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Therapeutic Appraisal of *Phalatrikadi Yoga* with *Lekhaniya Mahakashaya* in *Medoroga* w.s.r. to Metabolic Syndrome: A Review.

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ABSTRACT:

Santarpanottha Vikaras (diseases due to excessive nutrition) are increasing in current era due to faulty lifestyle. *Medodushti* (disorders of fat metabolism) serves as one of the important etiological factors in most of these disorders including dyslipidaemia, obesity, metabolic syndrome etc. Obesity and Metabolic syndrome (MS) are interconnected disorders having global prevalence, which are associated with physiological, biochemical, clinical and metabolic abnormalities. Both disorders directly influence the risk of cardiovascular disease (CVD) and diabetes mellitus. MS is considered as a first order risk factor for atherothrombotic complications. Pharmacodynamic attributes i.e., *Tikta*, *Katu*, *Kashaya Rasa*, *Laghu*, *Ruksha*, *Tikshna Guna* and *Ushna Veerya*, *Katu Vipaka* have individual effect in obesity. *Katu Vipaka* is having more significant influence in producing *Medohara*, *Lekhana* and *Karshana karma* which is important for management of obesity. It will also help in selection of drugs for the management of *Medoroga*. Overall, the drugs having dominance *Kaphavata shamaka*, *Dipana*, *Pachana* (digestion), *Srotoshodhana* (channel cleansing), and *Medohara* (lipolytic) properties are found to be effective in the management of *Medoroga* w.s.r. Metabolic Syndrome. In this context, *Ayurvedic* formulation is selected to laid down an emphasis on its therapeutic potential based on *Ayurvedic* pharmacodynamic and contemporary work done by the researchers of biomedical sciences.

Keywords: *Ayurveda*, *Medoroga*, Metabolic Syndrome, *Lekhaniya Mahakashaya*, *Phalatrikadi Yoga*

INTRODUCTION

Metabolic Syndrome is a cluster of metabolic abnormalities that includes hypertension, central obesity, insulin resistance, low high-density lipoprotein, hypertriglyceridemia and hyperglycaemia. [1] The prevalence of MS among adult population in India was 30% (95%CI: 28%-33%). There was a steady increase in the burden across the age groups from 13% (18–29 years

group) to 50% (50–59 years). We also found that people living in urban areas (32%; 95%CI: 29%-36%) had higher prevalence when compared to tribal (28%; 95%CI: 21%-36%) or rural adults (22%; 95%CI: 20%-25%). Gender distribution of MS showed that the females had higher prevalence (35%; 95%CI: 31%-38%) when compared to males 26% (95%CI: 22%-29%).[2] It has gained significant importance recently due to the exponential increase in obesity worldwide. India is reported to be positioned as the third amongst the countries having the highest rates with a prevalence of 11% amongst adolescent and 20% among adults.[3] Growing prevalence of obesity worldwide is an increasing concern surrounding the rising rates of diabetes, coronary, and cerebrovascular diseases. The total risk of death is increased by a factor of 1.5 compared with non-metabolic syndrome. MS is considered as a first order risk factor for atherothrombotic complications. Its presence or absence should therefore be considered as indicator of long-term risk.[4] In *Ayurvedic* prospective, concept of MS is remarkably resembling with over-nutritional disorders (*Santarpaṇajanya Vikaras*), which include *Medoroga / Sthaulya* (obesity), *Prameha* (diabetes), *Hṛdroga* (cardiac disease) etc. Faulty dietary habits and lifestyle deranged functions of different sets of *Agni* give rise to formation of *Ama* (reactive antigenic factor). [5] The production of *Medadhatu* is disturbed by variety of etiological factors including deranged *Medodhatvagni* (bio-fire). *Vaikṛta Meda Dhatu* interacts with *Ama* (reactive antigenic factor) circulates all over the body may lead to blockade of micro-channels and precipitate antigenic reactions and generate series of inflammatory events in the body. Disturbed metabolism, fat accumulation, production of *Ama* (reactive antigenic factor) and obstructed channels for lipid transportation are the key factors in the pathogenesis of the MS and other metabolic disorders and its complications.[6]

