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AYURVEDA PROTOCOL FOR LOWERING ATHEROGENIC INDEX OF PLASMA - A CLINICAL TRIAL

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ABSTRACT

INTRODUCTION: Incidence of cardiovascular-diseases has drastically increased in population of 18-50 years in last decade. Autopsy data of recent sudden deaths in young individuals indicated at least one cardiac abnormality. CAD is the most prevalent attributable cause to it, in which dyslipidaemias is a major risk factor, often underdiagnosed. This clearly demands incorporation of predictors of CAD risk such as Atherogenic Index of Plasma, in routine OP level to screen patients with lifestyle disorders susceptible for CVD at the earliest.

METHODOLOGY: Study aimed to determine change in AIP values in subjects having borderline high lipid values. In an open label single arm pre and post clinical study design, 30 patients having borderline high lipid values according to NCEP ATP III guidelines, with proper exclusion and with informed consent were recruited. Medicines administered were *Gandharvahasthadi Kaṣhaya* (herbal decoction containing Ricinus communis etc) and *Astachurna* (herbal powder containing 8 ingredients) for 5 days followed by *Vidangatanduladi Churna* (herbal powder containing Embelia ribes etc) for 30 days. Assessment was done one 0th day and 36th day. After completion of treatment, results were statistically analyzed.

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RESULT: Combination of polyherbal formulations used in the study is potent in reducing AIP values. There was a reduction in mean values of AIP from 0.1291(BT) to 0.0463(AT) with an improvement percentage of 64.05.

DISCUSSION: AIP is ratio of molar concentrations of TGL to HDL-C, where each concentration is expressed in mmol/L. Strong correlation of AIP with lipoprotein particle size explains its high prediction. Dyslipidemias in Ayurveda can be understood as an error in *Ahara-parinama* (digestion, absorption, assimilation of food). *Jatharagni-mandya* (low digestion strength) leads to improper *Sara-Kitta Vibhajana* (by-products of digestion) leading to accumulation of *Malarupi-kapha* (improper by-product) in body which is perceived as excess circulating lipids. When this *malarupi-kapha* localizes in *rasavaha srothas* (channel for nutrition) or *raktavaha srotas* (channels supporting circulation of blood) already having *khavaigunya* (weak or defective), can result in cardiovascular pathologies. Arresting the progress of this vitiated *Kapha Dosa* (body humor which controls body fluids and maintains the structural cohesion of the organism) from stages of *Sancaya* (stage of accumulation), *Prakopa* (stage of aggravation) or *Prasara* (stage of liquefaction and spreading of doshas) to a fully manifested disease is the main aim of treatment. *Samprapti-Vighatana*(intervening pathology) in this condition is achieved by correction of deranged *Agni*(digestive fire) by *Pacana-Dipana*(digestive-carminative) with *Gandarvahastadi-Kashayam* and *Ashtachurna*, followed by alleviation of vitiated *Kapha Dosa* by *Dosapratyanika-Chikitsa*(treatment corresponding to respective body humors) with the help of *Vidangatanthuladi-Churna.*

CONCLUSION: As a marker of lipoprotein particle size, it adds predictive value beyond that of the individual lipids, helps to screen and have an early warning of cardiovascular diseases and prevent it.

Keywords: Dyslipidemias, Ayurveda, Cardiovascular disease, risk factor, youth

INTRODUCTION

Cardiovascular disease – a global health concern is the cause of one-third of death worldwide. In the past decade, the mortality rate of youngsters of the age group 18 to 35 years has increased drastically. Autopsy data of recent sudden deaths in young individuals indicated at least one cardiac abnormality. And the basic need to deal this problem is the primary prevention of risk factors like dyslipidaemias, obesity, hypertension etc. Atherogenic index of plasma is an important marker to predict the risk of atherosclerosis and coronary artery diseases and is better than individual lipid concentrations[1]. It reflects the true relation

