

## CONTEMPORARY AND TRADITIONAL PERSPECTIVES OF METABOLIC SYNDROME (METS)- A CRITICAL REVIEW

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### ABSTRACT

Metabolic syndrome is an emerging global health problem in the 21<sup>st</sup> century and now it is becoming a pandemic disease. Nearby 20 – 25% worlds' adult population is suffering from MetS and the reasons for that are sedentary lifestyle, changing dietary habits, lack of physical activity, and stress. Mets are a major risk factor for non-communicable diseases such as diabetes mellitus, cardiovascular diseases, coronary heart disease, chronic kidney disease, stroke, and fatty liver disease. It is also a major risk factor for various viral infections disease like COVID 19 and secondary bacterial infection through hampering immunity. Mets proliferate the economic burden on an individual as well as the national health system. Present management modules only treat symptoms or the complication of MetS but do not treat the individual's body and mind as a whole. Up till now utmost recommendations focus on diet and exercise and do not consider stress-reducing strategies. Contemporary and traditional management composed can improve this condition. This paper critically reviews the contemporary and traditional perspectives of Metabolic syndrome (MetS) and recommends the adoption of holistic treatment, a good lifestyle with an appropriately balanced diet along with Yoga, *Pranayam*, Meditation and a stress-free living which can prove to be effective management for Metabolic syndrome (MetS).

**KEYWORDS:** Metabolic syndrome, hyperinsulinemia, Contemporary, traditional management.

### INTRODUCTION

Metabolic syndrome is a cluster of conditions characterized by increased blood pressure, a high blood sugar level, excess body fat around the waist, abnormal cholesterol and increases the risk of cardiovascular disease, stroke, and diabetes. Having just one of these conditions doesn't mean metabolic syndrome but any of these conditions increase the risk of serious disease. Out of these five conditions, more than one condition can increase the risk of Non-communicable diseases. Metabolic syndrome is also known as syndrome X, insulin resistance, hyperinsulinemia.<sup>[1]</sup>

Currently, the prevalence of the metabolic syndrome is significantly higher in the urban population than the rural population because of energy-rich food, consumption of fast food, decrease in energy expenditure (less physical activity), and erosion of traditional food habits.<sup>[2]</sup> The prevalence of MetS in rural India is 17.8% and 20.5% according to modified NCEP ATP III and IDF definition respectively.<sup>[3]</sup> In the urban population of India 33.17%

of males and 27.04% of females is identified as having the metabolic syndrome.<sup>[4]</sup> Prevalence of the metabolic syndrome in the United States was increased from 32.7% in 2003 to 34.9% in 2011. Almost 35% of adults population and 50% people of age more than 60 years were estimated to have metabolic syndrome.<sup>[5]</sup> The prevalence rate of metabolic syndrome is nearly 25% in Middle-East countries and it is a noticeable cause for stroke, coronary heart disease, and cardiovascular disease.<sup>[6]</sup>

There are significant differences in the prevalence of MetS according to socioeconomic status and lifestyle. Prevalence of MetS in the middle-income group 19% and in the lower-income group 9% in Chennai city.<sup>[7]</sup> The metabolic syndrome is associated with a 2-fold increase in cardiovascular outcomes and a 1.5-fold increase in all-cause mortality.<sup>[8]</sup> Intensified treatment recommendations in persons with MetS and even in those with only 1 or 2 MetS risk factors reducing macrovascular and microvascular complications by

≈50% and reduces of prevalence MI and stroke.<sup>[9]</sup> In individuals with MetS, up to 80% of CHD events may be preventable from optimal control of LDL-C, HDL-C, and blood pressure.<sup>[10]</sup>

## MATERIALS AND METHODS

This study has been done based on a critical review of modern literature, Classical information in Ayurveda & Yoga text, and Published research work in PubMed and Google scholar index journals. The possible correlation has been made between collected information and has been presented systematically.