In the present study, *Amalaki, Haritaki, Vibhitaki, Shunthi, Pippali* and *Maricha* are described in *Yogaratnakara* and *Musta, Kushtha, Vacha, Ativisha, Haridra, Daruharidra, Chitraka, Chirbilva, Haimvati* and *Kutaja* are described in *Lekhaniya Mahakashaya* in *Charaka Samhita Sutrasthana*, have been chosen as a formulation to put an overview of individual drugs based on classical insight and contemporary work done by the researchers of modern medical sciences. The detail accounts of individual drug like *Ayurvedic* pharmacodynamics, clinical & therapeutic uses, chemical constituents and recent pharmaco-clinical studies have been described as follows.

AIM AND OBJECTIVES

1. To study the aspects of metabolic syndrome as per *Ayurveda*
2. Understanding mode of action and applicability of *Phalatrikadi yoga* and *Lekhaniya Mahakashaya* as per *Ayurveda* concepts.

MATERIAL AND METHODS

This study is based on the literature review of the relevant *Ayurvedic* original texts with commentaries, necessary and valid interpretations, and the analysis made by different scholars. Electronic databases such as "PubMed" and "Google Scholar" had been searched to find the relevant studies and reviews published from inception until December 2022.

In the present study, *Amalaki, Haritaki, Vibhitaki, Shunthi, Pippali* and *Maricha* are described in *Yogaratnakara* and *Musta, Kushtha, Vacha, Ativisha, Haridra, Daruharidra, Chitraka, Chirbilva, Haimvati* and *Kutaja* are described in *Lekhaniya Mahakashaya* in *Charaka Samhita Sutrasthana*, have been chosen as a formulation to put an overview of individual drugs based on classical insight and contemporary work done by the researchers of modern medical sciences. The detail accounts of individual drug like *Ayurvedic* pharmacodynamics, clinical & therapeutic uses, chemical constituents and recent pharmaco-clinical studies have been described as follows.

Phalatrikadi Yoga [7] Table 1

Lekhaniya Mahakashaya [8] Table 2

Ayurvedic pharmacodynamics of selected trial drugs [9, 10] Table 3

Current Understandings of Selected Trial Drugs Table 4

DISCUSSION

Ayurveda strongly believes that the entire range of digestion and metabolism of the body depends upon proper functioning of *Agnis* (biological fire) at different level in the body. *Kayagni* (digestive fire) contributes its moieties to the *Dhatu* or *Dhatvagni* dealing with tissue metabolism. Faulty dietary habits and lifestyle deranged the functions of different sets of *Agni*, which give rise to formation of *Ama* (undigested toxic substance). *Ama* may clog to the *Srotasa* (channels) leading to *Srotorodha* (obstruction of channels) which in turn increases *Medoduṣṭi* (disorders of fat metabolism) and decreases the nutrient supply to subsequent *Dhatus.* The relationship of *Medoduṣṭi* (disorders of fat metabolism) is well established in the pathogenesis of *Santarpanottha Vikaras* (diseases due to

excessive nutrition) like *Sthaulya* (obesity) and *Prameha* (diabetes). These formulations possess hypolipidemic, anti-obesity and hypoglycaemic activities.

1. Study of *Rasa* in combination Table 5
2. Study of *Guna* in combination Table 6
3. Study of *Virya* in combination Table 7
4. Study of *Vipaka* in combination Table 8
5. Study of *Doshaghnta* in combination Table 9

On the basis of *Ayurvedic* pharmacological properties probable *Samprapti vighatana* can be understood as follows.

