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Review Article

A Review On The Metabolic Syndrome: Risk Factors, Pathophysiology, Causes Of Mets, Diagnosis And Treatment

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ABSTRACT

Metabolic syndrome (MetS) is a collection of metabolic abnormalities that includes visceral obesity, insulin resistance, fatty liver, hypertension, and atherogenic cardiovascular illnesses. The first step in managing the growth of MetS is changing one's lifestyle. MetS is strongly linked, if untreated, to an increased risk of developing type 2 diabetes and atherogenic cardiovascular disorders. Therefore, it has become crucial to look for new treatments in this context to lessen the severe burden of the disease because MetS is a major cause of morbidity and mortality on a global scale. Nevertheless, there isn't a single treatment for metastatic schizophrenia, and the pharmacotherapy that is currently available, together with associated comorbidities, necessitate the ongoing use of several medications, which helps patients but also reduces adherence to treatment.The metabolic syndrome, also known as syndrome X, insulin resistance, etc., is a pathologic state that is characterized by abdominal obesity, hypertension, hyperlipidemia, and insulin resistance, according to the World Health Organization. Although there were some discrepancies in the criteria provided by other health care groups, they are not particularly significant. Non-communicable diseases (NCDs) have taken center stage as the biggest threat to global health since most communicable infectious diseases have been effectively eradicated globally. The spread of the Western way of life throughout the world has led to the complete globalization of this issue, despite its origins in the West. In many developing nations, the urban inhabitants tend to have higher incidence of metabolic syndrome than their counterparts in the West.

INTRODUCTION

A number of conditions, including myocardial infarction, cerebrovascular accidents, peripheral vascular illnesses, insulin resistance, and type II diabetes mellitus, can accumulate to form metabolic syndrome, which increases the risk of atherosclerotic cardiovascular disease. Insulin resistance, hypertension, atherogenic

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dyslipidemia, and central obesity are among the metabolic diseases that collectively constitute metabolic syndrome.[1]

For the metabolic syndrome to be identified, three or more metabolic abnormalities must exist:

- More than 40 inches around the waist for males and 35 inches around the waist for ladies.
- 150 mg/dL or higher in serum triglycerides.
- Decreased levels of high-density lipoprotein cholesterol, with levels in males and women below 40 and 50 mg/dL, respectively.
- Higher than normal fasting glucose of 100 mg/dL.
- Blood pressure values of systolic 130 mm Hg or higher or diastolic 85 mm Hg or higher [2].

Comparing patients with metabolic syndrome to the general population, it is estimated that they have a 5-fold greater risk of diabetes mellitus and a 2-fold increased risk of atherosclerotic cardiovascular illnesses.[3] Accelerated atherosclerosis, early-onset type II diabetes mellitus, and premature atherosclerotic cardiovascular illnesses are also linked to metabolic syndrome. In [4][5] In recent decades, the percentage of the population that is obese has dramatically increased due to sedentary lifestyles and excessive calorie consumption [6]. The incidence of metabolic syndrome has increased dramatically over the past 20 years as a result of the exponential development in obesity in the population.[7] The metabolic syndrome currently affects almost one-fifth of the American and European populations.

The main factor causing metabolic syndrome is central obesity, which also causes insulin resistance, hypertension, and dyslipidemia.[8] Depending on the underlying atherosclerotic cardiovascular disease, the metabolic syndrome can appear in a variety of clinical ways. Metabolic syndrome is commonly characterized by higher blood pressure, symptoms of insulin resistance, and abdominal obesity with a high body mass index and enlarged waist circumference.[9] The health of an individual is significantly affected by metabolic syndrome. The prevalence of metabolic syndrome is increasing, yet it is possible to stop and even reverse its course with intervention [10][11].

MetS risk factors: how can it be controlled?

Lifestyle: The development of many metabolic syndrome risk factors is influenced by lifestyle choices, and altering some habits may help lower the disease's prevalence[12]. Overweight and sedentary behavior are common characteristics of people with metabolic syndrome [13]. An earlier study that lasted about seven years and involved 8800 adults aged 25 and up found that every hour spent watching TV increased the risk of cardiovascular death by 18%[14].Furthermore, lipid clearance and glucose metabolism appear to be hampered by insufficient exercise or muscle contraction[15]. Numerous past comprehensive analyses have evaluated the impact of lifestyle modifications on metabolic syndrome [16]. The goal of these studies was to accomplish dietary intervention [17]. A meta-analysis encompassing six trials revealed a 4.9 cm reduction in waist circumference for 643 people, an 11% reduction in triglycerides for nine trials involving 797 participants, and a 5% drop in fasting blood glucose for ten trials involving 816 participants [18]. According to van Namen et al. (2019), all trials showed reductions in the prevalence of metabolic syndrome after the intervention (39%) [19].

