

PREVENTIVE AND THERAPEUTIC POTENTIAL OF INDIAN SPICES ON METABOLIC SYNDROME

Charu Bansal¹, Saleha Zainab²

¹MD (Ayu.) Professor, ² PG Scholar
P.G. Dept of Swasthavritta, Pt. K.L.S. Govt. Ayurveda College & Institute,
Bhopal, Madhya Pradesh, India.

Email: bansalcharu@ymail.com

ABSTRACT

Metabolic syndrome refers to the clustering of several cardiovascular and metabolic risk factors, including dyslipidemia, hyperglycemia and increased blood pressure, abdominal obesity and insulin resistance. It is a central preliminary pathological indication in the development of cardiovascular disease; causing major public health challenges worldwide. Chronic inflammation and oxidative stress have been proposed as initiators of the metabolic syndrome, especially of insulin resistance. On the basis of pathophysiology, the metabolic syndrome can be considered as *medodushti* in *Ayurveda*. Though various conventional drugs are in use but none of them provide promising result. Various researches showed that Indian spices had potential effect in prevention and treatment of metabolic syndrome. This paper reviews the modern and *Ayurvedic* pharmacodynamics of spices in reference to its therapeutic and preventive potential.

Key words: Spice, Metabolic Syndrome, *Medodushti*

INTRODUCTION

The metabolic syndrome is substantially prevalent in India. Among urban Indians its prevalence ranges between 25-45%.^[1] Globally, among the elderly population metabolic syndrome (MetS) ranges from 45-65%. All classical risk factors comprising the MetS are prevalent in Asian Indians residing in India.^[2] In urban India, nearly 77.2% of the diabetic patients had MetS & in CAD patients, the prevalence of MetS was reported to be 60.06%.^[3] A quarter of the world's adults have

metabolic syndrome. People with metabolic syndrome have risk to develop CVD twice and type 2 DM four times. It is to be more prevalent in 41-60 years. Overweight and obesity is one of the major driving forces in the development of MetS.

MetS is a clustering of at least three of the five (unfold into nine combinations) following medical conditions:

- Abdominal (central) obesity
- Elevated blood pressure

- Elevated fasting plasma glucose
- High serum triglycerides
- low HDL levels

According to Indian Diabetic federation the metabolic syndrome or cardiometabolic syndrome is a cluster of the most dangerous heart attack risk factors that is Diabetes & Prediabetes, Abdominal Obesity, High Cholesterol and High blood pressure. The modern lifestyle of increased intake of high calorie cafeteria fast food associated with decreased energy expenditure contributes the current rising prevalence of obesity and Type 2 diabetes.^[4]

Though various conventional drugs are in use but none of them provide promising result. Various researches showed that Indian spices had potential effect in prevention and treatment of metabolic syndrome. In India use of spices in good quantity is the part of everyday cooking. It is estimated that near about 50 gm of garlic per week and 80 -200 mg curcumin an active ingredient of turmeric daily consumed by Indians.^[5] This review investigates the preventive and therapeutic potential of commonly used spices in India in Mets.

Aetiology of Metabolic Syndrome:

Many complex biochemical pathways involve in the initiation of metabolic syndrome.

1. It is well known that adipose tissue releases numerous bioactive mediators and pro-inflammatory cytokines which influence body weight homeostasis, glucose

metabolism, induce changes in cardiovascular structure and function, lipid metabolism, blood pressure, coagulation and inflammation, leading to endothelial dysfunction and atherosclerosis.^[6]

2. Inflammation has been considered as the important process which initiates the Mets.^[7]
3. Increased oxidative stress in the adipose tissue of obese person is closely linked to enhanced inflammatory signals, adipokine dysregulation and insulin resistance.^[8]
4. Active NF-KB pathways also considered as strong link for the initiation of diabetes, myocardial infarction and atherosclerosis.

Functions of Spices:

Various contemporary research data suggest the therapeutic and preventive doses of the active ingredients in spices can achieve by the daily dietary consumption of spices alone. The pungent compounds in spices help enhance metabolism and shown good positive effects on obesity, diabetes, and chronic inflammation insulin sensitivity, dyslipidemia, and the in cardiovascular diseases. Spices are a good source of peroxisome proliferators-activated receptor (PPAR) gama ligands. This is a therapeutic drug target for metabolic syndrome. Spices activate PPAR gama, inhibit NF-KB activation, and enhance anti-inflammatory cytokines expression (Jungbauer&Medjakovic, 2012).

