



Review Article

MANAGEMENT OF METABOLIC SYNDROME THROUGH AYURVEDA

Kavitha Sharma<sup>1\*</sup>, Preeti Sharma<sup>2</sup>, Ruhi<sup>3</sup>, Akhilesh K. Srivastava<sup>4</sup>

\*<sup>1</sup>PG Scholar, <sup>4</sup>Sr.Lecturer, P.G. Dept. of Rog Nidan, R.G.G.P.G Ayurvedic College, Paprola-H.P.

<sup>2</sup>Medical Officer, Community Health Centre, R.S. Pura, Jammu & Kashmir.

<sup>3</sup>PG Scholar, P.G. Dept. of Swasthvritha, R.G.G.P.G Ayurvedic College, Paprola- H.P.

ABSTRACT

Metabolic syndrome is defined as a constellation of interconnected physiological, biochemical, clinical and metabolic factors that directly increase the risk of cardiovascular disease and Type 2 Diabetes Mellitus. It is a major and increasing public health problem and clinical challenge worldwide in the wake of urbanization, increasing obesity and sedentary life style. Metabolic syndrome defined by IDF (2006) as presence of Central obesity with any one of the 3 factor i.e., Raise Triglyceride, Reduced HDL, Raised BP or Raised FBS. It increases 5 fold risk of Type II DM and 2 fold risk of Cardio-vascular disease. Worldwide prevalence of Metabolic syndrome ranges from 10% to 84% depending upon the Region (Urban/Rural), Composition (sex, age, race, ethnicity) of Population. IDF estimates that 1/3<sup>rd</sup> of world Adult population have Metabolic Syndrome. According to NCEP - ATP III CRITERIA 2001 Metabolic syndrome varies from 8 to 43% in men and 7 to 56% in women around the world. Lifestyle modification remains the initial intervention of choice as majority of people have sedentary lifestyle high socio economic status high BMI and are overweight. So lifestyle modification combine with specific Ayurvedic therapies i.e., Palliative (*Shaman*), *Panchkarma (Shodhan)*, *Sadhvrit* (good conduct/ethical regimen for balanced state), Exercise and Diet, *Yogic Practices* etc. could be effective in the Management of Metabolic Syndrome.

**KEYWORDS:** Metabolic syndrome, *Sthaulya*, *Medhovidhi*, *Panchkarma*, *Yogic Practices*.

INTRODUCTION

Healthy body is ideally having optimum and proportionate distribution of all body tissues and balanced bodily functions. But now a days, majority of people are not in *Samasamhanana* (well distributed body build up). Overweighting and Obesity is the chief complaint of the people in present era. The highest recorded prevalence worldwide is in Native Americans. In India, disease profile is changing rapidly. The WHO has identified India as one of the nation that is going to have most of the lifestyle diseases in near future. The population at risk has shifted from 40+ to 30+ or even younger. According to WHO reports 2003 an estimated 16.7 Millions of total global deaths result from Cardio vascular disease. Obesity has reached epidemic proportions globally with >1 billion individuals overweight, is a major contributor to global burden of chronic diseases. Worldwide there is an increasing trend in the prevalence of obesity, and it is reflected in the increasing prevalence of Metabolic Syndrome. According to NCEP ATP III categorized Metabolic Syndrome as, individuals must have at least 3 of these 5 measures must be outside of the cut-points,

increased central obesity (waist circumference), Hypertension or Raised systolic and/or Diastolic blood pressure, Serum Dyslipidemia i.e, Decreased high density lipoprotein cholesterol (HDL-C) and Raised Triglyceride (TG), and Impaired fasting blood sugar (FBS)<sup>[1]</sup>. Metabolic Syndrome definitions have been devised to include a cluster of cardiovascular disease (CVD) risk factors or risk markers that tended to occurs together<sup>[2]</sup>. The decline in physical activity levels in the past decades can be attributed to a combination of factors, including jobs becoming less physically active and more 'desk based', the reliance on motorized transport rather than walking and cycling, and the growth in the popularity of sedentary pastimes involving televisions and computers. Individual who watched television or computer < 1 hour daily compared with who carried out those behavior for >4 hours had a Two Fold increased risk of Metabolic syndrome <sup>[3]</sup>. Life style diseases are an important cause of rising mortality and morbidity in this modern world. Due to rapid urbanization and industrialization the incidence of metabolic disorders particularly Diabetes mellitus,

Hypertension, obesity is increasing worldwide to an alarming rate.