between atherogenic and protective lipoprotein and is calculated according to the formula $\log_{10}$[TG/HDL-C] which is more closely related to cardiovascular risk than individual lipoprotein cholesterol fractions or other atherogenic indices[3]. However, utilizing AIP to determine subclinical coronary artery disease (CAD) beyond traditional risk factors are limited in clinical practice[2]. AIP values under 0.11 is associated with lower risk of CAD, the values between 0.11 to 0.21 with intermediate risk and values above 0.21 is associated with increased risks[3]. Based on the pathophysiology of the condition, an Ayurveda protocol was selected which included polyherbal formulation namely, *Gandharvahasthadi Kaṣhaya*[4] (polyherbal formulation containing Ricinus communis, Holoptelia integrifolia, Plumbago zeylanica, Zingiber officinale, Terminalia chebula, Boerhavia diffusa, Tragia involucrate and Curculigo orchioides) and *Astachurna*[5] (polyherbal formulation containing Zingiber officinale, Piper nigrum, Piper longum, Apium graveolens, Rock salt, Cuminum cyminum, Carum carvi and Ferula foetida) as *Pachana-Dipana*[6] (digestive and carminative) during initial phase and *Vidangatanduladi Churna*[7] (polyherbal formulation containing Embelia ribes, Terminalia chebula, Terminalia bellerica, Emblica officinalis, Hordeum vulgare, Piper longum and Operculina turpethum) during subsequent phase.

MATERIALS AND METHODS

The drugs used for the study:

1) *Astachurna*

Table no: 1 Table showing ingredients of *Astachurna*

SI No	Drug	Botanical Name	Parts used	Drug Quantity taken for preparation
1	*Śuṇṭhī*	Zingiber officinale Rosc	Dried rhizome	250gm
2	*Marīca*	Piper nigrum Linn	Fruit	250gm
3	*Pippali*	Piper longum Linn	Fruit	250gm
4	*Ajamoda*	Apium graveolens Linn	Fruit	250gm
5	*Saindhava Lavaṇa*	Rock salt	As such	250gm

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6	*Śveta Jīraka*	Cuminum cyminum Linn	Fruit	250gm
7	*Kṛṣṇa Jīraka*	Carum carvi Linn	Fruit	250gm
8	*Hiṅgu*	Ferula foetida Regel	Extract	250gm

2) Gandharvahasthadi Kaṣhaya

3) Table no: 2 Showing ingredients of *Gandharvahasthadi Kaṣhaya*

SI No	Drug	Botanical Name	Parts used	Quantity
1	*Eranda*	Ricinus communis Linn	Root	450gm
2	*Cirabilva*	Holoptelia integrifolia Planch	Stem bark	450gm
3	*Chitraka*	Plumbago zeylanica Linn	Root	450gm
4	*Sunthi*	Zingiber officinale Rosc	Rhizome	450gm
5	*Harītakī*	Terminalia chebula Retz	Fruit rind	450gm
6	*Punarnava*	Boerhavia diffusa Linn	Root	450gm
7	*Yavasaka*	Tragia involucrate	Root	450gm
8	*Bhūmitāla*	Curculigo orchioides Gaertn	Rhizome	450gm

4) Vidangatanduladi Churna

5) Table no: 3 Showing ingredients of *Vidangatanduladi Churna*

Sl. no.	Ingredients	Botanical Name	Parts Used	Dose
1	*Viḍaṅgatandula*	Embelia ribes	Seed	1200gm
2	*Harītakī*	Terminalia chebula	Fruit rind	1200gm
3	*Vibhītakī*	Terminalia bellerica	Fruit rind	1200gm
4	*Āmalaki*	Emblica officinalis	Fruit rind	1200gm

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5	*Yavakshāra*	Hordeum vulgare	Plant	1200gm
6	*Pippali*	Piper longum	Fruit	1200gm
7	*Trivṛt*	Operculina turpethum	Root	3600gm

EXPERIMENTAL DESIGN

In the single group pre and post clinical study design, 30 patients having borderline high lipid values according to NCEP ATP III guidelines[8], excluding the patients undergoing treatment for high level lipid profile, pregnant, lactating, with uncontrolled diabetes, known case of coronary artery diseases, cerebrovascular accidents, any type of malignancy, renal and hepatic disorders, hypothyroidism and patients on prolonged medication with corticosteroids or antidepressants and with informed consent were recruited. Assessment was done on 0^{th} day of study. Initially *pachana-dipana* (digestive and carminative function) was done with *Gandharvahasthadi Kaṣhaya* and *Astachurna* for 5 days. 48ml (1pala) of *Gandharvahasthadi Kaṣhaya* was given two times daily before food for 5 days with a pinch of rocksalt[9] and jaggery[10]. 6 grams of *Astachurna* was given twice daily with first bolus of food with ghee. After 5 days and assessing *nirama lakshanas* (symptoms pertaining to digested and metabolized components in the body), 6 gms of *Vidangatanduladi Churna* was given from 6^{th} to 35^{th} day twice daily after food with honey. Assessment was done with 9-12 hours of fasting lipid profile [NCEP ATP 111 guidelines] on 0th day and 36^{th} day.