## OBSERVATIONS AND RESULTS

### 1. Contemporary Perspectives of metabolic syndrome

#### 1.1. Pathophysiology of metabolic syndrome

The most accepted hypothesis to describe the pathophysiology of metabolic syndrome is insulin resistance. Hence the metabolic syndrome is also known as insulin resistance syndrome. Insulin resistance has been defined as a defect in insulin action or insulin receptors on the muscles that results in hyperinsulinemia, required to maintain normal sugar. Abdominal obesity is a significant causative factor for MetS but despite abdominal obesity, some patients of normal weight can also be insulin resistant. Those are termed as metabolically obese, normal-weight individuals, typically having an increased amount of visceral adipose tissue. Increases in free fatty acid flux to the liver increase the production of very-low-density lipoproteins (VLDL). Under physiological conditions, insulin inhibits the secretion of VLDL into the systemic circulation. In the setting of insulin resistance, an increased flux of free fatty acids to the liver increases hepatic triglyceride synthesis. Thus, hypertriglyceridemia is an excellent reflection of the insulin-resistant condition and is one of the important criteria for the diagnosis of metabolic syndrome. In the presence of hypertriglyceridemia, a decrease in the cholesterol content of HDL and an increase in LDL is a key risk factor for cardiovascular disease. The defects of insulin action in glucose metabolism include failure to suppress gluconeogenesis in the liver and to mediate glucose uptake in insulin-sensitive tissues (i.e. muscle and adipose tissue). To compensate for defects in insulin action, insulin secretion must be increased to sustain euglycemia it leads to hyperinsulinemia. Insulin is having a vasodilator effect, with secondary effects on sodium reabsorption in the kidney. In the setting of insulin resistance, the vasodilatory effect of insulin can be lost, but the renal effect on sodium reabsorption is preserved. Fatty acids themselves can mediate relative vasoconstriction. Hyperinsulinaemia may result in increased sympathetic nervous system (SNS) activity and contribute to the development of hypertension. Insulin resistance increases uric acid, prothrombotic factors (fibrinogen, plasminogen activator inhibitor 1), serum viscosity, homocysteine, white blood cell count, pro-inflammatory cytokines, the presence of microalbuminuria, non-

alcoholic fatty liver disease, obstructive sleep apnoea, and polycystic ovarian disease are all associated with Metabolic syndrome.<sup>[1]</sup>

#### 1.2. Risk factor for metabolic syndrome<sup>[11]</sup>

**1.2.1. Age** - The risk of MetS increases with increasing age, affecting less than 10% of people in their 20s and 40% of people in their 60s.

**1.2.2. Race** - About 47 million adults in the United States (almost 25%) have MetS. Hispanics and South Asians are at increased risk for MetS.

**1.2.3. Obesity** - Excess fat in the abdominal area is a greater risk factor that means abdominal obesity, i.e., having an apple shape rather than a pear shape. Causes of obesity

**1.2.3. a. Eating habits:** Certain type of eating habits leads to obesity [B Shrilakshmi][12] Nibbling between meals, eat faster tends to consume more food, neurotransmitter or chemicals in the brain – responds to external cues to eat rather than internal hunger signal, eating outside food more frequently, eat more junk food (high fat, high carbohydrate), eat processed, concentrated and high-fat food, consumption of sugar-added beverages, a person who work in different shift

**1.2.3. b. Genetic factors:** a mutation in the human gene for the B3 receptor in adipose tissue, involved in lipolysis and thermogenesis marked an increase in the risk of obesity

**1.2.3. c. Sex:** hormonal predisposition put the woman at higher risk

**1.2.3. d. Less physical activity** – a sedentary lifestyle

**1.2.3. e. Stress:** depression, anxiety, and stress leads to excess caloric intake

**1.2.3. f. History of diabetes** - family history of type 2 diabetes or a history of diabetes during pregnancy (gestational diabetes)

**1.2.3. g. Sedentary lifestyle** - daily lifestyle and habits (e.g. low physical activity and excess caloric intake)

#### 1.3. Symptoms of Metabolic Syndrome or hyperinsulinemia

Weight gain particularly around the abdominal area, hunger, difficulty concentrating, lethargy, high blood pressure.

#### 1.4. Criteria for Metabolic Syndrome Any 3 of the following

##### 1.4.1. World Health Organization – 1998<sup>[13]</sup>

Diabetes or impaired glucose tolerance

Plus any two of the following:

**1.4.1.i. Obesity:** BMI > 30 or waist-to-hip ratio > 0.9 (male) or > 0.85 (female)

**1.4.1.ii. Dyslipidaemia:** triglycerides ≥ 150mg/dl or HDL cholesterol < 50mg/dl (male) or < 40mg/dl (female)

**1.4.1.iii. Hypertension:** blood pressure > 140/90 mm Hg

**1.4.1.iv. Microalbuminuria:** albumin excretion > 20 g/min

#### 1.4.2. National Cholesterol Education Program's Adult Treatment Panel III (NCEP: ATP III)<sup>[13]</sup>

1.4.2.i. A waist circumference of more than 102 cm in men or more than 88 cm in women

1.4.2.ii. Fasting triglyceride level of 150 mg/dL or higher

1.4.2.iii. The blood pressure level of 130/85 mm Hg or higher

1.4.2.iv. High-density lipoprotein cholesterol (HDL-C) level of less than 40 mg/dL in men or less than 50 mg/dL in women