1. **Probable Action on *Dosha*-** These drugs *Kapha Dosha* (bio-humor) by attributes of dominance its *Katu* (pungent), *Tikta* (bitter) *Rasa* and *Uṣṇa*-*Virya* (hot in potency). The *Vata Dosha* (bio-humor) is also aggravated in *Medoroga* (disorders of fat metabolism) due to *Srotavarodha* (obstruction of channel). Hence, *Ushna Virya* (hot in potency) helps to bring the *Vata and Kapha Dosha* in equilibrium and remove *Avarana* (covering) of *Vata* and clear the channels of lipid transportation.
2. **Probable Action on *Dushya*-** *Meda* is the chief culprits in *Medoroga* (disorders of fat metabolism). *Katu* (pungent), *Tikta* (bitter)-*Rasa* performs *Medo upashoshana* action. *Uṣṇa*-*Virya* (hot in potency) also helps in *Meda Vilayana* (dilution) action. The combination shows about more than 50% of total drugs have *Katu* (pungent), *Tikta* (bitter) and *Kashaya* (astringent) *rasa*, more than 80% have *ushna virya* (hot in potency) which have capacity to correct the vitiated lipids, reduces weight and abdominal fat.
3. **Probable Action on *Srotas*-** Due to *Katu* (pungent)-*Rasa*, all the involved channels are dilated i.e., "*Srotansi Vivrnoti*" (dilation) action. *Katu* (pungent), *Tikta* (bitter)-*Rasa* and *Ushna* (hot) *Virya* (potency) correct the *Medovaha* and *Mamsavaha Srotodushṭi* (channel abnormalities). In nut cell, maximum ingredients have *Katu* (pungent), *Tikta* (bitter) *Rasa*, *Laghu* (light), *Rukṣa (dry) Guna* and *Ushna Virya* (potency), *Katu Vipaka*, *Kapha*-*Vatashamaka*, *Karshna*, *Lekhaniya* (scraping), *Medohara*, *Dhatushoshana* properties, which normalize the state of *Agni*. Thus, regulated *Jaṭharagni* (digestive fire), corrects the tissue metabolism, prevents accumulation of *Medodhatu*, they also scrape out (*Lekhana*) excessive fat and clear the wastes from the body channels.
4. **Probable Action on *Agni*-** In the combination, maximum percentage of the drugs show *Dipana, Pachana* (digestion) properties. *Katu* (pungent), *Tikta* (bitter)-*Rasa*, *Ushna*-*Virya* (hot in potency) normalize the state of *Agni* (bio-fire) encounters *Dhatvagnimandya* (weak bio-fire) and potentiates the weakened *Dhatvagni*.
5. **Probable Action on *Ama*-** An *Ama* (reactive antigenic factor) means unripe and undigested byproduct formed due to improper functioning of bio-fire i.e., Agni; ranging from GIT to cellular levels, which reactive in nature. It needs proper metabolism and elimination by the virtue of its *Ushna virya* (hot in potency) (81.25% of total drugs) and *Dipana*-*pachana* (digestion), *Amapachana* (digestion of undigested product). It normalizes the state of *Agni*, and helps in *Amapachana* (digestion of undigested product).

These drugs not only correct the pathogenesis but also minimize the chances of short term and long-term complications. Pharmacodynamic attributes attributes i.e., *Tikta* (pungent), *Katu* (bitter), *Kashaya* (astringent) *Rasa*, *Laghu* (light), *Ruksha* (dry), *Tikshna* (strong) *Guna* (properties) and *Ushna Veerya* (hot in potency) and *Katu vipaka* have individual effect in obesity. *Katu Vipaka* is having more significant influence in producing *Medohara* (antiobesity), *Lekhana* and *Karshana karma* which is important for management of *Medoroga* (disorders of fat metabolism).

It also controls the further damage of cells, free radical's genesis and imparts better nourishment at cellular level. So, it seems that the formulation not only acts on symptoms of the disease, but also checks its progression by hitting the basic pathological process. All have various biological activities such as improves digestion, improves liver function and hepatoprotective action.