RESULTS

After completion of treatment, the results were statistically analyzed using paired t test and final conclusions were drawn. There was a reduction in mean values of AIP from 0.1291(Before Treatment) to 0.0463(After Treatment) with an improvement percentage of 64.05. Changes in all values were statistically significant with p value<0.0001.

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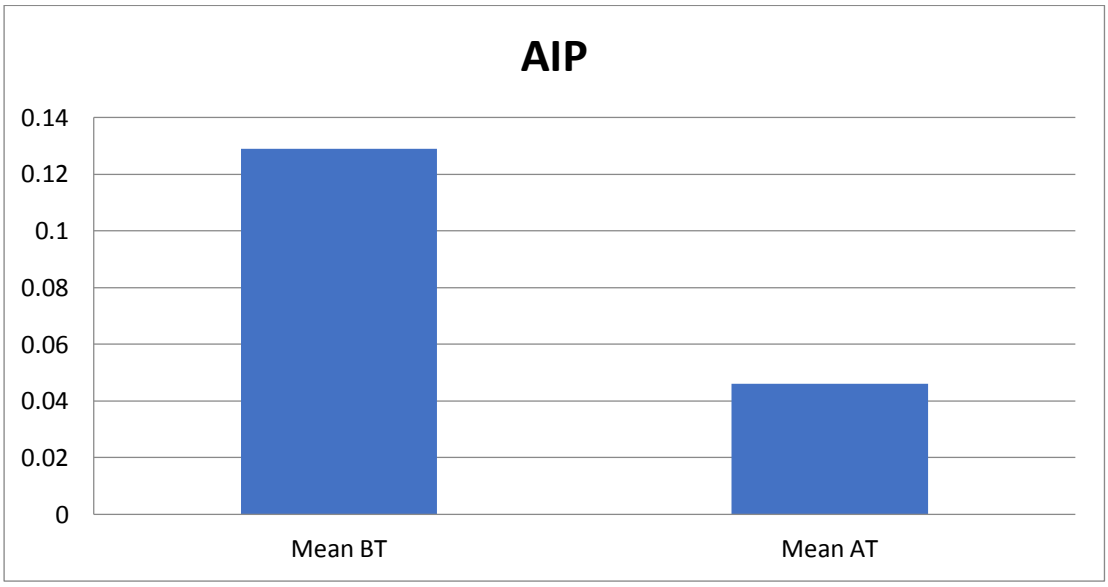
DATA RELATED TO AIP

Table no: 4 Showing Paired samples test for AIP

Paired sample statistics									
Study group	N	TGL	HDL	AIP (mg/dl)	Paired Comparison	Paired Differences		Paired t test	
		Mean		Mean	BT-AT	MD	SD	t- value	p value
BT	30	167.9	54.11	0.1291		0.0827	0.0416	10.873	0.0001
AT	30	147.7	57.83	0.0463					

Chart No: 1 Effectiveness of treatment on Mean AIP



DISCUSSION

Dyslipidaemias[11] does not show any signs and symptoms during the initial stages rather risks the individual to serious illness. The disease is usually detected in routine blood investigations or during the management of other illness[12]. Dyslipidemias can be taken as a stage of *Agni* derangement and if not taken into consideration, on a long run led to many major disorders like *hridroga* (diseases of heart), *medoroga* (diseases of adipose tissues), *prameha* (diabetes) etc.

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The food once ingested is acted upon by *Agni*[13] to produce *sara bhaga* or *ahara rasa* (nutritious part) and *kitta bhaga* or *mala* (waste products) in *dhatu parinama* (formation of tissues). The *sara portion* of *ahara rasa* is converted into *poshaka rasa* or *asthayi rasa* (transforming component of digestion) by the influence of *jataragni*[14] (digestive fire). *Rasa dhatwagni*[15] (enzymes building nutrients and essence) acts on *poshaka rasa* forming *poshya* or *sthayi rasa dhatu* (stable component after digestion) and *asthayi rakta dhatu* (transforming component of circulation). *Upadhatu* (metabolic by-products) are formed here as by-products[16].