1.4.2.v. Fasting glucose level of 100 mg/dL or higher

#### 1.4.3. International Diabetes Federation, 2005<sup>[13]</sup>

Central obesity (defined as waist circumference 94 cm for Europoid men and 80 cm for Europoid women)

Plus any two of the following:

1.4.3. i. Raised triglycerides  $\geq 150$ mg/dl, or specific treatment for lipid abnormality

1.4.3. ii. Reduced HDL cholesterol:  $< 40$ mg/dl in males, and  $< 50$ mg/dl in females, or specific treatment for this lipid abnormality

1.4.3. iii. Raised blood pressure: systolic blood pressure 130mmHg or diastolic blood pressure 85 mmHg

Metabolic syndrome is strongly associated with abdominal or apple shape obesity.

The World Health Organization says more than 1 billion adults are overweight and 300 million of them are obese, putting them at much higher risk of diabetes, heart problems, high blood pressure, stroke and some forms of cancer. According to a global survey of obesity in 195 countries, done in 2015, 604 million adults and 108 million children were obese. Since 1980 the prevalence of obesity doubled in 73 countries and increased in most other countries.<sup>[14]</sup>

#### 1.4.4. Treatments and drugs for MetS<sup>[11]</sup>

The main focus of treating MetS is managing the risk factors

1.4.4.i. Exercise- 45 minutes aerobic exercise, muscle strengthening, bone strengthening, stretching, and brisk walking

1.4.4.ii. Losing weight - Reduction of 7-10% of their body weight reduces insulin levels and blood pressure and decreases the risk of diabetes.

1.4.4.iii. Lipid abnormalities - Lipid-lowering drugs primarily LDL

1.4.4.iv. Clotting disorders - People with MetS can have several coagulation disorders that facilitate the forming of blood clots within blood vessels. These blood clots are often a precipitating factor for a heart attack.

1.4.4.v. Diet – Healthy eating plans limit unhealthy fats and emphasize fruits, vegetables, fish, and whole grains

1.4.4.vi. Stopping smoking - Smoking can increase the risk of heart disease and heart attacks and worsen other heart disease risk factors.

1.4.4.vii. Medication - Antihypertensive – Calcium channel blocker, diuretics, Angiotensin receptor blocker, angiotensin-converting enzyme (ACE), Lipid-lowering agent - statins, fibrates, or nicotinic acid, Oral hypoglycemic agent - Metformin, Sulphonylurea, insulin injections, or both, Low-dose aspirin - reduce the risk of blood clots, especially for people at high risk of heart disease.

## 2. Traditional Perspectives of Metabolic Syndrome in Ayurveda

### 2.1. Ayurvedic Approach to Metabolic Syndrome

Ayurved thought of metabolic diseases involves a multidimensional approach such as *Aahara*(diet), *Vihara*(lifestyle and type of work), *Dinacharya*(daily regime), *Ritucharya*(seasonal measure), *Nidra*(sleep) and *Bijadosha*(genetic disorders). In *Charak Samhita Sutrasthana Santarpaniya Adhyaya* vividly described *Santarpanjanya Vikaras* (Comprise of diseases due to overnutrition and defective tissue metabolism). Cause mentioned such as excessive consumption of sweet, food heavy for digestion, alcohol, fish, meat, milk, curd, food contains jaggery and no physical exercise is responsible for deranged functions of different sets of *Agni* (Metabolic fire) and giving rise to the formation of *Aama*(reactive antigenic factor). For the last few decades, the conventional system of medicine is focusing on the concept of metabolic syndrome, which seems very similar to the concept of *Santarpanjanya Vikaras* of *Ayurveda* especially *Sthaulya*(Obesity). Several factors in the body troubles in the production of *Medadhatu* (Lipids) major of them are *Medodhatvagni* (Lipid metabolic process). In this whole process, the quantity and quality of *Medadhatu* (lipids) are also disturbed by the same. When *Medadhatu* (lipids) interacts with the preformed form of *Aama* (reactive antigenic factor), it changes and alters the quality and quantity of fatty tissues including cholesterol. The interaction of *Aama*(reactive antigenic factor) with fatty tissues is known as *Sama Medadhatu* (unhealthy and bad lipids). This form of *Aama* (reactive antigenic factor), when circulates all over the body may lead to blockade of micro-channels and precipitate antigenic reactions and generate a series of inflammatory events in the body. If such categories of *Aama*(reactive antigenic factor) interact with *Medadhatu* (Lipids), it may lead to a variety of metabolic disorders.<sup>[15]</sup>