CONCLUSION

Thus, on the basis of observations made, it can be concluded that Metabolic syndrome is well defined but exact mechanism of complex pathways of MS is not yet completely known. In *Ayurvedic* classics, the concept of MS is strikingly resemblance with over-nutritional (*Santarpaṇjanya Vikaras*) disorders, which include *Sthaulya/Medoroga* (obesity/dyslipidemia), *Prameha* (diabetes), *Hṛdroga* (cardiac diseases) etc. The conventional management of metabolic syndrome is still not very satisfactory and the current strategy of prevention and treatment of metabolic syndrome is rapidly changing. On the basis of observations made, it can be concluded that the selected formulation has capacity to hit the pathogenetic components of *Medoroga* w.s.r. to Metabolic syndrome. It also improves the GI and tissue bio-fires. By virtue, this action it checks the *Ama* (reactive antigenic

factor). formation at GIT as well as cellular level, maintain the integrity of body channels. Recent clinic-pharmacological suggests that the majority of drug contents in the formulation have immunomodulatory activity, hypoglycaemic, hypolipidemic, anti-inflammatory, antitumor, purgative, hepato-regenerative effects, hepatoprotective, anti-ischemic, nephroprotective, anti-inflammatory, anti-cancerous, cardioprotective and anti-oxidative activities. We finally conclude that the formulation is effective as per Ayurvedic pharmacodynamics in the management of metabolic syndrome.

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Table 1 Phalatrikadi Yoga [7]

1.	*Haritaki*	*Terminalia chebula Retz.*	Fruit
2.	*Bibhitaki*	*Terminalia bellirica Roxb.*	Fruit
3.	*Amalaki*	*Emblica officinalis Gaertn.*	Fruit
4.	*Shunthi*	*Zingiber officinale Rosc.*	Rhizome
5.	*Pippali*	*Piper longum Linn.*	Fruit
6.	*Maricha*	*Piper nigrum Linn.*	Fruit

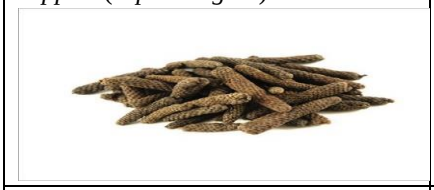
Table 2 Lekhaniya Mahakashaya [8]

1.	*Musta*	*Cyperus rotundus Linn.*	Rhizome
2.	*Kushtha*	*Saussarea lappa C.B.Clarke*	Root
3.	*Vacha*	*Acorus calamus Linn.*	Root
4.	*Ativiṣa*	*Aconitum heterophyllum Wall*	Root
5.	*Kutaki*	*Picrorhiza Kurroa Royle. Ex. Benth.*	Root
6.	*Haridra*	*Curcuma longa Linn.*	Rhizome
7.	*Daruharidra*	*Berberis aristata DC.*	Bark
8.	*Chitraka*	*Plumbago Zeylanica Linn.*	Root bark
9.	*Chirabilva*	*Holopteliya integrifolia Planch.*	Bark
10.	*Haimavati*	*Iris germenica Linn.*	Root

Table 3 *Ayurvedic* pharmacodynamics of selected trial drugs [9, 10]