Deit: Food has a significant part in how quickly MetS progresses[20]. According to a cross-sectional investigation of 773 participants, the prevalence of MetS is higher among those who prefer omnivorous meals over vegetarian ones

(47.55%). This result was explained by the vegetarian diet's decreased lipid and glucose levels [21]. Additionally, sustained ingestion of diets high in saturated fat causes the liver, skeletal muscle, and pancreas to accumulate fat and lipotoxins produced from fat, leading to the development of insulin resistance [22]. However, according to a different study, vegetarian diets did not lower the risk of Metabolic Syndrome in vegans (n = 1116) compared to pesco-vegetarians (n = 2461), lacto-vegetarians (n = 4313), and nonvegetarians (n = 85319) in a Taiwanese cohort [23].

Cardiovascular Disease (CVD): Several studies reveled that Atherosclerosis increased the incidence of MetS by 2-2.9-fold, while CVD enhanced the MetS frequency by 14.6-fold after 30 years [24]. Recently, a representative sample of adolescent cohort (n = 1516) was evaluated to define the correlation Between CVD and MetS incidence, The data showed that raised systolic blood pressure (SBP) was related with a high MetS prevalence Risk significantly, whereas diminished levels of SBP and glucose were Linked with MetS diminution [25]. Moreover, newly Clinical study was performed on 200 knee osteoarthritis patients to Evaluate the link between osteoarthritis, CVD, and MetS. Approximately, 84.8% of patients had full criteria of MetS [26]. Hence, early detection and management of these disorders May resist the developing epidemic of MetS.

Smoking: Most people agree that smoking is a major risk factor for Metabolic Syndrome (MetS) [27]. According to Nakanishi et al. (2005), smokers are 1.07–1.66 times more likely than non-smoker's to acquire MetS[28]. According to studies by Centa et al. (2011), smoking has been shown to raise cardiovascular risk factors, lower insulin sensitivity, and raise triglyceride levels[29]. Furthermore, smoking has been shown to cause belly obesity in teenagers of both sexes. Teenage smokers who smoked ten cigarettes a day as young adults had a waist circumference that was over 3.4 cm larger than that of nonsmoking girls [30]. After a year, smoking workers (n = 2136) had their incidence of MetS examined by Kawada et al.[31].The findings showed that the incidence of MetS was 6.3% higher among current smokers than in non-smokers.

Alcohol: According to Freiberg et al.(2004), there was a correlation between heavy alcohol intake (more than 20 times per month) and the incidence of MetS, low serum HDL cholesterol, elevated serum triglycerides, and a larger waist circumference. On the other hand, mild and moderate alcohol use (1–19 times/month) decreased insulin and serum lipid levels as well as the incidence of Metabolic Syndrome (n=8,125) [32].

Inadequate sleep: Inadequate sleep for an extended length of time has also been linked to MetS risk. Apart from increasing the risk of obesity and diabetes, inadequate sleep can cause both physical and emotional stress[33]. Similarities: Besides raising blood sugar, body weight, insulin resistance, and cardiovascular risk, obstructive sleep apnoea was also found to lower HDL levels. According to Coughlin et al. (2004), all of these sequences increase the prevalence of metabolic syndrome by 87% (n=61) compared to the control group%'s (n= 43)[34]