Kapha is formed during first *avasthapaka* (transient stage of digestion) and as *mala* (waste product) of *rasa* (essence) as part of *rasa dhatu parinama*[17] (transformation to essence and nutrients). If there is a *mandyam of jataragni* (low digestive fire), then there will be improper *sara-kitta vibhajana* (by-products of digestion) which leads to the formation of *malarupi kapha.* If this circulating *malarupi kapha* gets *sthanasamsraya* (localization as part of pathogenesis) in *rasavaha srotas* (channel for nutrition) with pre-existing *khavaigunya* (defective or weak channels), it will cause conditions like *hrudroga*. Considering *samprapti* (pathogenesis), this metabolic error can be perceived to a state prior to *sthanasamsraya* which can be *sanchaya* (stage of accumulation) or *prakopa* (stage of aggravation) or *prasara* (stage of liquefaction and spreading of vitiated body humors)[18].

The *nidanas* (aetiology) like *bija dushti*[19](defect in sperm and ovum), *Ahara* (diet), *Vihara* (activities) etc lead to the *kapha vrudhi* (profuse increase in the body humor which controls body fluids and maintains the structural cohesion of the organism) in *amasaya* (site where undigested food is present at the time of digestion). This excess *kapha* derange the quality of *pachaka pitta* (component of digestive fire). The *pachakagni* (digestive fire) which has *tyakta dravatwa swabhava* (devoid of liquid portion), due to the *prabhava* (extraordinary function) of excess *kapha* (attribute) loses its *prakruta avastha* (normal constituency) and become *vaikruta* (abnormal) which also causes dimunition of *agni* (digestive fire). Thus, *agni vasiahamya* (decrease in digestive capacity) leads to ama[20](undigested or partly digested intermediate product). Continuous *nidana sevana* (aetiological factors) and production of *ama* gradually lead to improper *dhatu parinama* (transformation). *Dhatwagni mandya* (defective tissue building enzyme) leads to formation of excessive *malarupi kapha.* The *prasara* of *malarupi kapha* can be interpreted as the initial stage of dyslipidemia. If a patient

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is diagnosed in this stage for susceptibility of CAD, then a preventive measure could be adopted before leading to *sthanasamsraya* in *hrudaya* if *khavaigunya* is present. When this condition continues for a long time, it can lead to *srotorodham* (obstruction to channels) causing diseases like stroke, angina etc.

The main objectives of management in this condition are correction of *Agni* and *doshapratyanika chikitsa* (treatment aiming respective body humors). *Samprati vighatana* (intervening pathology) was carried out by *Amaharana* (treating indigested and improperly formed products in digestion) by *Pacana- Dípana as* the first line of management. *Gandharvahastādi Kaṣāya* and *Astacūrṇa* were given for *Pācana- Dípana*[6]. *Gandharvahastādi Kaṣāya* is *Kaṭu* (pungent), *Tikta* (bitter), *Kaṣāya* (astringent) *rasa pradhana* (predominant taste), *Uṣhṇa vīrya* (hot potency), *Kapha Vata Śamana (*alleviating humors like *kapha and vata), Dīpana* and *Anulomaka*[21](propulsion of properly digested matters) *Ashtachurna* is *Katu, tikta rasa pradhana, ushna virya, laghu* (easily digestible),*tikshna guna* (attribute aiding elimination of morbid matters) and *vata kapha samana*[22]. Thus, *Agnimandya* is corrected and proper *Sara Kitta Vibhajana* is facilitated which prevents the formation of *Malarupi Kapha* in the body.