### Ayurvedic

Metabolic Syndrome can be comparable with *Santarpanjanya Vikaras* (Comprise of diseases due to over nutrition and defective tissue metabolism). Its main sign is central obesity so may be correlated with *Medhovridhi* or *Sthoulya*. *Sthoulya* is mentioned among *Santarpanajanyavyadhi* in Ayurveda, reflects *Nidana* similar to present time. As per latest IDF definition, for the diagnosis of Metabolic Syndrome, obesity is the only common and most important phenotypical marker of Metabolic Syndrome. The causative factors of the disease are similar in both MS and *Medoroga* i.e., *Atisampurana* (Excessive intake of diet specially *Madhura*, *Sheeta*, *Sanigdha Ahara*), *Avyayam*, *Diwaswapna* (less physical work), *Harsha*, *Achitana* (less mental work), *Beeja Dosh* (Genetic /Hereditary factor)<sup>[4]</sup>. High calorie diet and sedentary life style have been considered as the primary etiological factors for obesity and Metabolic Syndrome. Role of genetic factor in causing obesity and Metabolic Syndrome has been supported after discovery of *ob* gene which codes for leptin protein and leptin may increase blood pressure by causing sympathetic activation<sup>[5]</sup>. Similar a very scientific description of pathogenesis of *Sthoulya* is given in *Ayurveda* i.e. excessive indulgence in causative factors like Dietary, non- dietary and genetic factors causes *Kapha Prakopa* which cause *Khaivagunya* in *Medovaha Srotasa* results in *Jatharagni Mandyata* and *Ama production*. *Ama Dosh* develops affinity towards *Medo Dhatwagni Mandya* and *Apakva Medo Dhatu formation* excessive quantity which causes *Medovaha Srotodushti* and malnourishment of other *Dhatu* <sup>[6]</sup>. Clinical features of *Medo Roga* and obesity are also similar. *Apakva Medo Dhatu* which is immobile in nature is stored in *Medodharakala* in various sites i.e. *Udara*, *Sphika*, *Stana*, *Gala* and *Vasa* (*Mamsagata Sneha*) can be correlated with fat and adipose tissue<sup>[7]</sup>. In the pathogenesis of *Sthoulya* (obesity), both *Kapha* and *Vata Doshas* are vitiated along with *Medodhatvagnimandya* and *Srotorodha*. According to *Ayurvedic* perspective, the drugs having potential to break the *Samprapti Chakra* without producing any untoward effect is called the ideal one<sup>[8]</sup>. In the pathogenesis of *Sthoulya* (Obesity), both *Kapha* and *Vata Doshas* are vitiated along with *Medodhatvagnimandya* and *Srotorodha*. Therefore, drugs possessing *Vataghna*, *Kaphaghna*, *Deepan*, *Pachana* and *Srotoshodhaka* properties are indicated in *Sthoulya*. The drugs possess *Laghu*, *Ruksha*, *Tikshana*, *Srotoshodhana*, and *Rasayanaguna*; *Katu*, *Tikta Rasa* and *Ushna Virya*. *Lekhana*, *Srotoshodhana*, *Tridosh-hara*, and *Rasayana* properties and possess

the ability to break *Samprapti Chakra* of *Sthoulya*<sup>[9]</sup>. These properties also help in regularization of both *Jatharagni* as well as *Dhatvagni*, check the excessive growth and accumulation of *Medodhatu*. In the ancient Ayurvedic literature, various drugs has been documented as the best drug for the treatment of *Medoroga*. The drugs having potential of breaking *Samprapti chakra* of *Sthoulya* at various levels i.e. *Dosha*, *Dushya*, *Agni*, *Srotas* etc.

**Dosha:** *Sthoulya* is a *Tridoshaja Vyadhi* were *Kapha Dosh* is predominantly found vitiated<sup>[10]</sup>.

**Dushya:** *Sthoulya* is a *Dushyapradhanavyadhi* and main *Dushya* involved is *Meda Dhatu*.

**Agni and Ama:** *Mandagni* remains the root cause of *Sthoulya*. *Meda Dhatvagnimandya* is responsible for symptomatology like *Chala Safika Udara Stana*<sup>[11]</sup> etc.

**Srotas:** *Medovaha*, *Mamsavaha*, and *Rasavaha Srotodushti* is evident in *Sthoulya*.

### MANAGEMENT

It is *Santarpanajanyavyadhi*<sup>[12]</sup> but only *Aptarpana chikitsa* is not sufficient for the management of *Sthoulya*. Because main Etiological factors of *Sthoulya* are vitiated *Meda*, *Kapha* and *Vata*. Therefore, treatment should be planed considering vitiated *Vata*, *Meda*, and *Kapha*. *Charak Samhita* emphasized on the use of *Rukshana*, *Ushna*, and mainly *Kapha-Vata shamana* drugs for the management of *Sthoulya*<sup>[13]</sup>.

