

The ominous octet of “S” in noncommunicable disease

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ABSTRACT

Noncommunicable diseases (NCDs) have surpassed the infectious disorders as the major causes of morbidity and mortality worldwide. This is the first decade in the existence of humanity, where the prevalence of obesity has surpassed that of the malnutrition. Although the NCD rates have increased in developed countries, the mortality rates have reduced due to the effective management and prevention strategies. Similar trends are not seen in developing countries where the NCD-related mortality is on the rise. The risk factors for NCD are commonly encountered and require a lot of personal involvement to curb the rise. In this review, we shall discuss the common risk factors leading to the NCD and also suggest certain remedial measures. We propose the ominous octet of “S,” a constellation of risk factors starting with the letter “S,” leading to the NCD.

Key words: Diabetes mellitus, noncommunicable disease, salt, smoking, sugar

INTRODUCTION

Noncommunicable diseases (NCDs) are responsible for approximately two-thirds of deaths worldwide.^[1] NCD deaths are mainly due to the cardiovascular diseases (CVDs), diabetes mellitus (DM), cancer, and chronic obstructive lung disorders. The risk factors for NCD can be categorized as “modifiable” and “nonmodifiable.”^[2] The majority of the NCD are linked by the common preventable lifestyle-related risk factors (unhealthy diet, physical inactivity, obesity, and tobacco). Therefore, the prevention of these diseases can be achieved by a common focus of controlling these risk factors. In this review, we shall discuss the ominous octet of “S” leading to the NCD as shown in Figure 1. The octet components include sex, salt, sugar, sleep, smoke, stress, sunlight, and sedentary behavior. We briefly discuss the individual contribution of each of

this risk factor for the NCD and suggest certain remedial measures in this article.

HISTORY OF “S” OCTET

The octet of “S” has mythological and historical importance in the Indian context. The importance of a healthy sexual life and sleep has been explained in the historical treaties of the ancient Indian medicine.^[3] The importance of sunlight has been practiced by “Surya Namaskar,” which the daily ritual of prayer to Sun.^[4] Salt played a major role in the independence movement of the India with the famous Dandi March organized by Mahatma Gandhi. Another landmark event is the universal iodization of the salt, which led to the reduction in the prevalence of thyroid

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disorders.^[5] The sugar industry in India is established with the entry of the Dutch East Indian Company and is a major source of calorie consumption now. The sugar was termed as the “white gold” for its value and was one of the most valuable commodities in the eighteenth century.

SEX

Even though NCD has been studied in great detail, the same has not been explored widely with reference to the sexual and reproductive health (SRH). The links between NCD and SRH are not clear and marred by the common risk factors. Adolescent obesity is increasing in prevalence and predispose to negative body image, low self-esteem, and high-risk sexual behavior. Obesity coupled with sexual promiscuity could lead to many adverse consequences such as infertility, breast, uterine cancer, and other NCD. Smoking increases the risk of cervical and vulval cancer in women infected with human papillomavirus and increases the risk of testicular and penile cancer in men. The sexually active girls also use the contraceptive pills which may increase the risk of hypertension (HTN) and CVD. There are certain gender-based differences in the NCD due to the risk factors. Females are more obese and males have more exposure to the smoking. The high rates of obesity in women predispose them to the risk of diabetes and CVD.^[6] The symptoms of CVD are often atypical and masked in women leading to a delay in the diagnosis. The health of women also has transgenerational effect because the children born to undernourished mothers have a higher risk of development of metabolic disorders as described in the thrifty genotype hypothesis.^[7]

SALT

A small amount of salt (1–2 g daily) is essential for the normal physiology. For several million years, the evolutionary ancestors of humans ate a diet that contained <1 g salt per day. The deliberate addition of salt to food to improve the palatability began about 5000–10,000 years ago at

the beginning of agriculture and farming. Unfortunately, most adults currently consume 7–10 g of salt per day. A high salt diet can contribute to high blood pressure, stroke, heart disease, osteoporosis, stomach cancer, kidney disease, renal stones, and obesity.^[8] Other health conditions that can be affected by a high salt diet include asthma, Ménière’s disease, and diabetes. Excessive salt contributes to deterioration and morbidity in asthma by increasing the bronchial hyperactivity.^[9] In addition to raising blood pressure, excess dietary salt leads to several other adverse effects on the cardiovascular system. They include increased left ventricular mass, arteriosclerosis, arteriolar stiffness, and platelet hyperaggregability. All these act as independent cardiovascular risk markers in addition to HTN. The methods to consume less salt are given in Box 1.