### 2.2.1 Risk factor for metabolic syndrome according to Ayurveda

Etiological factors of *Sthaulya* mentioned in *Ayurveda Samhita's* are very much similar to causes or high-risk factors for metabolic syndrome. Such as *Guru Aahara* (a diet which is heavy for digestion – fast food), *Sheet Aahar Sevan* (excessive consumption of cold diet – cold drink, stale food), *Snigdha Aahar Sevan* (excessive consumption of unctuous food - deep-fried food), *Atibhojan* (overeating), *Madhura Aahar Sevan* (excessive sweet food intake), *Diwaswapna*(day time sleeping or wake up after sunrise in the morning),

*Avyayama* (not any physical exercise), *Navanna Sevan* (usage of fresh grains), usage of fresh alcoholic preparation, usage of domestic animal's meat, excessive use of curd, *Ikshu* (usage of sugarcane), *Shali* (excessive use of rice), *Masha Sevan* (excessive use of black gram), *Godhuma* (excessive wheat), usage of aquatic animal's meat (*Audaka Rasa Sevan*) beside all these dietary factors *Beejadosh* (hereditary) and psychological factors which may vitiate *Meda* and *Shleshma* leads to *Dhatwagnimandya*.<sup>[16]</sup>

## DISCUSSION

### 1. Pathophysiology of Hyperinsulinemia or Metabolic Syndrome in Ayurveda

In hyperinsulinemia condition glucose present in blood circulation but can't be used by muscle for energy and patient fill hypoglycemic and taking frequently meal similarly in *Sthaulya* because of *Aama* or *Strotorodha*, *Vayu* can't goes outside the body and it increases digestive fire and fills hungry (*Atikshudha*). The insulin resistance condition of metabolic syndrome is like the Ayurveda concept of *Aama* or *Kleda* which is the root cause of all disease. A major contributor to the development of insulin resistance is an accumulation of

circulating fatty acids, released from an expanded adipose tissue mass. Similarly in the Ayurveda pathophysiology of *Sthaulya* (obesity), there is *Medodatvaagni Dusti* because of *Kapha*, *Aama* leads to *Strotorodha* which only increases *Dusta Meda Dhatu* and other *Dhadu's* are not nourishes properly therefore patient fills lethargic.

### 2. Symptoms of Metabolic Syndrome or hyperinsulinemia according to Ayurveda

Sign symptoms of *Sthaulya* mentioned in Ayurveda are very much similar to metabolic syndrome. These are *Aayushoharso* (premature death), *Javoprodha* (early aging), *Kricchavyavayata* (erectile dysfunction), *Daurbalya* (malaise), *Daurgandhya* (bad odor of sweating), *Swedbadha* (excessive sweating), *Kshudhitmatram* (increase in appetite), *Atipipasa* (excessive thirst), *Chalaspika*, *Chalaudara*, *Chalastana*, *KshudraShwas* (dyspnea on exertion), *Nidraadhikya* (excessive sleep), *Gatrasada*, *Alpavyavaya* (erectile dysfunction and premature ejaculation), *Udarparshav Vriddhi* (increase fat on breast, buttock and abdomen), *Alasya* (lethargy), *Moha* (Giddiness).<sup>[17]</sup>

	<b>Sthaulya</b>	<b>Metabolic syndrome</b>
1.	<i>Aayushoharso</i>	Higher risk of mortality (2.6 to 3.6) time because of MetS in CVD, CHD, DM, and any other disease. 9 to 11-year premature death can happen if MetS were untreated. <sup>[18]</sup>
2.	<i>Javoprodha</i>	Metabolic Syndrome increases aging because of visceral fat (VAT) deposition and failure of metabolically active cellular mass, which also increases oxidation and cardio-metabolic risk. <sup>[19]</sup>
3.	<i>Kricchavyavayata</i>	Erectile Dysfunction is present in a high percentage of patients with MS. <sup>[20]</sup>

### 3. Ayurveda management for metabolic syndrome

Diet to reduce insulin resistance - Heavy and non-nourishing diet (*Guru Aptarpan Aahara*) and diet which reduces *Kapha* (phlegm) and *Meda* (fat) but not vitiate *Vata* - like *Yava* (Barley), millets like *Sorghum* (Jowar), Finger millet (Ragi), Pearl millet (Bajra), Kodo millet, Little Millet, Kulathi (horse gram), *Mudga* (Green gram), *Chana* (Bengal gram), *Masur* (Lentils), *Tuvar* (Red gram), Buttermilk, Amaranth, Brinjal, *Karela* (Bitter gourd), *Shigru* (Drum stick), seasonal fruits in small quantities, *Triphala* with all *Sabji*, honey, lukewarm water, salad, etc are advised.<sup>[21]</sup>