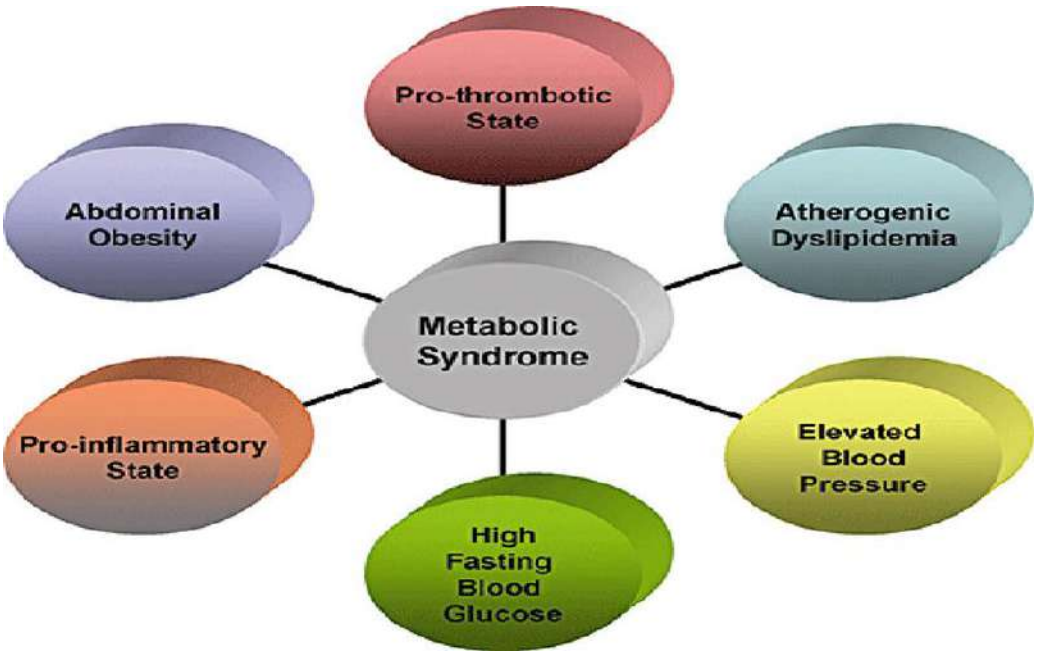


Fig.no.1. Metabolic syndrome risk Factors.

Stress: An independent sample of Western Finland's population aged 18–78 years (n = 3,407) was asked to self-rate stressful life events related to money, work, relationships, health, and housing. According to data analysis, individuals who experienced at least three intensely stressful life events in any of the life domains—finance, employment, or health—during the previous 12 months showed higher levels of triglycerides, waist circumference, and Body Mass Index (BMI). As a result, their incidence of MetS increased to 78.69% when compared to individuals who do not experience stress[35].

Epidemiology:

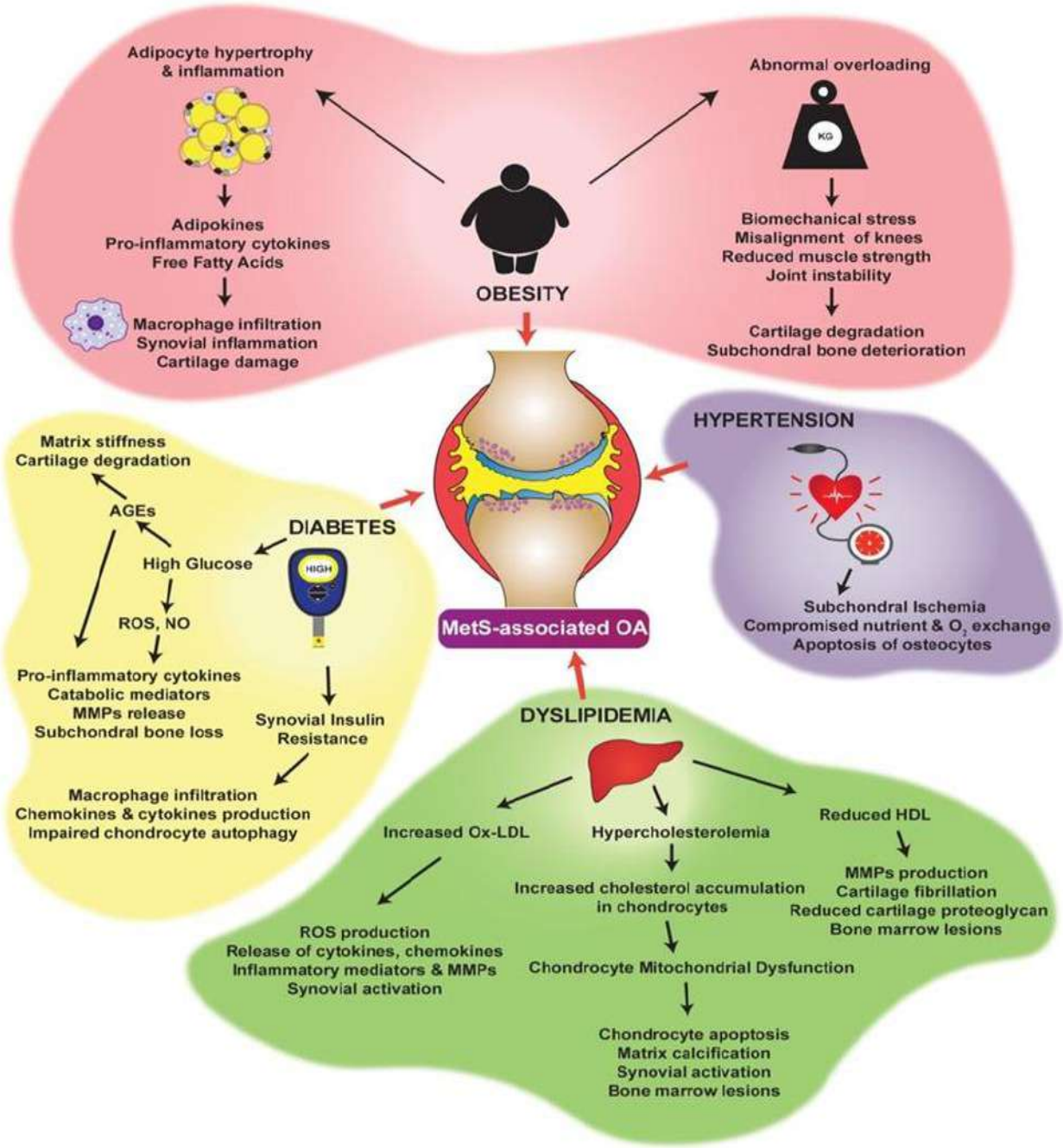
The global incidence of MetS varies and is often associated with the prevalence of obesity. Age, race/ethnicity, and gender all affect how often MetS is. Over twenty percent of Americans and over twenty-five percent of Europeans were found to be affected by MetS. While prevalence in South-east Asia was lower, it is rapidly increasing to frequencies that are similar to those in the west [36]. There are gender-related variations in the prevalence of MetS. For instance, the incidence of metabolic syndrome was higher in men than in women (3.9%; n=5775), whereas in another group (2.7%; n=1514), the prevalence was lower in males than in women[37].This variation could be caused by the type of job, lifestyle, and body fat [38 39]. There are variations in MetS prevalence based on ethnicity and gender as well. An analysis of National Health and Nutrition Examination Survey (NHANES) data collected in the United States between 1988 and 1994 revealed that the incidence of MetS is 26% higher in Hispanic women than in Hispanic men, and 57% higher in African-American women than in African-American men.[40]. Additionally, it was shown that race had an impact on MetS risk variables.For instance, Hispanics are more likely to have insulin resistance, African-Americans to have hypertension, and Caucasians to have dyslipidemia [41]. MetS is also quite age dependant; as would be expected, following the sixth or seventh decade, the prevalence rises [42]. The incidence of MetS increased by 35–37% in the 60–69 age group in the United States compared to the 20–29 age group at least 70 years ago, according to the NCEP-ATP III (The National Cholesterol Education Program–Adult Treatment

Panel III) criteria [43]. Still, a number of variables, such as diabetes, obesity, and cardiovascular disease (CVD), increase the risk of MetS [44].

Pathophysiology:

Over the past few decades, a lot of research has been done on metabolic syndrome. It has been suggested that the pathophysiology of metabolic syndrome mostly involves insulin resistance, adipose tissue malfunction, and chronic inflammation.[45][46] Normal conditions: an abrupt increase in serum glucose levels causes the pancreatic β-cells to secrete insulin, which facilitates the uptake of glucose by cells through glucose transporters. Hyperinsulinemia and elevated serum glucose levels are the outcomes of this abrupt increase in insulin, albeit, in individuals who are insulin resistant because their tissues are less responsive to it.[47] reduced glucose metabolism, fat deposition, cardiotoxicity, and chronic inflammation are the hallmarks of the metabolic syndrome, which are brought on by aberrant insulin signaling and reduced insulin production.[48] Visceral obesity constitutes a crucial element of the metabolic syndrome. Adipose tissues' release of free fatty acids increases insulin resistance and reduces pancreatic beta cells' ability to secrete insulin.[49] High free fatty acid content increases hepatic gluconeogenesis and lipid synthesis via activating protein kinases and inhibits skeletal muscle glucose absorption. The pathophysiology of prothrombotic condition, chronic inflammation, and hypertension is significantly influenced by both insulin resistance and free fatty acids. IN [50] Visceral adipose tissues are also known to generate a variety of pro-inflammatory cytokines, including resistin, leptin, and C-reactive protein. These cytokines can cause chronic inflammation, which may be a contributing factor to the metabolic syndrome's numerous consequences.[51][52].

