and does not want to work even after pressure	4
<i>Kshudra shwasa/Ayase shwasa</i> (~dyspnoea on exertion)	
No dyspnea even after heavy work	0
Dyspnea after moderate work but relieved later and tolerable; dyspnea by climbing upstairs of 10 steps and time taken will be more than 15 s	1
Dyspnea after little work but relieved later and tolerable; dyspnea by climbing upstairs of 10 steps and time taken will be more than 25 s	2
Dyspnea after little work but relieved later and not tolerable; dyspnea by climbing upstairs of 10 steps and time taken will be more than 35 s	3
Dyspnea in resting condition	4
<i>Nidradhikya</i> (~excess sleep)	
Normal and sound sleep for 6-8 h/24 h with feeling of lightness and relaxation in the body and mind	0
Sleep >8-9 h/24 h with slight heaviness in the body	1
Sleep >8-9 h/24 h with heaviness in the body	2
Sleep >10 h/24 h with heaviness in the body associated with <i>Jrimbha</i> and <i>Tandra</i>	3
<i>Swedadhikya</i> (~excess sweating)	
Sweating after heavy work and fast movement or in very hot weather	0
Profuse sweating after moderate physical work/play activities	1
Sweating after brisk walking for one min (133 steps)	2
Profuse sweating after slow walking for one min	3
Sweating even at rest or by mild activities in cold weather	4

Contd...

Table 3: Contd...

Parameters	Grade
<i>Atipipasa</i> (~excess thirst)	
Feeling of thirst (7-9 times/24 h) and relieved by drinking water	0
Feeling of moderate thirst (>9-11 times/24 h) and relieved by drinking water	1
Feeling of excess thirst (>11-13 times/24 h) not relieved by drinking water	2
Feeling of sever thirst (>13 times/24 h) not relieved by drinking water	3
<i>Atikshudha</i> (~excess hunger)	
As usual/routine	0
Slightly increased (one meal extra with routine diet)	1
Moderately increased (two meals extra with routine diet)	2
Markedly increased (three meals extra with routine diet)	3

Table 4: Effect on anthropometric measurements

Measurements	Before treatment (July 07, 2018)	After treatment (September 03, 2018)
Weight (kg)	58.0	52.20
BMI (kg/m ²)	30.9	27.8
Chest circumference (cm)	88.0	86.0
WHR	0.91	0.89
MUAC (cm)		
Right	29.0	28.5
Left	29.5	29.0
MTC (cm)		
Right	55.0	53.5
Left	55.0	53.5
SFT (mm)		
Biceps-Left	19.5	13.2
Biceps-Right	20.7	13.5
Triceps-Left	35.3	28.2
Triceps-Right	35.9	28.5

BMI: Body mass index, WHR: Waist/hip ratio, MUAC: Mid-upper arm circumference, MTC: Mid-thigh circumference, SFT: Skin-fold thickness

Table 5: Effect on laboratory parameters

Parameters	Before treatment (July 06, 2018)	After treatment (September 04, 2018)
Hb (g %)	11.1	11.8
RBC (millions per cubic mm)	5.66	5.94
WBC (per cubic mm)	9300	8000
FBS (mg/dl)	102	76
Serum cholesterol (mg/dl)	138	104
Serum triglycerides (mg/dl)	135	71
Serum HDL (mg/dl)	50	44
Serum LDL (mg/dl)	61	46
Serum VLDL (mg/dl)	27	14
APO-B (mg/dl)	89	55

Hb: Hemoglobin, RBC: Red blood count, WBC: White blood count, FBS: Fasting blood sugar, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, VLDL: Very low-density lipoprotein, APO-B-Apolipoprotein-B

in serum high-density lipoprotein was also observed but was within the normal limits. The follow-up study of the patient had shown that there was further decrease in anthropometric parameters by following just modified diet and lifestyle. *Vachadi vati* is effective possibly due to its *Kapha-medo hara* properties, helped in improving *Dhatvagni*

thus improved the fat metabolism, thus there was marked improvement in anthropometric and laboratory parameters.

CONCLUSION

Ingredients of *Vachadi vati* are easily available and very cost-effective. This case study shows that *Vachadi vati* along with diet and lifestyle modification is effective regimen for weight loss in children. It can also be concluded that by following modified diet and lifestyle, healthy weight could be maintained. This case report can be useful in future studies related with childhood obesity.