In *Ayurveda*, treatment of obesity is described very systemically. Various single herbs, compound formulations, exercises and life style modification have been mentioned. In Ayurveda management of any disorder is divided into 3 parts<sup>[14]</sup>:

1. *Nidana Parivarjana* (Avoidance of causative factors)
2. *Shodhana* (Purification therapy for removal of body toxins)
3. *Shaman* (Medication therapy)

### Nidana Parivarjana

It is the 1st line of treatment for any disease<sup>[15]</sup>. *Nidana* (causative factors) must be avoided for best management of the disease. Skip the fast foods, sweetened drinks, high calorie diet, limit red meat and avoid processed meat, choose nuts, whole grains, poultry or fish. Choose whole grains and whole grain products over highly processed carbohydrates.

### Shodhana

Complete eradication of disease is achieved by removing vitiated dosha to avoid recurrence of disease and restoration of normal strength, complexion and longevity is achieved. *Acharyas* have mentioned internal purification therapy for management of *Sthoulya*. *Charaka* has mentioned

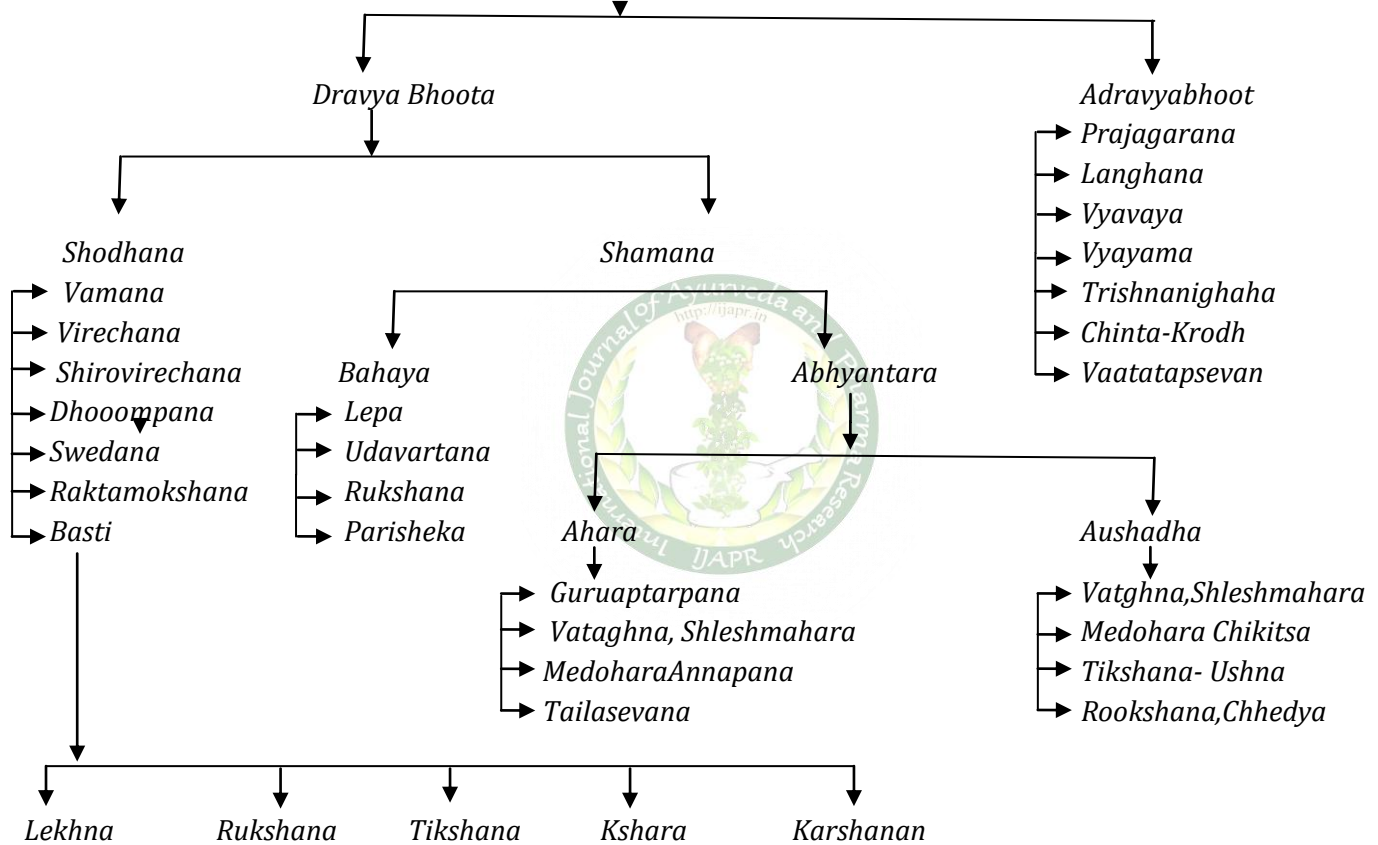
*Sthoulya* under the caption of *Santarpanajanita Vyadhi* and for its management; *Vamana*, *Virechana* and *Raktamokshana* are recommended<sup>[16]</sup>. *Ruksha*, *Ushna* and *Tikshana Basti* (administration of medication through anal route) are also suggested by Acharya Charaka<sup>[17]</sup>. An effort has been done by Chaturvedisonal *et al.* to study the role of *Lekhana basti* and *Virechana karma* in the management of obesity. According to this, *Basti* provides better results than *Virechanain* the management of obesity<sup>[18]</sup>.