Through their inhibition of the insulin signaling pathway, the inflammatory cytokines further exacerbate insulin resistance in the liver, adipose tissues, and skeletal muscles. By deactivating insulin receptors in the skeletal muscles, these cytokines—particularly tumor necrosis factor-alpha—promote insulin resistance.[53] Insulin resistance increases the level of fibrinogen, which in turn triggers more inflammatory cytokines and thrombogenesis.[54]. The metabolic syndrome has a negative Impact on multiple bodily systems. Insulin resistance leads to microvascular damage, which puts patients at risk for vascular resistance, endothelial dysfunction, hypertension, and inflammation of the vessel walls. Atherosclerosis and the emergence of hypertension might result from endothelial damage that disturbs the body's balance[55].Moreover, high blood pressure has a negative impact on a number of bodily processes, such as peripheral vascular disease, cardiomyopathy, left ventricular hypertrophy, and increased vascular resistance and stiffness. It can also impair renal function. Ischemic heart disease may arise from the combined effects of metabolic syndrome-induced hypertension and endothelial dysfunction. Hypertension creates vascular resistance, which leads to the development of coronary artery disease, whereas endothelial dysfunction brought on by elevated plasminogen activator inhibitor-1 and adipokine levels can produce thrombogenicity. Symptomatic ischemic heart disease can result from the atherosclerotic process, which can be accelerated by dyslipidemia linked to metabolic syndrome.[56][57].



Pathophysiology Of Metabolic Disorder.

History and Physical:

History:-

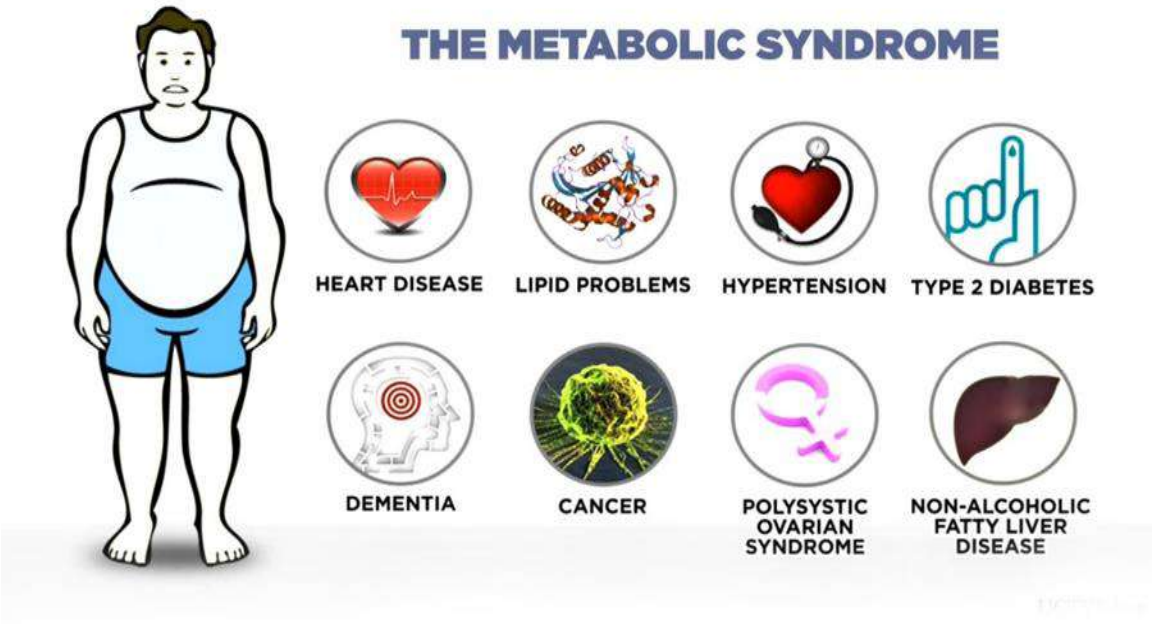
Patients who are suspected of having metabolic syndrome must have a complete medical history, even though the diagnosis is made based on results from laboratory tests and physical examinations. The identification of risk factors for metabolic syndrome and the management of it can be aided by a thorough history of the patient's eating patterns, lifestyle, and family history. A history of early coronary artery disease justifies an assessment of the various elements of metabolic syndrome. Concurrently, diabetes

mellitus—a well-known component or consequence of the metabolic syndrome—is suggested by the traditional signs and symptoms of polyuria, polydipsia, and polyphagia. Recognizing, treating, and preventing diseases all depend on the history and physical examination [58]. Obtaining social history is particularly important in order to screen for modifiable factors, such as smoking, that may influence the development of cardiovascular problems in individuals with metabolic syndrome.