*Langhan* (Fasting), *Amapachan* (oral use of digestives to augment the fat metabolism) - *Aama* or *Kleda* which is the main reason for muscle or tissue to inhibit the utilization of sugar leads to hyperinsulinemia.<sup>[21]</sup>

*Ruksha Udwartan* (Dry medicated powder massage) - *Chana* or *Kulthi* flower and *Triphalachurna* + *Haridrachurna* + *Lodhrachurna* + *Jambuchurna*.

*Samshodhana Chikitsa* (Purificatory procedures) - *Vaman* (Therapeutic emesis), *Virechan* (Therapeutic purgation), *Lekhanvasti* (Medicated enema) are advised for the management of *Sthaulya*.<sup>[21]</sup>

*Charaka Samhita* has mentioned ten *Lekhaniya Dravyas* - a group of 10 drugs, these drugs principally perform the *Lekahana Karma* of excess and abnormal *Meda*, causing weight reduction as well as relief in other signs and symptoms. These drugs are given below 1. *Mustaka* (Cyperus rotundus) 2. *Kustha* (Saussurea lappa) 3. *Haridra* (Curcuma longa) 4. *Vacha* (Acorus calamus) 5. *Ativisha* (Aconitum heterophyllum) 6. *Katu Rohini* (Picrorhizakurroa), 7. *Chitraka* (Plumbago zeylanica) 8. *Chirabilva* (Holoptelea integrifolia) 9. *Daruharidra* (Berberis aristata) 10. *Haimvati* (Karanj) (Millettia pinnata)

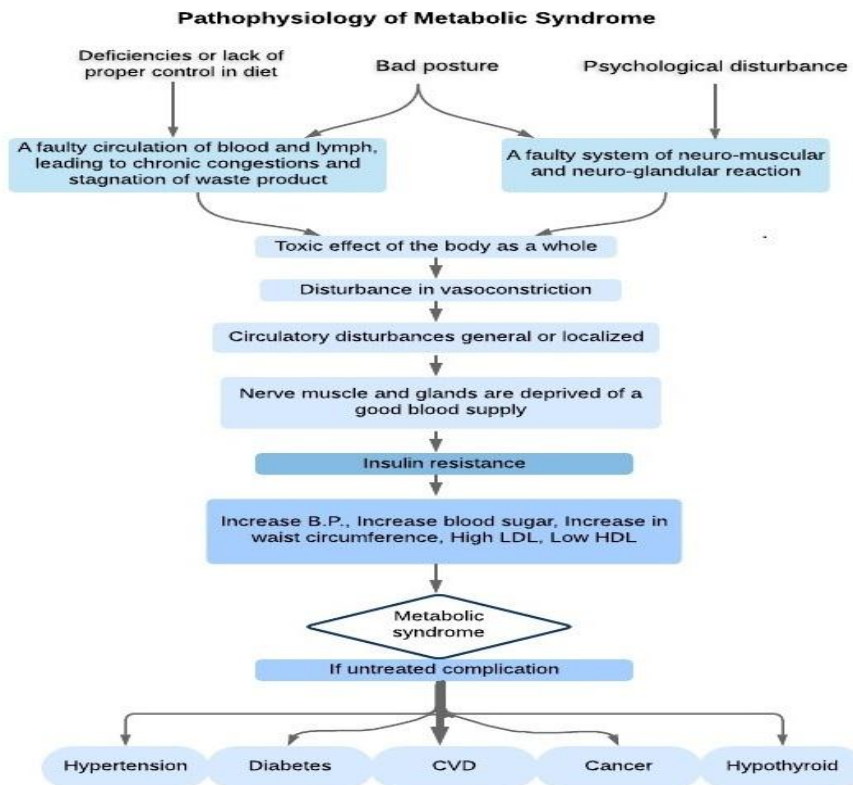
Some useful herbs/ classical formulation which are useful for the management of *Sthaulya* (Obesity) and Metabolic Syndrome:-

Drugs for internal use - *Guduchi* (Tinospora cardifolia), *Vidanga* (Embeliaribes), *Triphala*, *Mustha* (Cyperus rotundus), *Guggul* (Commiphora Mukul), *Sonth* (Zingiber Officinale), *Shilajatu*, *Haridra* (Curcuma longa).<sup>[21]</sup>



