International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG(USA) Volume 6, Issue 3 - 2019

Review Article

DOI: http://dx.doi.org/10.22192/ijarbs.2019.06.03.023

Understanding Metabolic Syndrome in Women: A Review of Gendered-Specific Insights

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Abstract

Metabolic syndrome encompasses a range of risk factors, such as central obesity, elevated blood glucose levels or insulin resistance, dyslipidemia, and hypertension. Women face a heightened risk of various health issues associated with this syndrome, particularly during the menopausal transition, which introduces hormonal fluctuations that may facilitate its onset. Addressing the components of metabolic syndrome through effective detection, prevention, and treatment strategies is crucial for alleviating the burden of cardiovascular diseases. Therefore, identifying at-risk populations is essential. This study aims to enhance awareness regarding the prevention of metabolic syndrome and promote health initiatives that can lead to improved health outcomes and quality of life for women. As a growing public health issue, metabolic syndrome—characterized by central obesity, dyslipidemia, hypertension, and insulin resistance—demands attention, particularly in women. This review consolidates existing research on the prevalence, risk factors, pathophysiology, diagnosis, and management of metabolic syndrome in women, emphasizing the differences that exist between genders.

Keywords: Metabolic syndrome, obesity, blood glucose, insulin resistance, dyslipidemia, hypertension, life style

Introduction

Community health is family-centered, it is important to understand the myriad ways in which a family affects and is affected by the health status of individual member, especially women. Every family has its own cultural values and rules, knowledge and skills that allow them to deal with health problems in their community. Healthy women produce healthy family and lead to healthy community. As women represent the nucleus of the community, therefore success of health activities and programs depend on them. This study will highlight the health needs of women in the Indian society.The prevalence of Metabolic Syndrome (Met S) is notably high among Asian populations, including Indians, yet there is limited data regarding its impact on women specifically. Women face an increased risk of various health issues associated with Metabolic Syndrome, particularly during the menopausal transition, which brings about significant hormonal changes that may facilitate the syndrome's development. Metabolic Syndrome encompasses a range of risk factors that heighten the likelihood of developing type-2 diabetes mellitus and cardiovascular diseases. This study aims to enhance awareness regarding the prevention of Metabolic Syndrome and promote health initiatives that can lead to improved health outcomes and quality

of life for women. The financial implications of screening, diagnosing diabetes, and advising on lifestyle changes are substantially lower—by a factor of 100—compared to the costs associated with treating diabetes, hypertension, heart diseases, and their complications. It is crucial to promptly identify this target population and encourage them to adopt lifestyle modifications. Implementing healthy lifestyle changes can significantly mitigate or even reverse the effects of Metabolic Syndrome, and the sooner these changes are made, the more manageable it becomes to counteract serious conditions like cardiovascular disease or diabetes. Investigating Metabolic Syndrome will shed light on the epidemiological patterns among women experiencing concurrent hypertension and hyperglycemia.This study is a randomized and designed to compare the effects of an interdisciplinary lifestyle modification program and their socioeconomic status.

Methodology

To comprehensively review the prevalence of metabolic syndrome in women, systematic literature is sifted. Studies reporting the prevalence of metabolic syndrome specifically in women are included.

Discussion

The Metabolic syndrome is a widely prevalent and multi-factorial disorder.An association between certain metabolic disorders and cardiovascular disease has been known since 1940s. In 1980s this association became more clearly defined and the term Metabolic Syndrome (also known as Syndrome X or the Dysmetabolic Syndrome) was coined to designate a cluster of metabolic risk factors that come together in a single individual.

In 1988, Reaven outlined ‘Syndrome X’ and the association between glucose intolerance, hypertension and dyslipidemia, with insulin resistance suggested as the underlying cause. The term "metabolic syndrome" dates back to at least the late 1950s, but came into common usage in the late 1970s to describe various associations of risk factors with diabetes that had been noted as early as the 1920s (Joslin,1921).