**Shamana**

Among *Sad upakramas*, *Langhana* and *Rukshana* can be administrated for *Samshamana*

purpose in *Sthoulya*. *Samshamanachikitsa* can be implemented through seven different ways. According to *Acharya Charaka* administration of *Guru* and *Apatarpaka* articles which possess additional *Vata*, *Shleshmala* and *Medonashaka* properties are considered as an ideal for *Samshaman* therapy<sup>[19]</sup>. *Chakrapani* has explained that *Guru Guna* is sufficient to alleviate vitiated *Agni* and *Atikshudha*. *Apatarpana* property provides less nourishment and thus leads to depletion of *Meda*. *Gangadhara* has interpreted that *Guru Property* is suitable to alleviate *Tikshnagni* and vitiated *Vata* especially *Kosthagata Vata* which ultimately reduces *Atikshudha* and *Apatarpan* property causes reduction of *Meda*<sup>[20]</sup>.

**Medo Roga (Sthoulya) Chikitsa<sup>[21]</sup>**



Obesity is the major driving force in the development of Metabolic Syndrome. In order to prevent Metabolic Syndrome, a multi-dimensional approach is essential, treatment modality should be planned considering vitiated *Meda*, *Kapha* and *Vata* as they are the key factors in pathophysiological cascade which should include behavior modification, dietary restriction and modification, increase in physical activities, incorporation of *Yoga* practices in daily routine. *Prakriti* based counseling and safe *Ayurvedic* drugs are required to get optimum results.

**Guggulu:** *Guggulu* has got *Lekhana*, *Shodhana* and *Kapha-Vatahara* activity<sup>[22]</sup>. *Guggulu* alleviate vitiated *Kapha* by virtue of their *Tikta*, *Katu Rasa*; *Laghu*, *Ruksha*, *Tikshan*, *Srotoshodhaka* and *Rasayana Guna*;

*Ushna Virya*; *Katu Vipaka* and *Tridoshahara Prabhava*<sup>[23]</sup>. Recent studies have established that *Guggulu* has cholesterol lowering effect. *Guggulu* has *Guggulsterone*, an *FXR* antagonist and down regulates *FXR* target genes and *FXR* antagonism has been suggested as a mechanism for the cholesterol lowering effect [24]. Anti-inflammatory and Antioxidant Effect, Enhance Basal Metabolic Rate, *Guggulsterone* stimulate thyroid activity, This effect has established the fact that *Guggulu* increases *BMR*<sup>[25]</sup>.

**Shilajatu:** *Shilajatu* break the pathophysiology circuit of disease with their *Tridosahara Prabhava*. *Shilajatu* help in combating Metabolic Syndrome as well as obesity through actions Hypolipidemic

activity i.e., by conversion of cholesterol to bile acids and subsequent excretion through the enterohepatic circulation represent a major pathway to remove excessive cholesterol from the body<sup>26</sup>. Anti-inflammatory activity due to Presence of high concentration of fulvic acid and humic acid reduces inflammation which improve insulin resistance<sup>[27]</sup>. Anti-oxidant activity, Hypoglycemic activity, *Shilajatu* stimulates the pancreas to secrete insulin<sup>[28]</sup>.

**Haridra:** *Haridra* has *Tikta, Katu rasa, Katu Vipaka, Rukhsha* and *Laghugunna*<sup>[29]</sup>. It is *Varnya*, cleanses *Srotas* due to *Ushna Veerya*, pacifies all the three *Doshas*, acts on *Kapha* and pacify *Kapha-vata Dosh*<sup>[30]</sup>. Various studies have been done to establish the pharmacological action of *Haridra*. curcumin is the main content of *Haridra* and proven for its anti-inflammatory, anti-oxidant, anti-diabetic, anti-bacterial, Hepato-protective activities. It show anti-diabetic activity by inhibiting the enzyme HPA (Human pancreatic amylase) causing reduction in starch hydrolysis leading to lowered glucose level<sup>[31]</sup>. It decreases several risk factors like cholesterol, triglycerides, free-radical damage<sup>[32]</sup>. Curcumin show anti-inflammatory property by the up regulation of PPAR-Y, leading to the suppression of pro-inflammatory cytokine, TNF- $\alpha$  expression and release<sup>[33]</sup> and also inhibit phospholipase, lipooxygenase, COX-2, leukotrienes, thromboxane, prostaglandin's, hyaluronidase etc.<sup>[34]</sup>.