## 4. Traditional Perspectives of Metabolic Syndrome in Yoga

### 4.1 Pathophysiology of Metabolic Syndrome



According to yoga, in the pathophysiology of chronic disease three factors are important these are bad posture of the body, improper diet, and psychological factors. Anxiety, fear, and stress are important factors to disturb the Psycho-Physiological mechanism of body and mind leads to disturbance in metabolism. Yoga stabilizes Psycho-Physiological mechanisms means to maintain body and mind in their balance state or regain it quickly. Yoga helps to become mentally strong and physically fit to fight against disease and maintain normal body metabolism.<sup>[22]</sup>

#### 4.2 Yogic management for metabolic syndrome

Three steps according to yoga to overcome the problem of MetS

1. Cultivation of correct psychological attitude
2. Reconditioning of neuro-muscular and neuro-glandular systems, in fact, the whole body – to enable it to withstand greater stress and strain.
3. Laying great emphasis on health-giving diet, and encouraging the natural processes of elimination

#### 4.2. a. Yogic *Shuddhikriya* (cleansing processes) for Metabolic Syndrome

In MetS, hyperinsulinemia is a major problem that is correlated with an excess of *Aama*, *Kapha*, and *Meda* according to Ayurveda. In *Hathayoga* if the body has an excess of *Kapha* and *Meda* then *Shuddhikriya* (cleansing process) is most important before start *Pranayama*. *Vaman Dhauti* is advised for all types of *KaphajaVyadhi*;

MetS is *Santarpanjanya* or *Kaphaj Vyadhi Vaman Dhauti* purifies the body internally and reduces insulin resistance. *Kapalbhati* reduces *Kapha* and *Kleda* from the body and increases *Jatharagni* and regularize *Medodhatvagni* to nourish all the *Dhatu*s. Thus *Kapalbhati* and *Vamana Dhauti* is an important purification process to overcome insulin resistance. *Kapalbhati* also balances and strengthens the nervous system and tones the digestive organs. It purifies the *nadis*, and removes sensory distractions.<sup>[23]</sup>

#### 4.2. b. Pranayama for Metabolic Syndrome

4.2. b.i. *Anulomvilom Pranayama* (*Nadishodhak* or *Malshodhak Pranayama*) – *NadiSuddhi* means purification of all channels of circulations and communication. *Mala-Suddhi*- the eradication of *Malas* means any factor that disturbs the balance of the working body and mind. Minor blockages are removed and muscle can utilize sugar present in blood and thus it overcomes hyperinsulinemia.

4.2. b. ii. *Bhramari* relieves stress and tension, and so helps in improving anger, anxiety, insomnia and increases the healing capacity of the body. *Bhramari* brings a meditative state by harmonizing the mind and pointing the awareness to inerself. The vibration of the *Bhramari* (humming sound) builds a soothing effect on the mind and nervous system. It normalizes the Hypothalamus- Pituitary- Adrenal axis mechanism and breaks of stress chain. *Bhramari* regulates Psychological

disturbances which is one of the major risk factors for the pathophysiology of metabolic syndrome.

#### 4.2. c. Asana for Metabolic Syndrome

*Asana* gives physical and mental stability that would contribute to sense well-being. *Asana* contributes stability, health and flexibility. (H.P.) *Asana* one overcomes uncertainty, instability. In Metabolic syndrome, stress is one of the major factors to an imbalance of the nervous system and hormonal system which leads to hyperinsulinemia through external or internal stimuli. If *Asana* are done in the proper way, there would be no clash between two opposites such as pleasure and pain, heat, and cold (*dvandvanabhigatah*) i.e. stressor and the body and mind start functions harmoniously. *Asana* work on the whole body and mind to treat MetS.

The most important factor for the pathophysiology of any disease according to yoga is bad posture. Like life of any building depends on its design human life expectancy depends on the correct posture. *Asana* is an essential remedy in yoga to correct our bad posture. *Asana* are primarily meant to overcome disturbance in the tonic rhythm of the body and thus re-establish a harmonious function of the whole system. *Asana* are purposely devised so as to enable the lower center to restore the original balance tone of the body. A steady posture is supposed to signify an attitude where there is a minimum of neuro-muscular activity. Emotions and mental attitude have a profound effect on our nervous system as a whole and this is reflected in our posture through these tonic reactions.

Working conditions of this fast machine-age, long sedentary hours of work, congested room, economic stresses, and daily socio-political excitements too contribute to an imbalance of mind and body. Health and elasticity especially after a certain age depend more on the tone of these deep muscles of the spine rather than that of extremities'. *Asana* not only makes for a stylish waist-line but tone the whole system too excellently. Regular practice of correct *Asana* can break the stress-related pathophysiology of metabolic syndrome and maintain physical and mental balance.