Table 1: Review of Pharmacological Properties of Spices found in various researches

Name of the Spice	Botanical name	Pharmecological properties of spices
Turmeric or <i>Haldi</i>	<i>Curcuma longa</i>	In <i>vitro</i> studies it showed Anti- inflammatory, Antioxidant, prevent protein glycosylation & lipid peroxidation. ^[9] Also inhibit NFkB-mediated cytokine expression in adipocytes. (Gonzales A M & Orlando R A,2008) Decreases lipid peroxidation of HDL & LDL(Miquel J et al,2002) Shows Anti-thrombotic responses in vitro studies

Cumin seed or Jeera	<i>Cuminum cyminum</i>	Hypoglycemic effect & decreases tissue lipid concentration in <i>vitro</i> studies. ^[10]
Black cumin	<i>Nigella sativa</i>	Reduced blood total cholesterol and weight gain in animal models (Tauseef, Butt, & Anjum, 2009).
Black Mustared or Rai	<i>Brassica nigra</i>	Showed Hypoglycemic effect. Improved post-parandial concentration and insulinaemia in normal rats. ^[11]
Fenugreek or Methi	<i>Trigonella foenum</i>	Reduces body fat, body weight, glycemic response, plasma insulin concentrations & decreases TGs and total cholesterol concentrations. ^[12]
Cinnamom or Dalchini	<i>Cinnamomum verum</i>	Attenuated the progression of DM (Khan et al, 2003), decreases insulin resistance (Kannappan et al,2006) suppresses lipid peroxidation in liver in vivo studies. ^[10]
Coriander Or Dhania	<i>Coriandrum sativum</i>	Decreases fasting serum glucose concentration and increased insulin release from pancreatic beta cell in vitro study. (Eidi M, et al, 2008) decrease LDL and total lipid concentration and increases HDL. ^[13]
Cardamom or Elaichi	<i>Elettaria cardamomum</i>	Inhibit platelets aggregation ^[14] and reduces Hypertension (Gilani A H, et al, 2008)
Clove	<i>Syzygium aromaticum</i>	Aqueous extracts have insulin-like biological activity (Broadhurst, Polansky, & Anderson, 2000) and lower fasting blood glucose levels (Shukri, Mohamed, & Mustapha, 2010). The eugenol and eugenyl acetate in cloves are anti-oxidative.
Black Pepper or Kali Mirch	<i>Piper nigrum</i>	Strong antioxidant effect showed by reducing glutathione concentration in liver, heart and kidney. ^[15]
Red chilli or Lal Mirchi	<i>Capsicum annuum</i>	Reduces adiposity in rats by enhancing energy and lipid metabolism, possibly by increasing catecholamine secretion from the adrenal medulla through the activation of the sympathetic nervous system. ^[16]
Ginger Or Adarak	<i>Zingiber officinale</i>	Srinivas Nammi et al. Protective effects of ethanolic extract of zingiberofficinale Rhizome on the development of Metabolic Syndrome in high fed rats found that ginger showed Anti-inflammatory effect, lowers body weight and serum glucose and insulin, and increases insulin sensitivity. Also, increases the fecal extraction of cholesterol.
Garlic or Lahsun	<i>Allium sativum</i>	Showed antioxidant and organ (heart, liver & kidney) protective effect in vitro studies. ^[17] Decreases blood lipids & glucose concentration (Banerjee S K, et al,2003)
Tamarind or Imli	<i>Garcinia cambogia</i>	Potent inhibitor of ATP citrate lyase. Thus, modulating fat metabolism. ^[18] Attenuated body weight visceral fat accumulation, lipid concentration and plasma insulin (Kim K Y, et al, 2008).

Nut Mag or Jaiphal	<i>Myristica fragrans</i>	Enhances Intracellular insulin signaling (Yang S, et al,2006) and prevent lipid abnormalities.
Curry leaves or kadipatta	<i>Murraya koenigii</i>	Scavenged ROS by Antioxidant effect [19] decreases blood cholesterol in diabetic mice (Xie J T, et al, 2006). Also, showed hypoglycemic effect.

The broad scientific description about spices also found in *Ayurvedic* classics in *AharaVarga*. Acharya Bhavmishra described

spices in *Haritkyadi Varga & karpooradi Varga* in detail.

Table 2: Pharmacological Properties of Spices in *Ayurvedic* Classics. (referred from *Haritkyadi Varga* of *Bhavprakasaha Nighantu*.)