**Triphala:** *Triphala* is a *Tridhoshicrasayan* having a balancing and rejuvenating effect. It is rich in polyphenol, vitamin C, Tanins, Linolenic acid etc.<sup>[35]</sup>. It has Antioxidant property by converting reactive oxygen free radicle to non-reactive products by polyphenolic contents<sup>[36]</sup>. Antidiabetic activity with lipid peroxide inhibiting and hydroxyl and superoxide radicle scavenging property. Immunomodulatory activity by enhanced phagocytosis, phagocytic index, anti-oxidant activities and decreased Corticosterone levels in animals exposed to noise stress. Anti-inflammatory due to selective inhibition of COX-2<sup>[37]</sup>, Anti-microbial<sup>[38]</sup>, Anti-cancerous<sup>[39]</sup>, anti-obesity<sup>[40]</sup>, wound healing property<sup>[41]</sup> etc. Various animal studies has shown the Anti-diabetic property of *Triphala*, one in high fructose diet induced and another in alloxan diabetic rats and found to inhibit lipid peroxide formation and to scavenge hydroxyl and superoxide radical in vitro<sup>[42]</sup>.

### Pathyapathya

This is the unique contribution of *Ayurveda* and explained for almost all diseases. It plays an important role as much as of medicine and it is rightly mentioned that "if one follow *Pathya*, than

there is no need of medicine and if not then also there is no use of therapeutic measures".

The things which are best for *Srotas* is called *Pathyam*, and one which deteriorates the condition is called *Apathya*<sup>[43]</sup>.

**Table :Pathya Apathya<sup>[44]</sup>**

Pathya	Apathya
Yava, Kodrava	Godhuma, Navanna, Shali
Mudga, Rajamasha, Kulatha, Chanaka	Masha, Tila
Patola, Vrunthaka	Madhura Phala
Takra, Madhu, Ushnodhaka, Sarshapa Taila, Arista, Asava, Jeerna Madya	Dugda, Draksha, Navaneeta, Grutha, Dadhi
	Anupa, Gramya

### Yogic practices

**Asana:** *Asana* is third part of *yoga* which include different yogic postures. 84 classic yogic *Asanas* are taught by lord Shiva is mentioned in several classical texts of *yoga*<sup>[45]</sup>. Patanjali *yoga sutra* does not mention a single *Asana* by name, however do mention 84 classic *Asanas* and associate them with Shiva. Spiritually *Asanas* help in controlling the mind and to attain salvation and preservation of health and cure of various diseases. Various studies carried out on normal individuals, obese, hypertensive and diabetic have demonstrated a decrease in body fat percentage, increase in lean body mass, normalization of the insulin glucagon ratio, reduction in free fatty acid and up regulation of the insulin receptor with the yogic practices.

### Pada-Hastasana

This *Asana* massages and tones the digestive organs, alleviates flatulence, constipation and indigestion. Spinal nerves are stimulated and toned. Inverting the trunk can increase vitality, improve metabolism, concentration and helps in nasal and throat diseases. Dynamic form of *Padastansa* also helps to remove excess weight<sup>[46]</sup>.

### Ardha Matsyendrasana

It gently massages the kidney and the liver and ensures improvement over backache and pain in the hips. The gentle massage in the liver ensures proper functioning and secretion of the hormones, digestion and thus the production of the insulin hormone that regulates the sugar levels in the blood<sup>[47]</sup>.

### Shashankasana

It improves gastritis, indigestion, constipation. It improves diabetes, poor physique, shortness of height and poor circulation etc. Improves flexibility and strength of the spine which can counter all the adverse effects of sedentary life.

Regulates functioning of adrenal glands. Tones muscles of pelvic region, so beneficial for reproductive organs<sup>[48]</sup>.

### **Mandukaasana**

The name comes from *Manduk* means frog and *asana* means posture. As the patient is advised to be in kneeling position placing the thigh high on the legs with soles upwards. It improves diabetes, poor physique, shortness of height, poor circulation, indigestion, constipation. It improves flexibility and strength of the spine which can counter all the adverse effects of secondary life<sup>[49]</sup>.

### **Bhujangasana**

The cobra pose massages and stimulates the pancreas enhancing its performance and thus, useful for people suffering from diabetes. This pose and its variations allow more blood to circulate in the body, making the organs healthy so as to perform its regular functions more effectively. Researchers found that regular yoga practice leads to improvements in cholesterol and fasting glucose levels. It massages and tones the abdominal organs like the pancreas and liver, stimulate the nervous and circulatory system which in turn helps in controlling diabetes<sup>[50]</sup>.