#### 4.2. d. Meditation for Metabolic Syndrome

A meditation and relaxation practice calms the hyperactive sympathetic nervous system, balance the endocrine system, strengthens the immune system, and reduces the stress. Scientific study on Om chanting suggests that the repetition of Om chanting results in physiological rest and mental alertness and increased sensitivity to sensory transmission.<sup>[24]</sup>

#### 4.2. e. Diet for Metabolic Syndrome

The third aspect of yoga to treat any chronic disease is a precise diet. *Sthaulya* is *Kapha* and *Medaj Vyadhi* and the diet plan described in the classic Ayurveda text for *Sthaulya* is *Kaphagna* and *Medoghana* but not vitiate

*Vata* also i.e. heavy for digestion but gives fewer calories (*guru cha apatarpanasthulanamkarshanamprati*). This diet plan can be used for the treatment of MetS to reduce hyperinsulinemia.

#### 4.2. f. Yogic Practices for Metabolic Syndrome

Weekly three yoga sessions for 1 year for 60-min consisting of 10-min of warm-up, 40-min of *Hatha yoga* practice, and 10-min of breathing exercise and relaxation. The postures in the routine training protocol including *Sukhasana* (easy pose), *Adhomuhasvanasana* (downward dog), *Uttanasana* (standing forward bend), mountain pose, *Ukatassanna* (chair pose), *Virabhadrasana* (warrior pose), *Utthitaparsvakonasana* (side angle pose), *Trikonasana* (triangle pose), *Vrksasana* (tree pose), *Salabhasana* (locust pose), *Dandasana* (staff pose), *Baddhakonasana* (bound angle pose), *Gomukhasana* (cow face pose), spinal twist, *Setubandhasana* (bridge pose), *Suptapadangusthasana* (reclining big toe pose), *Vajrasana* (thunderbolt pose), *Tadasana* (mountain pose), *Padangusthasana* (big toe pose), and *Shavasana* (corpse pose). *Asana* starts very relax, keeping an eye on the pattern of the posture rather than trying to accomplish the exact posture itself. When the final position has arrived; it should be maintained for a time in a relaxed way as much as possible that activate the parasympathetic nervous system leads to decrease blood pressure, blood sugar, waist circumference and increases HDL. These results suggest that yoga exercise improves cardiovascular risk factors including central obesity and blood pressure in middle-aged and older adults with MetS.<sup>[25]</sup> Yoga sessions of 90 minutes for 10 weeks trend to reduced blood pressure a significant increase in energy level, and trends to improvement in well-being and stress.<sup>[26]</sup> RCT of yoga on the parameter of MetS shows significant improvement for body mass index, systolic blood pressure, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol.<sup>[27]</sup>

#### CONCLUSION

Metabolic syndrome is a lifestyle disorder that has no specific etiology and manifests as a group of symptoms creating it challenging to diagnose and treatment. Contemporary and traditional management together can resolve the problem of management of this lifestyle disorder. Thus adopting a holistic treatment, a good lifestyle with an appropriately balanced diet, Yoga, *Pranayama*, Meditation and stress-free-living can prove to be effective management for Metabolic syndrome.

#### REFERENCES

1. IzetAganovi, Tina Duek PATHOPHYSIOLOGY OF METABOLIC SYNDROME, *Ejifcc*, 2007; 18(1): 003-006.
2. Saklayen MG. The Global Epidemic of the Metabolic Syndrome. *CurrHypertens Rep.*, 2018; 20(2): 12. Published, 2018 Feb 26. doi:10.1007/s11906-018-0812-z.