In 1977, Haller used the term "Metabolic Syndrome" for associations of obesity, diabetes mellitus, hypolipoproteinemia, hyperuricemia, and hepatic steatosis when describing the additive effects of risk factors on atherosclerosis. The same year, Singer (1977) used the term for associations of obesity, gout, diabetes mellitus and hypertension with hypolipoproteinemia. Phillips, Gerald B. (1978) developed the concept that risk factors for myocardial infarction concur to form a "constellation of abnormalities" (glucose intolerance, hyperinsulinemia, hypercholesterolemia, hypertriglyceridemia and hypertension) .

The terms Metabolic Syndrome, Insulin Resistance Syndrome, Dysmetabolic Syndrome, Obesity Syndrome, and Reaven’s Syndrome, Syndrome X are now used specifically to define a constellation of abnormalities that are associated with increased risk for the development of type-2 diabetes and atherosclerotic vascular disease (heart disease and stroke). Metabolic Syndrome is a set of risk factors that includes: abdominal obesity, a decreased ability to process glucose (increased blood glucose and/or insulin resistance, dyslipidemia, and hypertension.
A global transition in the disease pattern has been observed, where the relative impact of infectious diseases is decreasing while chronic diseases like cardiovascular disease, cancer and diabetes are increasingly dominating the disease pattern. As of today, four out of five deaths due to chronic diseases will occur in low- and middle-income countries (WHO, 2005).

World-wide, the prevalence of MetS ranges from 10% to 50% (Cameron et al, 2004). The detection, prevention, and treatment of the MetS components should become an important approach for the reduction of the cardiovascular disease burden in the general population. Hence, the identification of the population at risk is of utmost importance.

Metabolic syndrome is more predictive of CHD events in women than in men. Where a woman accumulates fat in her body is an important factor in determining whether she’s at higher risk for metabolic syndrome. The “apple shape” is a higher-risk situation than the “pear shape.” Excessive waistline fat causes “sick fat cells,” which produce a “toxic stew” of substances, increasing a woman’s risk of developing cardiovascular disease and diabetes. There are very less studies have specifically looked at women for Metabolic Syndrome.

Obesity, hypertension, dyslipidemia and diabetes are no longer diseases of the wealthy. By 2025, three out of four people with diabetes will be living in third world countries and similar trends are likely for the other components of the syndrome.

The metabolic syndrome (MetS) is a constellation of obesity, hyperglycaemia, decreased high density lipoprotein (HDL), increased triglyceride, and high blood pressure (Magliano el, 2006). The Metabolic Syndrome (MetS) has emerged as a significant contributor to the rising rates of diabetes and cardiovascular diseases (CVD), posing a substantial public health challenge globally, as noted by Zimmet et al. (2001) and Grundy et al. (2004). This syndrome is increasingly recognized as a pressing issue worldwide, with distinct gender-specific variations in its prevalence, manifestation, and associated risks; research indicates that women experience more severe CVD outcomes, as highlighted by Sarafidis et al. (2006) and Bentley-Lewis et al. (2007). The diagnosis of MetS in menopausal women is influenced by factors from their reproductive years, and according to the American Heart Association (AHA), half of all women will encounter some form of CVD in their lifetime. CVD remains the leading cause of death among women in the United States, with an estimated 42 million women over the age of 20 affected.It is disconcerting to think that two-thirds of cardiac deaths (66%) occur without individual awareness of the risk of CVD (Rosamond et al, 2008).

In recent years, several studies (Shiwaku et al, 2005, Cheung, 2005, Enas et al, 2007 and Pan et al, 2008) have shown the increasing importance of metabolic syndrome in low-income countries, but few studies have focused on women populations.

Recent studies from developing countries reported various prevalence rates depending on the criteria used in defining the MetS. In Iran, using the NCEP criteria, prevalence of metabolic syndrome was estimated to be between 24% and 30%, depending on sex. In Seychelles, an island country of African region, according to the ATP, WHO and IDF definitions, the prevalence of metabolic syndrome was, respectively, 24.0%, 25.0%, 25.1% in men and 32.2%, 24.6%, 35.4% in women (Kelliny et al,2008). In the semi-rural areas of Turkey the prevalence of MetS was 27.6% by NCEP criteria (Arikan et al, 2009).