### **Dhanurasana**

It helps to maintain a strong digestive system which directly or indirectly helps in maintaining the hormonal levels thus controlling diabetes. It also helps in reducing abdominal fat to shape your body slim and improves the flexibility of your spine and body posture by stretching the entire front of the body, ankles, thigh, groins, abdomen and chest. So beneficial in low backache, slip disc, obesity, etc. <sup>[51]</sup>

### **Suryanamaskar**

It is the combination of several postures along with regular breathing. Practice of *Suryanamakar* is a sort of training to the body, mind and soul. *Suryanamaskar* stimulates every large muscle group in the body. It stretches upto 90% of the body muscle and improves the general physical fitness by strengthening the muscles. Each posture counteracts the proceeding one producing a balance between flexion and extension, performed with synchronized breathing and aerobic activity.

Thus *Suryanamaskar* increases *Agni*, hence increases the metabolism of *Meddhatu*. It produces *Laghuta* in the body, clears the channels of the body. So it channelizes *Dhatu paka* process and reduces *Medha* and *Kapha*.<sup>[52]</sup>

## **DISCUSSION**

*Sthoulya* is a *Dushya* dominant *Vyadhi*, and it is comparable with Metabolic Syndrome. Incidence of Metabolic Syndrome is continuously rising in India due to changing life style, about 33% of urban

population has metabolic syndrome. Among number of culprit etiological factors; unhealthy eating patterns, reduced physical activity, increased sedentary pursuits, increased mental stress and possibly constitutional predispositions are important. The old saying "The longer the belt, the shorter the life" is time tested. Due to remarkable risk profile of modern synthetic anti-diabetic, Anti-hypertensive, Anti-obesity and Hypo-lipidemic agents there is an urgent need to develop ecofriendly, bio friendly plant based products to replace synthetic chemicals particularly which has implication for future patterns of CVD and DM. The whole story of MS revolves around obesity. It is clearly evident from *Samprapti* of *Sthoulya*. There is an involvement of all the three *Doshas* in *Sthoulya* but the vitiation of *Kapha-Vata* and *Meda* of prime importance. *Kapha* and *Meda* are main *Dosha* and *Dushya* respectively. *Sthoulya* has been considered as *Kapha Nanatmaja Vyadhi* in *Charak Samhita*. Further it has been mentioned in *Charak Samhita* that *Sthoulya* and *Purvarupa* of *Prameha* are the manifestations of *Medovaha Srotodushti*. Hence, *Chikitsa* of *Medovahasrotas* cures both *Sthoulya* and *Prameha*. *Katu*, *Tikta Rasa* performs *Medohara* and *Kaphahar* action and executes *Srotoshodhana* by virtue of its "Srotansi Vivrunoti" action, *Laghu*, *Ruksha*, *Tikshana*, and *Srotoshodhaka Guna* augments *Medohara* action of the drug by controlling *Ama* production which is basically responsible for *Srotoavrodha*. *Ushana Virya* helps in *Kleda* and *Meda Vilyana* action, also alleviates *Dhatvagnimandya* by potentiating the weakened *Meda Dhatvagni*, thereby alleviating *Apakva Medodhatu*. These properties probably increase basal metabolic rate which in turn helps in mobilization of body fat from depot sites. The exact mode of action of *Yoga Asanas* is unknown. But due to various twists, stretches and subjected to strains in the body the internal organs are stretched and strained which increases the blood supply, oxygen supply increasing the efficiency and functioning of the organ and also stretching of various glands results in increased endocrine function. It can be postulated that yoga practices have direct rejuvenation effect on pancreatic cells, which may increase the utilization and metabolism of glucose in peripheral tissue, liver and adipose tissue through enzymatic effect. Acc. to Sahay et al. *Yoga Asanas* has significant role in reducing free fatty acid and decrease activity of serum lipases. Satyanand et. al states the effect of Yoga on hypertension and it have been postulated that stress is one of the predisposing factor for hypertension and yoga reduces the cortisol levels so helps in reducing the stress and it also promote the flexibility of the vessels and reduces.

## CONCLUSION

Metabolic syndrome is a constellation of interconnected physiological, biochemical, clinical and metabolic factors that directly increase the risk of CVD and Type 2 Diabetes Mellitus. The whole story of MS revolves around obesity and in today's clinical practice whether Ayurvedic, homeopathic or Allopathic system of medicine receive large no of patient suffering from metabolic disorders. So such patients can be treated with Ayurvedic drugs, diet and yogic practices. Various clinical trials and experimental studies had already proved the efficacy of Ayurvedic drugs and formulation in the management of metabolic disorders and further more needed.