Spice	Properties of Spices	<i>Ayurvedic</i> Pharmacological properties of spices
All kinds of cumin	<i>Katu rasa, Ruksha, Ushna</i>	<i>Agnideepak, Pachak</i>
Black pepper	<i>Katu rasa, Ruksha, Ushna</i>	<i>Agnideepak, alleviates kaphadosha</i>
Dry ginger	<i>Kutu rasa, ushna</i>	<i>BestPachak, cure kapha dosha</i>
Coriander	<i>Kashaya, katu, Tikta rasa, Ushna</i>	<i>Agnideepak, Pachak</i>
Fenugreek	<i>Tikta rasa, Ushna</i>	<i>Agnideepak, Vatahara</i>
Asafoetida	<i>Ushna, Tikta rasa</i>	<i>Vatakaphaghna, Pachak</i>
Turmeric	<i>Katu, Tikta rasa, Ushna, Ruksha</i>	<i>Cures Prameha and Kaph dosha</i>
Garlic	<i>Katu, Madhur rasa, Tikshna</i>	<i>Cures heart diseases, Agnimandya and Kaphadosha</i>

DISCUSSION

Metabolic syndrome considered as a predictor of CVD and Diabetes. It involves various complex biochemical pathways. Chronic inflammation and oxidative stress has been proposed as initiators of the metabolic syndrome, especially of insulin resistance. Thus, intervention targeting this oxidative and inflammatory process is needed to prevent and cure the Mets. These pathways can be interrupted by phytochemicals present in the spices.

There is no precise term for Metabolic Syndrome in the *Ayurvedic* classics. But it can be correlated with *Medodushti* because

Acharya charak had described that excessive consumption of food, lack of physical exercises and day sleep is the cause of *Medodushti* (*Ch. Vi 5/6*) and also mentioned that premonitory features or pre-diabetes and obesity is seen in *MedoPradoshajaVikara* (*Ch. Su.28*).

ATP III recommended that obesity be the primary target of intervention or first-line therapy for metabolic syndrome. Because weight loss lowers serum cholesterol and triglycerides, raises HDL cholesterol, lowers blood pressure and glucose, decrease serum levels of CRP and PAI-1 and reduces insulin resistance.

In view of *Ayurvedic* principle metabolic syndrome could be well treated as a *SantarpanothaVikara* in general and *MedoPradoshajaVikarain* particular. Therefore the lifestyle modulation including therapeutic dietetics will be effective in the prevention and management of metabolic syndrome. The food which reduces the *Kaphadosha* will definitely reduce the increased *meda dhatu*. Therefore *katu* (pungent), *tikta*(Bitter), *kashaya*(astringent) *rasa* is recommended for *medoroga* because of its *kaphaghana* property (As. San.Su.1/36). *Acharya Charak* also suggested *ruksha* (dry) property diet in the treatment of *santarpanjanya roga* (Ch.su.23/25).

Ayurvedic classics had given importance to spices by classified them in separate *AharaVarga*. Various scientific researches showed significant effect of spices in the treatment of *Medoroga* with their *Katu Tikta kashaya Rasa*, *Uhana Veerya*, *Sroyoshodan*, *Agnideepak* and *Vatakaphashamak* action. Almost all spices are predominant in *Katu rasa* (pungent taste) and *Ushna* in *veerya* (hot in potency) and have *deepanpachan* and *Agnivardhan* (enhances digestive fire) properties. Most of the spices due to above described properties augment the digestive fire leading to proper formation of the *Rasadi Dhatus* digest the *Amadosha* present at the *Jatharagni* level as well as the *medodhatvagni* level. Also leads to proper absorption of the ingested food and depletes the *Sneha*, *Kleda* and *Mala* and *Medo Dhatu*. It relieves the obstructions to the channels in the body thus relieving the obstructive pathology and leads to proper formation of the *dhatus* (As. San.Su.18/15).

Ruksha Guna is the opposite to *Snigdha Guna* which is the dominant property of *Medo Dhatu*. *Ruksha* property of spices because of the dominance in *Vayu* and *Agni Mahabhuta* alleviates the vitiated *Kaphadosha* which is the

main *dosha* responsible for the pathogenesis of *Mets*.

By Adoption of Spices in good quantity in Diet, Metabolic Syndrome and its complications could be easily prevented as well as treated because of their anti-oxidant and anti-inflammatory effects and significant weight reduction effects.

CONCLUSION

It could be concluded that Metabolic Syndrome is the condition of *Medodushti* and developed as a result of *Agnimanda* specially *medodhatwagnimanda*. In India many of above described spices are part of everyday cooking. Most of these spices work as an Antioxidant, immunomodulator and help to detox the micro channels (*Srotas*), enhances *agni*, do *Amapachan* and *deepan*. Spices also have been proved the promising anti-diabetic, anti-hyperlipidemic & free radical scavenging activity. Thus by using these spices in significant quantity one can easily prevent or cured by Metabolic Syndrome by enhancing their *Jatharagni*, *Bhutagni* and *Dhatvagni*. Hence it could be established as a best intervention technique in the prevention and treatment of Metabolic Syndrome.

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