There is a scarcity of data regarding the prevalence of MetS in Bangladesh. However, in a study conducted amongst rural Bangladeshi women (≥18 years), the prevalence was low (<3%) (Zaman et al, 2006). Another prevalence study conducted on clinic based hypertensive patients (20–79 years) found prevalence of 64% (Siddique et al, 2008). This study underscores the importance of metabolic syndrome in rural Bangladesh as one in every five elderly subjects is affected by the syndrome. Metabolic syndrome is increasing in prevalence, paralleling an increasing epidemic of obesity. In the United States, where almost two thirds of the population is overweight or obese, more than one fourth of the population meets diagnostic criteria for metabolic syndrome (Misra and L. Khurana, 2009). In the United States, data from a 1999-2000 survey showed that the age-adjusted prevalence of metabolic syndrome among adults aged 20 years or older had risen from 27% (data from 1988-1994) to 32%. (Chow et al, 2008).

From Eckel et al (2005), prevalence among men varies from 8% in India to 24% in the U.S. and varies in women from 7% in France to 43% in Iran. The Inter-ASIA study in China reported that the prevalence among women was higher than men at every age group. There is a steep increase in the prevalence after 30 years of age in both men and women in the U.S., peaking for men between 50 and 70 years and for women-60 to 80 years. Similar trends have been found in European and Chinese populations (Reynolds & He, 2005). The metabolic syndrome, a dangerous combination of pre-diabetes and heart-disease factors that affects up to 25 percent of the population, is a chief culprit in American illness.

On a global level, the type-2 diabetes epidemic in 2005 comprises of 97 million known cases, and an equivalent number of unknown cases, with around 314 million people having IGT. By 2025, it is estimated this will rise to approximately 500 million people raising concerns about a potential cardiovascular epidemic. From global projections, the major changes will occur in Eastern European states, the Middle East and India**.**Based on the NCEP classification, a rapidly growing epidemic of metabolic syndrome is taking place in China. In 1992, the prevalence of metabolic syndrome in China was 13.3 percent, 12.7 percent in males and 14.2 percent in females *(*Zhonghua et al, 2002*)*. By 2000, the prevalence of Metabolic Syndrome had increased to 15.1 percent, 13.6 percent in men and 16.6 percent in women (Gu et al, 2005). The prevalence rate was established using the modified Asian criteria for waist circumference, which is informed by research indicating that individuals of Asian descent face similar cardiovascular disease risks at smaller waist measurements—specifically, 90 cm for men and 80 cm for women (Tan et al, 2004). A 2004 survey conducted in Singapore revealed varying prevalence rates of the syndrome among the three primary ethnic groups, with 15% among the Chinese,

19% among the Malays, and 20% among the Indians. These studies predominantly employed either the WHO or ATP III criteria to define metabolic syndrome. It is estimated that between 20% and 25% of South Asians have developed metabolic syndrome, with a significant number potentially at risk (Cameron et al, 2004). In India, 25% of participants met the metabolic syndrome criteria according to the IDF guidelines (Sachdev et al, 2009), while another investigation indicated a prevalence of 9.3% based on NCEP criteria in rural central India (Kamble et al, 2010). Previous research has highlighted one or more components of the syndrome.Prevalence rates have varied (11% - 41%) depending on the definition and cut-offs used as well as population characteristics (Deepa et al, 2002). Using NCEP-ATP III criteria, Ramachandran et *al.2003* reported prevalence of 41% in Chennai, while Gupta *et al.,* 2004 reported 31% in Jaipur.

Prabhakaran *et al.* 2007 reported prevalence of 24.6% from Delhi, with three-fold higher prevalence in urban compared to rural areas. The prevalence of metabolic syndrome in India has been reported at 23.2%, 18.3%, and 25.8% based on the definitions provided by WHO, ATP III, and IDF, respectively (Deepa et al., 2007). Additionally, Misra et al. (2004) indicated that insulin resistance affects 28% of urban children and young adults. Among the 150 million individuals diagnosed with diabetes globally, approximately 40 million are from India. Projections suggest that by 2025, the incidence of diabetes in India could surge by 150-200%, leading to the alarming statistic that one in four diabetics worldwide will be Indian. The situation is exacerbated by the fact that a significant number of individuals with diabetes remain undiagnosed. Beyond those diagnosed with diabetes, there exists a considerable population with impaired glucose tolerance (IGT) or impaired fasting glucose (IFG), now classified as prediabetics, with 35% likely to progress to diabetes. This group faces similar cardiovascular risks as those with diabetes, and India has the highest number of prediabetics, with 8.7% in urban areas and 7.4% in rural regions.