## REFERENCE

1. Longo faucikesper, Harrison's Principles of Internal Medicine volume I, 18th Edition McGraw-Hill Companies, Inc, page 1992.
2. Longo faucikesper, Harrison's Principles of Internal Medicine volume I, 18th Edition McGraw-Hill Companies, Inc, page 1993.
3. Bloom garden ZT, obesity, hypertension and insulin resistance. Diabetes care 2002; 25:2088-97.
4. Pt.Kashinatha Shastri and Dr Gorakha Natha Chaturvedi, Charaka Samhita of Agnivesh with Vidyotini Hindi commentary part-2, Chaukhamba Bharti Academy, Varanasi, 2013.Sutra Sthana 23, verse 3-4.pg. 436.
5. Longo faucikesper, Harrison's Principles of Internal Medicine volume I, 18th Edition McGraw-Hill Companies, Inc, page 1993.
6. Madav Nidana , chapter 34 , verse 4-6 , page- 28.
7. Pt.Kashinatha Shastri and Dr.Gorakha Natha, Charaka Samhita of Agnivesh with Vidyotini Hindi commentary, Chaturvedi, part-2, Chaukhamba Bharti Academy, Varanasi, 2013. Sutra Sthana 21, verse 4-7.pg. 411.
8. Kaviraj Ambikadutt Shashtri, Sushruta Samhita vol. 1, Chaukhambha Sanskrit Sansthana, Varanasi, reprint edition 2007.
9. Pt.Kashinatha Shastri and Dr Gorakha Natha Chaturvedi Charaka Samhita of Agnivesh with Vidyotini Hindi commentary, part-2, Chaukhamba Bharti Academy, Varanasi, 2013.Sutra Sthana 21, verse 24.pg. 411.
10. Pt.Kashinatha Shastri and Dr Gorakha Natha Chaturvedi Charaka Samhita of Agnivesh with Vidyotini Hindi commentary, part-2, Chaukhamba Bharti Academy, Varanasi, 2013.Sutra Sthana 21, verse 9.pg. 411.
11. Ajay Kumar Sharma Kayachikitsa, vol-3, Chaukhamba Publishers, Varanasi, edition 2009, page 170.
12. Charaka Samhita of Agnivesh with Vidyotini Hindi commentary by pt.Kashinatha Shastri and Dr.Gorakha Natha Chaturvedi, part-2, Chaukhamba Bharti Academy, Varanasi, 2013. Sutra Sthana 23, verse 4 - 6.pg. 414.
13. Pt.Kashinath Shastri and Dr.Gorakha Natha Chaturvedi, Charaka Samhita of Agnivesh with Vidyotini Hindi commentary, part-2, Chaukhamba Bharti Academy, Varanasi, 2013.Sutra Sthana 21, verse 22.pg. 437.
14. Pt.Kashinatha Shastri and Dr Gorakha Natha Chaturvedi, Charaka Samhita of Agnivesh with Vidyotini Hindi commentary part-2, Chaukhamba Bharti Academy, Varanasi, 2013.Vimaan Sthana 7, verse 30.pg. 734.
15. Kaviraj Ambikadutta Shastri, Sushruta Samhita of Maharishi Sushruta, Part-2 (Uttartantra 1/1) , Varanasi: Chaukhambha Sanskrit Sansthan; 2007.
16. Pt.Kashinatha Shastri and Dr Gorakha Natha Chaturvedi Charaka Samhita of Agnivesh with Vidyotini Hindi commentary, part-2, Chaukhamba Bharti Academy, Varanasi, 2013.Nidaan Sthana 23, verse 7.pg. 437.
17. Pt.Kashinatha Shastri and Dr Gorakha Natha Chaturvedi Charaka Samhita of Agnivesh with Vidyotini Hindi commentary, part-2, Chaukhamba Bharti Academy, Varanasi, 2013.Sutra Sthana 21, verse 21.pg. 414.
18. Chaturvedisonal et al.
19. Pt.Kashinatha Shastri and Dr Gorakha Natha Chaturvedi Charaka Samhita of Agnivesh with Vidyotini Hindi commentary, part-2, Chaukhamba Bharti Academy, Varanasi, 2013. Sutra Sthana 21, verse 20.pg. 414
20. Dr.Indradeva Tripathi, Edited by Prof. Ramanath Dwivedy Chakradatta of Sri Chakrapanidatta with Vaidyaprabha Hindi commentary, Chaukhambha Sanskrit Bhawan Varanasi, Chikitsasthan 36, verse 5.
21. Prof.Ajay Kumar Sharma, Kayachikitsa, vol-3, Chaukhamba Publishers, Varanasi, edition 2009, page 173.
22. Prof.P.V.Sharma, Dravya Guna vigyana, Chaukhamba books, Volume II, Edition- 2015, page 54.
23. Ibid, page 55.
24. Urizar et al. science. 2002.
25. Tripathy YB, Malhotra OP et al 1984.
26. Sharma P et al 2003.