After correction of deranged *Agni* by *Pācana- Dīpana*, the second objective of management is the allievation of *Kapha Doṣa* by *Doṣapratyanīka Chikitsa*. It is attained by the administration of *Viḍaṅgataṇṭhulādi Cūrṇa* having *Pācana, Dīpana, Lekhana* (pharmacological effect leading to drying and removal of adhered morbid matters), *Chedana* (pharmacological effect leading to scrapping of adhered morbid matters) *and Kapha hara Karma*[23](treatment modalities aiming pacification of bodily humor kapha). Major ingredients are *Tikta, Kaṭu* and *Kaṣāya Rasas, Laghu, Rūkṣa* (dry), *Tīkṣṇa, Uṣhṇa* (hot) and *Sara (mobile)Guṇas, Uṣhṇa Vīrya* and *Kaṭu Vipāka*(pungent post digestive factor). *Kaṭu, Tikta* and *Kasaya Rasa* acts as *Sneha kledopaśoṣaṇa*[24](drying of unctuous portion). It acts as Dīpana, Pācana, Lekhana and Chedana. Sukha Virecana (mild purgative) property of the drug eliminated the accumulated *Malās* (waste products) from the *Koṣṭhā* (digestive tract) smoothly. Thus, it improves the quality of *Pācakapitta* (digestive component of bodily humor pitta) by acting at *Pitta Sthāna* (abode of bodily humor pitta). Emoidin an active compound can act on mysenteric plexus causing irritation and promotes motility of lumen. Saponins present in *Trivṛt mūla* (root of Operculina turpethum) precipitates cholesterol from micelles and interfere in enterohepatic circulation of bile acids making it unavailable for intestinal

absorption and increases its excretion. It helps to excrete large amount of bile which indirectly helps in excretion of cholesterol[25].

Kaṣāya Rasa (astringent taste) predominance of *Vibhītakī* along with its *Uṣhṇa Vīrya* and *Pācana- Dīpana Karma* acts as *Kledopaśoṣaṇa* (drying of unctuous portion). *Haritaki* due to its *Pachana-Dipana*, *anulomana* and *kaphapittahara* (pacification of bodily humors like kapha and pitta) property corrects the metabolic error due to impaired *agni* and eliminates *kapha* and *pitta* after proper *paka of malas*[26] (proper formation of waste products). *Harītaki* increases gastric emptying rate which reduces the absorption of dietary cholesterol[27]. Chebulinic acid in *Harītaki* interacts with microbes in gut and converts them to anti-oxidant Urolithin. Thus, it prevents oxidative damage and further complications of Dyslipidemia[28].

Preventing the formation of endogenous cholesterol by inhibiting pathways of its metabolism and increasing excretion of cholesterol from the body are the two main mechanisms involved in correction of lipid parameters. The only excretory route of cholesterol from the body is through Bile. Bile acid sequestrants serve as ion exchange resins that binds to negatively charged ions in small intestine. The formation of this insoluble complex prevents the reabsorption of bile acids and thus leads to their excretion. This increase in bile acid excretion increases the demand for more bile production. Liver cells increase the number of LDL receptors to meet this demand. So, the end result is decrease in amount of circulating LDL[29]. By unknown mechanism, this increases the HDL level as well. In *Vidangatanduladi churna*, *Trivrit* with its increased gastric emptying activity and promoting intestinal motility would have prevented reabsorption of cholesterol from intestine and at the same time laxative property of both *Trivṛt* and *Triphala* (combination of haritaki, vibhitaki, amalaka) subsequently normalised lipid levels by hindering its absorption and increasing excretion[30,31].

10. Conclusion

Lipid metabolic disorders impose a serious threat to the society if uncontrolled. From the study, the combination of polyherbal formulations used is potent in reducing AIP values, thus enabling an early diagnosis and preventive aspect of the lipid metabolic disorders could be made possible. Changes in the lipid parameters may be due to multiple mechanisms on different lipid metabolism

pathways initiated by different Phyto-constituents in the formulation. The diagnosis and prevention of these lipid disorders at the earliest can arrest the progression of this disease

entity and prevent further complications like atherosclerosis. The present study showed that the combined effect of *Pachana- Dipana* with *Vidangatanduladi churna* was beneficial in managing borderline Dyslipidemias. Ayurveda drugs which posess *Tikta, Kaṭu* and *Kaṣāya Rasas*, *Laghu, Rūkṣa, Tīkṣṇa, Uṣhṇa* and *Sara Guṇas, Uṣhṇa Vīrya, Kaṭu Vipāka, Chedana, Lekhana, Anulomana Karma*, produced significant *Kaphahara* action which is an ideal choice in prevention and management of Dyslipidemias. Further, predictors like atherogenic index of plasma can be made use of in the OP practice also. Hence, disease is best forecasted in young population whose mortality rate is high because of the underdiagnosed risk factors.