Dr. Ramachandran highlighted the Indian perspective on the prevalence of prediabetes and metabolic syndrome, noting in 2003 that both IFG and IGT are widespread in India, with rates of 8.7% and 8.1%, respectively, and a 33% overlap between these populations. IGT is prevalent across various regions and age groups, while diabetes is predominantly found in individuals over 40 years of age, with a prevalence of 24% compared to 15.7% for IGT, and only 5% of diabetic patients are under 40. Indian women are particularly vulnerable to developing diabetes, hypertension, hypercholesterolemia, heart disease, and metabolic syndrome. The prevalence of metabolic syndrome varies significantly among different populations, with rates ranging from 13.8% in premenopausal women to over 60% in postmenopausal women (Heidari et al., 2010; Ruan et al., 2010; Tandon et al., 2010). These variations are likely influenced by ethnic differences and the criteria employed for diagnosis.

Though all studies for the prevalence of Met S in menopausal women have shown its higher percentage in postmenopausal as compared to pre-menopausal women, most have been cross-sectional. Heidari*et al.*, 2010, in a study of 1596 women showed a prevalence of 44.9%, 57.9% and 64.3% in pre-, peri- and postmenopausal women respectively.

Janssen et al. (2008) conducted a longitudinal study known as the Study of Women's Health across the Nation (SWAN), which tracked 949 premenopausal women over a span of nine years. By the conclusion of the study, a new-onset incidence of metabolic syndrome (Met S) was recorded at 13.7%, with an odds ratio of 1.45 (95% CI 1.35-1.56) indicating an increased risk of developing Met S annually during the peri-menopausal phase. The onset of obesity, particularly characterized by an accumulation of abdominal fat, is considered a key factor in the advancement of metabolic syndrome. This propensity for abdominal fat accumulation, rather than fat distribution in the hips, buttocks, or limbs, is associated with elevated blood fatty acids, which can contribute to insulin resistance, hypertension, increased abdominal lipids, and ultimately, diabetes. Notably, Asian Indians are particularly susceptible to central obesity, heightening their risk for metabolic syndrome. In the rural female population studied, the overall prevalence of metabolic syndrome was found to be 12%.Women in the age group ≥60 years had the highest prevalence (27.8%), whereas those in the age group 20–39 years had the lowest prevalence (4.2%) in Ballabgarh, Haryana (Misra et al, 2011).

Conclusion

The paradox of entrusting the woman with the responsibility of health and at the same time denying her opportunities to health remains a major obstacle.

Factors that influence women's health in India most commonly include poverty, poor education and poor nutrition. Access to education for Indian women is a major problem. The impact of a poorly educated mother is passed on to the daughter. The foregoing factors call for urgent attention to health issues, especially those which affect women who are the traditional health providers. This study highlights the health needs of women in the Indian society. Women face an elevated risk for various health issues associated with Metabolic Syndrome. Implementing healthy lifestyle modifications can significantly mitigate or even reverse the consequences of this syndrome. The sooner these changes are adopted, the more manageable it becomes to counteract the serious implications of conditions like cardiovascular disease or type-2 diabetes. Women experiencing this syndrome undergo several metabolic alterations, and recognizing these changes is essential for gaining a comprehensive understanding of their metabolic health.

Hence such endeavors are of paramount importance in changing the present scenario of Metabolic Syndrome in women.

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DOI:10.22192/ijarbs.2019.06.03.023	

How to cite this article:
Manju Dewan. (2019). Understanding Metabolic Syndrome in Women: A Review of Gendered-Specific Insights. Int. J. Adv. Res. Biol. Sci. 6(3): 315-321.
DOI: http://dx.doi.org/10.22192/ijarbs.2019.06.03.023