Physical Exam: -

Vitals and overall appearance are the first aspects of the patient encounter that can lead to a metabolic syndrome diagnosis. Particular measurements are required since, as was previously noted, three irregularities point to the diagnosis. Waist circumferences should be assessed for every patient who comes in for an evaluation [59]. During the physical examination, xanthomas and acanthosis Nigerians, two symptoms of dyslipidemia and insulin resistance, may be found.[60]

Causes Of Metabolic Syndrome:



Reasons behind metabolic syndrome

Genetic cause of metabolic Syndrome:

Genetic factors account for 60% of the variation in body mass index (BMI), according to research on twins, adoptees, and relatives. BMI is derived from calorie intake and energy expenditure, both of which are influenced by genetic factors [61]. The underlying genetic causes of obesity in the general population have not been much better understood, despite strong evidence that family history affects the development and progression of the disorder and its progression[62]. Only 10% of the population is impacted by these genetic changes, which result in obesity, despite the fact that more than 30 different genes have been identified to far as having a substantial impact on its pathogenesis. Still, genetic research has provided a great deal of insight into the pathogenesis of MC4R gene loss of function mutations have been connected to both autosomal dominant and recessive obesity [63]. Furthermore, case reports of individuals with MC3R and POMC gene mutations who are also obese have been described [64].By suppressing neurons in the arcuate nucleus that generate agouti-related peptide (AGRP) and neuropeptide

Y (NPY), leptin also inhibits the orexigenic pathway.Mice lacking either leptin (ob/ob) or leptin receptor (db/db) are fat, insulin-resistant, and hyperinsulinemic[65]. Conversely, physiological leptin levels need to be 20–30 times greater in order to induce weight reduction in mice or humans. This suggests that maintaining a healthy weight by avoiding weight loss is the major purpose of leptin [66]. Except for a small number of patients with homozygote mutations in the leptin gene, most obese people have high leptin levels. The primary technique used to identify the genes responsible for the disease has been genetic association studies since obesity and metabolic syndrome are complex conditions caused by a combination of genes and gene-environment interaction [67].

Non- Genetic cause of metabolic Syndrome:

The other symptoms of the syndrome in humans have been connected to Hyperinsulinemia in experimental studies conducted on mice given diets high in fructose or sucrose. Discusses the role of Hyperinsulinemia in the formation of the metabolic syndrome, which is characterized by the appearance of elevated triglyceride levels, hypertension, hypertriglyceridemia, and a decline in high-density lipoprotein. When baseline obesity, fat distribution, and weight increase were taken into consideration, significant correlations between insulin and the other factors were still evident [68].

Diagnosis Of Metabolic Syndrome:

The term "metabolic syndrome" refers to a group of risk factors that frequently coexist with one another rather than an actual disease. When any three or more of the following are present, a person is diagnosed with metabolic syndrome:

- central, or abdominal Obesity: extra body fat around the belly (abdomen).
- an increase in blood pressure, or hypertension.
- elevated triglycerides in the blood.
- low concentrations of the "good" cholesterol, high density lipoproteins (HDL).
- diabetes or impaired glucose tolerance (IFG). Blood glucose levels that are greater than usual but not high enough to be classified as type 2 diabetes (IFG) happen when this happens [69].

Central Obesity:

The majority of body fat deposits around the abdomen and upper torso are referred to as central obesity. Your waist circumference increases with increasing waist size. Gender and ethnic background have an impact on an individual's risk for central obesity.

Generally speaking, you generally need to reduce some weight if your waist is 94 cm or more for males or 80 cm or more for women. If a man has a waist measurement of 90 cm or over, he is deemed to be at danger if he is from the Middle East, South Asia, China, Asian-Indian, South, or Central American ethnic origins.