3. Kempegowda, P., Marcus, S.R., Solanki, P. et al. Prevalence of the metabolic syndrome in rural India—a disparity in definitions. *Int J Diabetes Dev Ctries*, 2011; 31: 188-193.
4. Thiruvagounder, Manopriya, et al. "The prevalence of metabolic syndrome in a local population in India." *BiochemiaMedica*, 2010; 20(2): 249-252.
5. Aguilar M, Bhuket T, Torres S, Liu B, Wong RJ. Prevalence of the metabolic syndrome in the United States, 2003-2012. *JAMA.*, 2015; 313(19): 1973-1974. doi:10.1001/jama.2015.4260.
6. Ansarimoghaddam A, Adineh HA, Zareban I, Iranpour S, HosseinZadeh A, Kh F. Prevalence of metabolic syndrome in Middle-East countries: Meta-analysis of cross-sectional studies. *Diabetes MetabSyndr*, 2018; 12(2): 195-201. doi:10.1016/j.dsx.2017.11.004
7. Mohan V, Shanthirani S, Deepa R, et al. Intra-urban differences in the prevalence of the metabolic syndrome in southern India -- the Chennai Urban Population Study (CUPS No. 4). *Diabet Med*, 2001; 18(4): 280-287.
8. Mottillo S, Filion KB, Genest J, et al. The metabolic syndrome and cardiovascular risk a systematic review and meta-analysis. *J Am CollCardiol*, 2010; 56(14): 1113-1132. doi:10.1016/j.jacc.2010.05.034.
9. Gaede P, Vedel P, Larsen N, et al. Multifactorial intervention and cardiovascular disease in patients with type 2 diabetes. *N Engl J Med*, 2003; 348: 383–393.
10. Wong ND, Pio JR, Franklin SS, et al. Preventing coronary events by optimal control of blood pressure and lipids in patients with the metabolic syndrome.
11. Gupta A, Gupta V. Metabolic syndrome: what are the risks for humans?. *Biosci Trends*, 2010; 4(5): 204-212.
12. B. Shrilakshmi. Dietetics. New Age International Publication 7<sup>th</sup> Edition, 2014.
13. IzetAganovi, Tina Duek Pathophysiology Of Metabolic Syndrome, eJIFCC2007Vol18No1pp003-006.
14. Obesity collaborators GBD. Health effects of overweight and obesity in 195 countries over 25 years. *N Engl J Med*, 2017.
15. Kumar, BaghelPramod. "METABOLIC SYNDROME AND AYURVEDA: A CRITICAL REVIEW." *World journal of pharmaceutical research*, 2017; 592-602.
16. Dhanashree Mahajan &Sharayu A. Kore, Sthaulya (Obesity): An Ayurvedic Perspective, *InternationalJournalofMedicalResearchandPharmaceuticalSciences* Volume5 (Issue8), August 2018.
17. Vd. Harish Chandra Singh Kushwaha Charakasamhita part I, Chaukhambaorientalia Varanashi – reprint edition, 2016; 310-315.
18. Lakka H, Laaksonen DE, Lakka TA, et al. The Metabolic Syndrome and Total and Cardiovascular Disease Mortality in Middle-aged Men. *JAMA*, 2002; 288(21): 2709–2716.
19. Siervo M, Lara J, Celis-Morales C, et al. Age-related changes in basal substrate oxidation and visceral adiposity and their association with metabolic syndrome. *Eur J Nutr*, 2016; 55(4): 1755-1767. doi:10.1007/s00394-015-0993-z.
20. Besiroglu H, Otunctemur A, Ozbek E. The relationship between metabolic syndrome, its components, and erectile dysfunction: a systematic review and a meta-analysis of observational studies. *J Sex Med.*, 2015; 12(6): 1309-1318. doi:10.1111/jsm.12885.
21. RavidattaTripathiAstangaSamgrahaSutrastha,Chaukhamba Sanskrit Pratishthan, Second Edition, 439.
22. Swami Kuvalyananda and Dr. S.L. vinekar, Yogic Therapy its Basic Principles and Methods. Kaivalyadhama, Lonavala. Reprinted, 2015.
23. Hathapradipika of Svatomarama, Kaivalyadhama, S.M.Y. M. Samiti. Lonavala, Second Edition, 46-53.
24. Telles S, Nagarathna R, Nagendra HR. Autonomic changes during "OM" meditation. *Indian J PhysiolPharmacol.*, 1995; 39(4): 418-420.
25. Siu PM, Yu AP, Benzie IF, Woo J. Effects of 1-year yoga on cardiovascular risk factors in middle-aged and older adults with metabolic syndrome: a randomized trial. *DiabetolMetabSyndr*. 2015; 7: 40. Published, 2015 Apr 30. doi:10.1186/s13098-015-0034-3.
26. Cohen B E, Chang AA, Grady D, Kanaya AM. Restorative yoga in adults with metabolic syndrome: a randomized, controlled pilot trial. *MetabSyndr RelatDisord*, 2008; 6(3): 223-229. doi:10.1089/met.2008.0016.
27. Chu P, Gotink RA, Yeh GY, Goldie SJ, Hunink MG. The effectiveness of yoga in modifying risk factors for cardiovascular disease and metabolic syndrome: A systematic review and meta-analysis of randomized controlled trials. *Eur J PrevCardiol*, 2016; 23(3): 291-307. doi:10.1177/2047487314562741.