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REFERENCES

1) Andersson C, Vasan RS. Epidemiology of cardiovascular disease in young individuals. Nat Rev Cardiol.2018;15(4):230-240.
2) Won KB, Jang MH, Park EJ, et al. Atherogenic index of plasma and the risk of advanced subclinical coronary artery disease beyond traditional risk factors: An observational cohortstudy. Clin Cardiol.2020;43(12):1398-1404.
3) Niroumand S, Khajedaluee M, Khadem-Rezaiyan M, et al. Atherogenic Index of Plasma (AIP): A marker of cardiovascular disease. Med J Islam Repub Iran. 2015;29:240.
4) K.V. Krishnan vaidyan and S. Gopalapilla, Chikitsa sara sarvaswam, Sahasrayogam, Vidyarambham publishers, Reprint edition 2018, Kashaya Prakaranam, Page 78
5) K.V. Krishnan vaidyan and S. Gopalapilla, Chikitsa sara sarvaswam, Sahasrayogam, Vidyarambham publishers, Reprint edition 2018, Churna Prakaranam, Page 166
6) Adamalla and Kashiram, Sarangdharacharya's Sarangdhara Samhita with Deepika and Gudartha Deepika commentary, Choukambha Krishnadas academy, reprint edition 2013, Prathamakhanda, 4th Chapter, sloka number 1, Page number:34.
7) Pt. Hari Sadashiva Sastri Paradakara, Vagbhata's Ashtanga Hridaya with Sarvanghasundhara vyakhya of Sri Arunadatta and Ayurveda Rasayana Tikka by

Hemadri, Choukambha Orientalia, reprint edition 2015, Kalpa Sthana 2nd chapter, sloka number 15-16, Page number:743

8) Arthur C. Guyton, John E. Hall, Textbook of Medical Physiology, Elsevier Publications, 11th edition, Chapter 68, Page number:851

9) Pt. Hari Sadashiva Sastri Paradakara, Vagbhata's Ashtanga Hridaya with Sarvanghasundhara vyakhya of Sri Arunadatta and Ayurveda Rasayana Tikka by Hemadri, Choukambha Orientalia, reprint edition 2015, Suthra Sthana 16th chapter, sloka number 40-42, Page number:252

10) Pt. Hari Sadashiva Sastri Paradakara, Vagbhata's Ashtanga Hridaya with Sarvanghasundhara vyakhya of Sri Arunadatta and Ayurveda Rasayana Tikka by Hemadri, Choukambha Orientalia, reprint edition 2015, Suthra Sthana 5th chapter, sloka number 47-48, Page number:75

11) Parhofer KG. The Treatment of Disorders of Lipid Metabolism. Dtsch Arztebl Int. 2016 Apr 15;113(15):261-8

12) Feingold KR, Anawalt B, Boyce A et al. Approach to the Patient with Dyslipidemia. Endotext. South Dartmouth,2020 May.

13) Tripathi Js, K. (2013). Exploring Novel Concept of Agni and its Clinical Relevance. Alternative & Integrative Medicine, 02(08).

14) Vaidya Yadavji Trikamji Acharya, Charaka samhita of Agnivesha revised by Charaka and Dridhabala with the Ayurveda Dipika commentary of Chakrapanidutta, Choukambha Sanskrit Sansthan.Varanasi reprint edition 2016, Chikitsa Sthana 15th chapter, sloka number 38-41, page number :516-517.

15) Vaidya Yadavji Trikamji Acharya, Charaka samhita of Agnivesha revised by Charaka and Dridhabala with the Ayurveda Dipika commentary of Chakrapanidutta, Choukambha Sanskrit Sansthan.Varanasi reprint edition 2016, Chikitsa Sthana 15th chapter, sloka number 6-8, page number :512.

16) Vaidya Yadavji Trikamji Acharya, Charaka samhita of Agnivesha revised by Charaka and Dridhabala with the Ayurveda Dipika commentary of Chakrapanidutta, Choukambha Sanskrit Sansthan.Varanasi reprint edition 2016, Chikitsa Sthana 15th chapter, sloka number 22, page number :515.