Drugs	***Rasa***	***Guna***	***Virya***	***Vipaka***	***Doshakarma***	**Relevant therapeutic uses**
Haritaki	*Pancharasa Kashaya pradhana*	*Laghu, Rukṣa*	*Ushna*	*Madhura*	*Tridoṣa-shamaka*	*Pramehahara, Rasayana Agnivardhaka, Hṛidrogahara, Anulomaka*
Bibhitaki	*Kashaya*	*Ruksha, Laghu*	*Ushna*	*Madhura*	*Tridoṣa-shamaka*	*Shvas-kasahara, Bhedaka Shothahara,*
Amalaki	*Amla pradhana pancharasa*	*Ruksha, Laghu, Shita*	*Shita*	*Madhura*	*Tridosha-shamaka*	*Prameha-hara, Virechaka Vayasthapana, Rasayana,*
Shuṇthi	*Katu*	*Laghu, Snigdha*	*Ushna*	*Madhura*	*Vata-kapha shamaka*	*Dipana, Amadoshahara, Pachana, Anulomana*
Pippali	*Katu*	*Laghu, Tikshṇa Snignha,*	*Ushna*	*Madhura*	*Vata-kapha shamaka*	*Dipana, Pachana, Amavatahara,*
Maricha	*Kaṭu*	*Laghu, Tikshna*	*Ushna*	*Katu*	*KaphaVata shamaka*	*Dipana, Pachana, Shulahara Chedaka*
Musta	*Tikta, Katu, Kashaya*	*Laghu, Ruksha*	*Shita*	*Katu*	*Kapha-pitta-hara*	*Dipana, Pachana, Lekhana*
Kushtha	*Tikta, Katu, Madhura*	*Laghu, Ruksha, Tikshna*	*Ushna*	*Katu*	*Kaphavata-shamaka*	*Kushthghna, shvas-kashara, Hridroga*
Ativiṣha	*Tikta, Katu,*	*Laghu, Ruksha*	*Ushna*	*Katu*	*Kaphapitta-hara*	*Dipana, Pachana, Lekhana*
Vacha	*Tikta, Katu,*	*Laghu, Ruksha, Tikshna,*	*Ushna*	*Katu*	*Kaphavata-shamaka*	*Lekhana, Adhamanahara, shulahara*
Kuṭaki	*Tikta*	*Laghu, Ruksha*	*Shita*	*Katu*	*Kaphapitta-shamaka*	*Dipana, Lekhana, Bhedana, Prameha-hara,*
Haridra	*Katu, Tikta*	*Laghu, Ruksha*	*Ushna*	*Katu*	*Kaphavata-shamaka,*	*Pitta-Rechaka, Pachana, Pramehahara, Lekhana*
Daruharidra	*Tikta, Kashaya*	*Laghu, Ruksha*	*Ushna*	*Katu*	*Kaphapitta-shamaka*	*Chedana,YkritaPliha rogahara, Pramehahara, Rechaka*
Chitraka	*Katu*	*Guru,Ruksha, Tikshna,*	*Ushna*	*Kaṭu*	*Kaphavata-shamaka*	*Dipana, Pachana, Lekhana, Bhedana*
Chirabilva	*Tikta,Katu, Kashaya*	*Laghu, Tikshna,*	*Ushna*	*Katu*	*Kaphavata-shamaka*	*Lekhana, Bhedana, Krimihara*
Haimvati	*Tikta, Katu,*	*Laghu,Ruksha, Tikshna,*	*Ushna*	*Katu*	*Kaphavata-shamaka*	*Lekhana, Adhamanahara, Shulahara*

Table 4 Current Understandings of Selected Trial Drugs

Selected Trial Drug	Contemporary Pharmacological Evidences
Haritaki (*Terminalia chebula*) 	It has antimicrobial activity, antidiabetic activity, hypolipidemic, anti-secretary or anti-ulcer activity, anti-amoebic effect, immuno-modulatory activity, antioxidant activity, cytoprotective effect, anti-aging activity & hepatoprotective activity. [11]
Bibhitaki (*Terminalia bellirica*) 	Recent research has shown that it has hypoglycaemic effect, hypolipidemic, anti-obesity effect, hepatoprotective effect, antidepressant activity, wound healing activity, antipyretic and analgesic activity, antiviral, antifungal and antimalarial activity.[12]
Amalaki (*Emblica officinalis*) 	Recent evidence suggests that *Amalaki* has anti-diabetic activity, antioxidant, hepato-protective activity, anti-cancer activity, anti-inflammatory, antipyretic, analgesic, antimicrobial activity, gastroprotective activity, anti-hyperlipidaemic activity. [13]
Shunthi (*Zingiber officinale*) 	*Zingiber officinale* has immuno-modulatory, anti-tumorigenic, anti-inflammatory, anti-apoptotic, anti-hyperglycaemic, anti-obesity, anti-lipidemic, anti-emetic actions. Ginger is a strong anti-oxidant substance and may either mitigate or prevent generation of free radicals. [14]
Pippali (*Piper longum*) 	The pharmacological properties of *Piper longum* include anticancer, antioxidant, anti-inflammatory, hepatoprotective, immunomodulatory, anti-hyperlipidaemic, analgesic, anti-depressant, anti-amoebic, anti-obesity, radio-protective, cardio-protective, coronary vasodilation, bioavailability-enhancing and anti-fungal activities. [15]
Maricha (*Piper nigrum*) 	It has antihyperglycemic, antihyperlipidemic, antidiabetic action, neuroprotective activity, anti-microbial, anti-inflammatory, anti-oxidant action, anticancer, anti-convulsant and analgesic action. [16]
Musta (*Cyperus rotundus*) 	*Cyperus rotundus* has antihyperglycemic, anti-obesity activity, antihyperlipidemic, antidiabetic action, hepatoprotective activity, anti-microbial, anti-inflammatory, wound healing activity, anti-oxidant action, antiallergic action in various experimental studies. [17]
Kushtha (*Saussurea lappa*) 	It has anti-cytotoxic, diuretic, antibacterial, hypolipidemic, antiseptic, insect repellent, insecticidal, hypotensive, spasmolytic, bronchodilator, anti-ulcer, anti-mycotic, anti-inflammatory, immunostimulant action in various invitro and in vivo experimental models. [18]