Declaration of patient consent

Authors certify that they have obtained patient consent form, where the patient/caregiver has given his/her consent for reporting the case along with the images and other clinical information in the journal. The patient/caregiver understands that his/her name and initials will not be published and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Barnes LA, Opitz JM, Gilbert-Barnes E. Obesity: Genetic, molecular, and environmental aspects. *Am J Med Genet A* 2007;143:3016-34.
- Available from: <http://www.cdc.gov/healthyyouth/obesity/facts.htm/>. [Last accessed on 2018 Jan 12, 18:10].
- Available from: http://www.japi.org/feb ruary_2009/R-1.html/. [Last accessed on 2018 Jan 12, 18:15].
- Raatikainen K, Heiskanen N, Heinonen S. Transition from overweight to obesity worsens pregnancy outcome in a BMI-dependent manner. *Obesity* 2006;14:165-71.
- August GP, Caprio S, Fennoy I, Freemark M, Kaufman FR, Lustig RH, et al. Prevention and treatment of pediatric obesity: An endocrine society clinical practice guideline based on expert opinion. *J Clin Endocrinol Metab* 2008;93:4576-99.
- Tripathi RD, Shukla V, editor. *Charak Samhita of Agnivesha*,

- Sutra Sthana, Ashtaninditiya Adhyaya. Ch. 21. Verses 3. Varanasi: Chaukhambha Sanskrit Sansthan; 2007. p. 300.
7. Shastri A, editor. Sushruta Samhita of Sushruta, Sutra Sthana. Ch. 15. Verses 37. Varanasi: Chaukhambha Sanskrit Sansthan; 2016. p. 81.
8. Gupta AK, editor. Astanga Hridaya of Vagbhata, Sutra Sthana. Ch. 15. Verses 35-36. Varanasi: Chaukhambha Publications; 2016. p. 143.
9. Shrivastava S, editor. Sharangdhara Samhita of Sharangdhara, Purva Khanda 6. Verses 14-17. Varanasi: Chaukhambha Orientalia; 2009. p. 53.
10. Tripathi RD, Shukla V, editor. Charak Samhita of Agnivesha, Sutra Sthana. Ch. 21. Verses 3. Varanasi: Chaukhambha Sanskrit Sansthan; 2007. p. 303-4.
11. Shastri A, editor. Sushruta Samhita of Sushruta, Sutra Sthana. Ch. 15. Verses 38. Varanasi: Chaukhambha Sanskrit Sansthan; 2016. p. 81.
12. Mishra SN, editor. Bhaisajya Ratnavali by Kaviraj Govind Das Sen. Siddhiprada Hindi Commentary. Ch. 39. Verses 1-2 & 64-70. Varanasi: Chaukhambha Surbharati Prakashana; 2009. p. 723, 729.
13. Biju KR, Rajagopala S, Patel KS. A Clinical Study on The Efficacy of *Triphalaguduchyadi vati* in the Management of *Sthanhya* (Obesity) in Children, (Ph.D. Thesis) IPGT&RA, Gujarat Ayurved University; 2011.
14. Lamba N. The concept of medoroga & its management through Ayurveda. Int Ayurvedic Med J 2017;5:156-61.
15. Parauha S, Hullur MA, Prashanth AS. Sthaulya – A life style disorder. SSRG IJMS 2017;4:4-7.
16. Tiwari N, Srivastava A, Manglesh R. An innovative approach for management of obesity through Ayurveda: A review. Int J Res Ayurveda Pharm 2017;8:137-9.
17. Lad V. Textbook of Ayurveda: A Complete Guide to Clinical Assessment. Vol. 3. Albuquerque, NM: Ayurvedic Press; 2006. p. 26.
18. Hegde PL, Harini A. A Text Book of Dravyaguna Vigyana. Vol. 2. New Delhi: Chaukhambha Publications; 2016. p. 850-7.
19. Hegde PL, Harini A. A Text Book of Dravyaguna Vigyana. Vol. 2. New Delhi: Chaukhambha Publications; 2016. p. 590-7.
20. Hegde PL, Harini A. A Text Book of Dravyaguna Vigyana. Vol. 2. New Delhi: Chaukhambha Publications; 2016. p. 248-55.
21. Hegde PL, Harini A. A Text Book of Dravyaguna Vigyana. Vol. 2. New Delhi: Chaukhambha Publications; 2016. p. 60-71.
22. Hegde PL, Harini A. A Text Book of Dravyaguna Vigyana. Vol. 2. New Delhi: Chaukhambha Publications; 2016. p. 109-16.
23. Hegde PL, Harini A. A Text Book of Dravyaguna Vigyana. Vol. 2. New Delhi: Chaukhambha Publications; 2016. p. 354-70.