17) Vaidya Yadavji Trikamji Acharya, Charaka samhita of Agnivesha revised by Charaka and Dridhabala with the Ayurveda Dipika commentary of Chakrapanidutta,

Choukambha Sanskrit Sansthan.Varanasi reprint edition 2016, Chikitsa Sthana 15th chapter, sloka number 9-11, page number :512.

18) Vaidya Yadavji Trikamji Acharya and Naraan Ram Acharya Kavyatheertha, Susrutha's Susrutha Samhita with the Nibandha Sangraha Commentary of Dalhanacharya and the Nyayachandrika panjika of Sri Gayadasacharya on Nidanasthana, Choukambha Orientalia, reprint edition 2014, Sutra Sthana 21st chapter, sloka number 18-32, page number:103-105.

19) Vaidya Yadavji Trikamji Acharya, Charaka samhita of Agnivesha revised by Charaka and Dridhabala with the Ayurveda Dipika commentary of Chakrapanidutta, Choukambha Sanskrit Sansthan.Varanasi reprint edition 2016, Shareera Sthana 4th chapter, sloka number 31, page number :322

20) Pt. Hari Sadashiva Sastri Paradakara, Vagbhata's Ashtanga Hridaya with Sarvanghasundhara vyakhya of Sri Arunadatta and Ayurveda Rasayana Tikka by Hemadri, Choukambha Orientalia, reprint edition 2015 Chikitsa Sthana 10th chapter, sloka number 32, Page number:667

21) K.V. Krishnan vaidyan and S. Gopalapilla, Chikitsa sara sarvaswam, Sahasrayogam, Vidyarambham publishers, Reprint edition 2018, Kashaya Prakaranam, Page 78.

22) K.V. Krishnan vaidyan and S. Gopalapilla, Chikitsa sara sarvaswam, Sahasrayogam, Vidyarambham publishers, Reprint edition 2018, Choorna Prakaranam, Page 166.

23) Pt. Hari Sadashiva Sastri Paradakara, Vagbhata's Ashtanga Hridaya with Sarvanghasundhara vyakhya of Sri Arunadatta and Ayurveda Rasayana Tikka by Hemadri, Choukambha Orientalia, reprint edition 2015 Kalpa Sthana 2nd chapter, sloka number 15-16, Page number:743.

24) Pt. Hari Sadashiva Sastri Paradakara, Vagbhata's Ashtanga Hridaya with Sarvanghasundhara vyakhya of Sri Arunadatta and Ayurveda Rasayana Tikka by Hemadri, Choukambha Orientalia, reprint edition 2015 Chikitsa Sthana 10th chapter, sloka number 14-21, Page number:176.

25) Scientific Explanation for Using Purgation Therapy in Tamaka Shwasa (Bronchial Asthma) Kajaria Divya, Tripathi J.S, Tiwari S.K. ISSN 2321-2187 IJHM 2013; 1 (3): 46-49 © 2013 AkiNik Publications.

26) Adamalla and Kashiram, Sarangdharacharya's Sarangdhara samhitha with Deepika and Gudartha Deepika commentary, Choukambha Krishnadas academy, reprint edition 2013, Prathamakhanda,4th Chapter, sloka number 1, page number:3.

27) Tamhane MD, Thorate SP, Rege NN, Dahanukar SA, Effect of oral adnministration of Terminalia chebula on gastric emptying: An experimental study, J. Postgrad. Med., 43 (1), 1997, 12-13.

28) Wang M, Li Y, Hu X. Chebulinic acid derived from triphala is a promising antitumour agent in human colorectal carcinoma cell lines. BMC Complement Altern Med. 2018 Dec 27;18(1):342.

29) R.S. Satoskar, Nirmala N. Hedge, S.D. Bandarkar. Pharmacologicy and Pharmacotherapeutics, 27th edition, Popular prakashan Private limited, Chapter 39, page 584

30) Birari RB, Bhutani KK. Pancreatic lipase inhibitors from natural sources: unexplored potential. Drug Discov Today. 2007 Oct;12(19-20):879-89.

31) Lunagariya NA, Patel NK, Jagtap SC, Bhutani KK. Inhibitors of Pancreatic lipase: state of the art and clinical perspectives. EXCLI J. 2014 Aug 22;13:897-921.