Vacha (*Acorus calamus*) 	*Acorus calamus* has antioxidant, anticonvulsant, neuroprotective, hypolipidemic, anti-cellular, anti-obesity, immunomodulatory activity, antibacterial, antihypertensive, anti-carcinogenic activity, cytotoxic activity, spasmolytic action in experimental studies. [19]
Ativiṣa (*Aconitum heterophyllum*) 	It has antibacterial, antipyretic, anti-inflammatory, anthelminthic, neuroprotective, antihypertensive, immunomodulator activity, anti-hyperlipidaemic, action. [20]
Haridra (*Curcuma longa*) 	*Curcuma longa* has anti-diabetic, hypolipidemic, anti-inflammatory, anthelmintic, anti-atherosclerotic, neuroprotective, cytotoxic activity, antiallergic, chemoprotective, anti-diarrhoeal, hepatoprotective, anti-asthmatic and anti-cancerous action. [21]
Daruharidra (*Berberis aristata*) 	It is useful as antipyretic, antibacterial, antimicrobial, antihepatotoxic, antihyperglycemic, anticancer, antioxidant and antilipidemic agent. [22]
Chitraka (*Plumbago zeylanica*) 	It has anti-inflammatory, antioxidant, antidiabetic, antihyperlipidemic, antipyretic, appetizer, uterotonic, antibacterial, antifungal, antifertility, anticoagulant, antitumour, hepatoprotective and nephroprotective actions etc. [23]
Chirabilva (*Holoptelea integrifolia*) 	It has anti-inflammatory and analgesic effects in experimental studies, Hypolipidemic action, anti-emetic, anti-ulcer, adaptogenic, anticancer, hepatoprotective, anti-diabetic and antioxidant effect. [24]
Kutaki (*Picrorhiza kurroa*) 	It has immunomodulatory activity, hypoglycaemic, hypolipidemic, anti-inflammatory, antitumor, purgative, hepato-regenerative effects, hepatoprotective, anti-ischemic, nephroprotective, anti-inflammatory, anti-cancerous, cardioprotective and anti-oxidative activities. [25]
Haimvati (*Iris germanica*) 	It has anti-inflammatory, anti-osteoporotic activity, antioxidant and antimicrobial activity, antifungal, antimicrobial, antioxidant, antimutagenic activities, antihyperlipidemic, antidiabetic and immunomodulatory activity. [26]

Table 6 Study of Rasa in combination

Rasa	**No. of Drugs**	**%**
Madhura	3/16	18.75
Amla	2/16	12.50
Lavana	0/16	0.00
Katu	13/16	81.25
Tikta	11/16	68.75
Kashaya	6/16	37.50

Table 7 Study of *Guna* in combination

Guna	**No. of Drugs**	**%**
Laghu	14/16	87.50
Ruksha	12/16	75
Tikshna	7/16	43.75
Shita	1/16	6.25
Snigdha	2/16	12.50
Guru	1/16	6.26

Table 8 Study of *Virya* in combination

Virya	**No. of Drugs**	**%**
Ushna	13/16	81.25
Shita	3/16	18.75

Table 9 Study of *Vipaka* in combination

Vipaka	**No. of Drugs**	**%**
Madhura	5/16	31.25
Katu	11/16	68.75

Table 10 Study of *Doshaghnta* in combination

Dosha	**No. of Drugs**	**%**
VPK	3/16	18.75
VK	9/16	56.25
KP	4/16	25