27. Russell 2003 and Tierra M. Planetary Herbology. Twin Lakes, WL: Lotus press 1988 p.17,
28. Frawley David, Lalvasant, The yoga of Herbs 2<sup>nd</sup> ed. Twin Lakes. WL. Lotus press 2001.
29. Prof.P.V.Sharma, Dravya Guna vigyan, Chaukhamba books, volume II, Edition- 2015, page 162.
30. Prof.P.V.Sharma, Dravya Guna vigyan, Chaukhamba books, volume II, Edition- 2015, page 164.
31. Ponnusamy S, Ravindran R, Evaluation of traditional Indian Anti-diabetic medicinal plants for human pancreatic amylase inhibitory effect in vitro evidence based complementary and alternative medicine.
32. <http://www.life123.com/health/menshealth/health/turmeric-for-cardiovascular.html>.
33. Jacob A, Wu R, Zhou M, Wang P (2007) Mechanism of the anti-inflammatory effect of curcumin: PPAR- $\gamma$ - Activation, PPAR Research.
34. Chainanin (2003) Safety and anti-inflammatory activity of curcumin: A component of turmeric (*Curcuma Longa*) J Altern Complement Med 9: 161-168.
35. Prabhakar J, Senthil kumar M, Priya MS, Mahalakshmi K, Evaluation of antimicrobial efficacy of herbal alternatives (Triphala and green tea polyphenols), MTAD and 5% , 2010.
36. Mahalakshmi et al, Antibacterial activity of Triphala, GTP and Curcumin on Enterococci Faecalis. Biomedicine. 2006; 26(3-4): 43-46.
37. Prativadi Bhayankaram VS et al, Antidiabetic activity of Triphala fruit extracts, individually and in combination, in rat model of insulin resistance. 2008, 3(2);251-256.
38. Shi Y et al Triphala inhibits both in vitro and vivo, xenograft growth of pancreatic tumor cells by inducing apoptosis, BMC Cancer, 2008; 8:294.
39. Sharma A et al, Simultaneous Quantitation of Gallic Acid From Fruits of *Phyllanthus Emblica* Linn. *Terminalia Bellirica* Roxb. And *Terminalia Chebula* Retz. Asian J Chem. 2009; 21(9); 7111-7116.
40. Gurjar S, et. al. Triphala and its constituents ameliorate visceral adiposity from a high diet in mice with diet-induced diabetes, Altern Ther Health Med. 2012 Nov-Dec.
41. Kumar MS et al, Triphala promotes healing of infected full thickness of dermal wound. J Surg Res. 2008: 144(1);94-101.
42. Prativadi bhayankaram VS et al, Antidiabetic Activity of Triphala fruit extracts, individually and in combination, in rat model of insulin resistance. 2008, 3(2);251-256.
43. Pt.Kashinatha Shastri and Dr.Gorakha Natha Chaturvedi, Charaka Samhita of Agnivesh with Vidyotini Hindi commentary, part-1, Chaukhamba Bharti Academy, Varanasi, 2013. Sutra Sthana 21, verse 21-24. pg. 415.
44. Ajay Kumarsharma, Kayachikitsa, Part- III, Chaukhamba Publishers, Varanasi, 2009, Pg 178.
45. Parmhanas Swami Anant Bharti, Hath Yoga Radipika, Chaukhamba Bharti Academy, Varanasi, Pg24.
46. Kashinath Samgandhi, Swasathvritta Sudha, Ayurveda Sanskrit Hindi Pustakh Bhandar, Jaipur, Edition 2017, Page 260.
47. Kashinath Samgandhi, Swasathvritta sudha Ayurveda Sanskrit Hindi Pustakh Bhandar, Jaipur, edition 2017, page 272.
48. Dr.Sarvesha kumar Aggarwal, Swasthvritta vigyan, Chaukhamba Orientalia, Varanasi, edition 2015, Page 142.
49. Dr.Sarvesha Kumar Aggarwal, Swasthvritta vigya, Chaukhamba Orientalia, Varanasi, edition 2015, Page 147.
50. Kashinath Samgandhi, Swasathvritta sudha, Ayurveda Sanskrit Hindi Pustakh Bhandar, Jaipur, edition 2017, page 284.
51. Kashinath Samgandhi, Swasathvritta Sudha, Ayurveda Sanskrit Hindi Pustakh Bhandar, Jaipur, edition 2017, page 249.
52. Swasathvritta Sudha, Ayurveda Sanskrit Hindi Pustakh Bhandar, Jaipur, edition 2017, page 249.

**Cite this article as:**

Kavitha Sharma, Preeti Sharma, Ruhi, Akhilesh K. Srivastava. Management of Metabolic Syndrome Through Ayurveda. International Journal of Ayurveda and Pharma Research. 2020;8(1):87-93.

**Source of support: Nil, Conflict of interest: None Declared**

**\*Address for correspondence**

**Dr Kavitha Sharma**

PG Scholar,

P.G. Dept. of Rog Nidan,

R.G.G.P.G Ayurvedic College,

Paprola-H.P., India.

Email: [kavitasharmajnk@gmail.com](mailto:kavitasharmajnk@gmail.com)