High Blood Pressure:

A person has hypertension if their blood pressure is greater than 140/90 mmHg and there are no other risk factors. This could be brought on by lifestyle choices, heredity, or other illnesses like kidney or cardiovascular disease. In addition, high blood pressure raises your risk of kidney disease, stroke, and cardiovascular disease.

While less than 130/80 mmHg is the optimal range (or lower, if additional disorders are present), each person's blood pressure will vary. Find the ideal goal for you by speaking with your doctor, and make sure your blood pressure is taken on a regular basis.

A healthy body weight, frequent exercise, quitting smoking, cutting back on sodium (salt) in food, lowering stress, and limiting alcohol consumption can all help improve your lifestyle, but occasionally medication is needed [70].

Cholesterol and Triglycerides:

Our livers produce the fatty material known as cholesterol. By accumulating on blood vessel walls, LDL (low density lipoproteins) cholesterol can obstruct arteries. High density lipoproteins, or HDL cholesterol, offer some defence against the accumulation of fatty blockages.

In addition to being created by the liver, triglycerides can also be obtained through diet. Triglycerides might rise as a result of excessive alcohol use. Higher-than-normal triglyceride levels are probably present in individuals who are insulin resistant. The "good" or protective cholesterol, known as HDL cholesterol, is typically found in lower concentrations in blood triglycerides.

Increased risk for atherosclerosis (artery narrowing), a contributing cause to heart disease, is associated with higher triglycerides and lower HDL cholesterol. Atherosclerosis, high blood pressure, and elevated triglyceride levels are among the conditions for which being overweight or obese is a risk factor.

Impaired Glucose Tolerance(pre-diabetes):

The terms "pre-diabetes" and "impaired glucose tolerance" can be used interchangeably. When your blood glucose level is higher than usual but yet not high enough to be classified as diabetes, they happen. Without modifying their lifestyle, one-third of those with impaired glucose tolerance or impaired fasting glucose will acquire diabetes.

Metabolic Syndrome Conditions Are Linked:

It is challenging to figure out the sequence of events because all of these conditions are intricately intertwined. Which situation, if any, serves as the primary catalyst? According to several studies, metabolic syndrome may have its origins in obesity.

You can lower your blood pressure, improve your triglyceride and cholesterol levels, and improve your body's reaction to insulin by losing weight and engaging in regular physical activity. You may be able to avoid cardiovascular disease and type 2 diabetes by doing this [71].

Metabolic Syndrome And Insulin Resistance:

Insulin resistance is the result of your body not using the hormone insulin as efficiently as it should, particularly in the liver and muscles.

Normally, glucose is produced by your digestive system from carbs and enters your bloodstream through your intestines. Insulin is released into your bloodstream by your pancreas when your blood glucose level rises. Insulin enables the transfer of glucose from your bloodstream into your muscle cells. After entering a cell, glucose and oxygen are "burned" to create energy.

An individual with insulin resistance requires higher insulin production and release from the pancreas in order to sustain normal blood glucose levels. It is estimated that around 25% of people are insulin resistant in one way or another.

Insulin Resistance And Diabetes:

Most individuals with type 2 diabetes have insulin resistance, which raises the chance of acquiring the disease. Your blood glucose levels will increase and you may develop impaired glucose tolerance (IGT), diabetes, or impaired fasting glucose if your pancreas is unable to create enough additional insulin to overcome your body's resistance.

A markedly elevated risk of cardiovascular (heart and blood vessel) illness and other metabolic syndrome characteristics are common in people with type 2 diabetes [72].

Metabolic Syndrome Treatment:

Treatment for metabolic syndrome is focused on the interactions between each of its constituent diseases, such as dyslipoproteinemia, hypertension, hyperglycaemia, and abdominal obesity. It is imperative to alter one's lifestyle, lose weight, get more exercise, give up smoking, and consume less alcoholic drinks.

Obesity Treatment: -

Treatment for obesity needs to be all-encompassing. Patients are encouraged to eat healthier and engage in more physical activity. If the patient does not lose weight after a prolonged period of following these procedures, medical treatment and, in certain situations, surgical treatment are taken into consideration. A small weight loss is also beneficial for treating obesity, preventing cardiovascular illnesses, and preventing type 2 diabetes mellitus [73].

10% or more weight loss decreased the risk variables related to lipids and fasting insulin levels, according to a study by Sacks [74]. Through extensive lifestyle modification, a person can reduce their risk factors for cardiovascular disease, avoid or delay the onset of type 2 diabetes, and ameliorate other health effects associated with obesity by losing 5–10% of their starting weight [75, 76, 77]. While sustained weight loss as little as 3% can lead to benefits in several cardiovascular disease risk variables, weight loss of at least 5% is typically regarded as clinically relevant [78, 79]. Greater decreases in cardio metabolic risk are a result of even greater weight loss [80,81]. 5–15% weight loss is a reasonable goal. This clearly lowers the risk of cardiovascular disease and metabolic disorders [82].

Metabolic syndrome and hypertension: -

A multi-targeted, integrated therapy approach is necessary to treat obesity, lipid problems, high blood pressure, and type 2 diabetes mellitus (if present) at the same time in order to adequately protect the renal, cardiovascular, and cerebrovascular systems, given the complicated etiology of metabolic syndrome [83]. Pharmacotherapy should be administered to treat the lipid- and non-lipid cardiovascular risk factors concurrently if lifestyle changes (diet, exercise, weight loss, stopping smoking, and consuming less alcoholic beverages) prove ineffective. ACE inhibitors should be the first line of treatment for patients with metabolic syndrome and hypertension, unless there is a contraindication. Both albuminuria and the risk of acquiring a new case of type 2 diabetes mellitus are decreased by ACE inhibitors and angiotensin receptor blockers (ARBs). ACE inhibitors provide Cardioprotective and Reno protective benefits, beyond their effect on blood pressure; they also improve Insulin resistance. Long-acting calcium channel blockers are also recommended in hypertensive patients with metabolic syndrome. These drugs also improve insulin resistance. Selected beta-blockers Can be administered to patients with hypertension and metabolic syndrome. Hypertensive patients with Metabolic syndrome should be aggressively treated for every component of the syndrome to provide Cardiovascular, cerebrovascular and renal protection. Most patients eventually require two or more Antihypertensive drugs to reach the blood pressure goal. [84]

Hypertension treatment according to 2018 ESC/ESH guidelines for management of arterial Hypertension recommendations

In most circumstances, starting treatment with a combination of two medications is the best course of action. The ideal combination of two medications is a RAS blocker plus either a CCB or a diuretic. In cases when a beta-blocker is indicated specifically, such as for heart failure, angina pectoris, post-myocardial infarction, or heart rate management, using a beta-blocker in conjunction with a diuretic or any other medication from the other major classes is an alternative. It is advised to use monotherapy for elderly individuals who are frail or very high-risk who have high normal blood pressure, or for low-risk patients with stage 1 hypertension whose systolic blood pressure is less than 150 mmHg. Three-component therapy (RAS blocker, CCB, and diuretic) is advised if the two-component therapy is insufficient. Spironolactone may also be

added to the treatment if resistant hypertension is evident, unless it is contraindicated [85].

Dyslipoproteinemia Treatment: -

Comprehensive treatment is required for dyslipoproteinemia. The patient needs to adhere to the regimen's recommendations for food, exercise, and quitting smoking. Pharmacological therapy will start if the regime measures fail to produce the desired lipid target values. PCSK9 inhibitors, fibrates, statins, and inhibitors of cholesterol absorption are employed in the treatment. Patients with metabolic syndrome who have a very high risk of cardiovascular disease are actually always required to have pharmacological treatment [86].

A new category of extreme cardiovascular risk has been Identified by the European societies 2019 (ESC/EAS guidelines 2019): the occurrence of a recurrent cardiovascular event within two years of the first such event in a patient who has already received statin treatment. For this patient population, new, lower LDL-c targets are advised [87].

CONCLUSION:

Numerous dysmetabolic events, including obesity, hypertension, dyslipidemia, diabetes mellitus type 2 (T2DM), and cardiovascular issues, are present in the MetS, one of the major health risks of the modern era. Actually, although having its roots in the West, the MetS has become a global concern due to the expansion of the Western style of life throughout the world. After a diagnosis, it's critical to act quickly by adopting a better lifestyle and using medication as needed.We have focused our attention in this review on natural bioactive components derived from plant extracts, spices, herbs, and essential oils that have shown promise in the treatment of patients with MetS, given that natural compounds have been used extensively and successfully for medical and health purposes throughout the course of human evolution. With regard to managing Metabolic Syndrome (MetS) and delaying the onset of multiple complex multifactorial diseases, such as cancer, diabetes, obesity, and cardiovascular disease, the introduction of such dietary supplements may represent a promising treatment alternative.

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