SLEEP

Sleep hygiene plays an important role in the normal functioning of brain, heart, immune system, neurobehavioral system, and performance of the human beings. The ability to sleep soundly for more than 8 h a day is a distant dream for most of the adults in the current era. The average number of hours of sleep decreased from 9 to 7/day in the last century of economic development. The modern development is characterized by the shorter sleep duration (SSD), lack of physical activity, and availability of excess calories. These lifestyle changes and SSD pose an enormous burden on the metabolic milieu of the human body, leading to multiple NCD, including obesity, HTN, and type 2 DM.^[10] The lack of sleep is affecting the younger generation mostly in the productive age group. Sleep hygiene is a practice of good quality and quantity of sleep, which ensures normal daytime alertness of human beings. The measures to improve the sleep hygiene include having a fixed routine of bedtime, avoidance of caffeinated drinks, and also proper bedroom environment.

SMOKE

Tobacco use is the single most common cause for the NCD. The incidence of tobacco users has been increasing despite the rise in awareness about the harmful effects of the substance. Smoking leads to more than 15 types of cancers such as lung, oral cavity, larynx, bladder, kidney,



Figure 1: The ominous octet

Box 1: Measures to limit the salt intake

- Restrict sodium intake to below 2–3 g/day
- Avoid processed food, cheese, sandwiches, pizza
- Avoid red meat and salty snacks
- Avoid pickles, papads
- Use olive oil and avoid salted butter
- Use vinegar, lemon juice instead of the salt

and stomach.^[11] Smokeless tobacco also leads to increased risk of cancer in addition to the HTN and CVD. The effects of smoking are seen even in people who are exposed to passive smoking or second-hand smoking. In addition to smoking, the air pollution is a common environmental risk factor for the NCD.^[12] Global estimates suggest that about 7 million deaths are attributable to the air pollution every year. Outdoor and indoor air pollution is seen due to the people using the wood or coal as their primary cooking fuel. In rural India, people use the traditional chulhas along with wood, coal, kerosene, and dung as the fuel for cooking.^[13] This results in the release of the toxic fumes which increases the risk of chronic obstructive pulmonary disease in the rural female population. The new smokeless chulha offers many advantages such as the consumption of less firewood, reduced deforestation, carbon emission, and longer life of the chulha.

STRESS

Stress and health are closely interrelated with bidirectional mechanisms. Stress is a silent culprit that affects all the organ systems leading to NCD. The stress at the workplace and home has similar adverse consequences on health. Stress leads to various physiological, immunological, endocrine, and neural adaptive mechanisms that increase the insulin resistance. The coping strategies help in mitigating the detrimental effects and morbidity associated with the stress. Many persons claim that the social unwinding helps them in tackling the work pressure better and accept it as the coping strategy. The consumption of alcohol in the evening is often viewed as a coping strategy to alleviate the work-related stress.^[14] Similar claims are made in the case of marijuana smoking in Caribbean islands and Shisha smoking in the Middle Eastern countries. The prevention of NCD includes managing the unhealthy coping skills, education about the stress adaptation, and positive reinforcement. A multipronged approach is required to deal with the ways to minimize the stress and handle the stressful situations with ease and proper coping skills.

SUGAR

Excessive sugar consumption affects human health beyond simply adding calories. Importantly, sugar induces all of the diseases associated with metabolic syndrome. This includes HTN (fructose increases uric acid, which raises blood pressure), hypertriglyceridemia, insulin resistance, and diabetes. The fructose causes damage to lipids, proteins, and DNA through nonenzymatic binding and it can be said that fructose exerts toxic effects on the liver

similar to those of alcohol.^[15] Another unique feature of fructose is that it is the only sugar that raises the uric acid concentration. Fructose enters hepatocytes where it is completely metabolized by fructokinase with the consumption of adenosine triphosphate and lactic acid.^[16] The uric acid is generated in the process and may rise by 1–4 mg/dL after the ingestion of a large fructose-based meal. Hyperuricemia is an independent risk factor for the CVD, and this is a key mechanism about how fructose causes CVD. The sugar content of the beverages also determines the ill effects of its consumption leading to diabetes and CVD. Few studies have also linked the consumption of sugar to cancer and cognitive decline.

SUNLIGHT

Sunlight helps in the formation of Vitamin D which is essential for the absorption of dietary calcium. Without Vitamin D, the small intestine absorbs no more than 10–15% of dietary calcium. The solar ultraviolet black (UVB) photons that penetrate the skin alter the 7-dehydrocholesterol in the skin leading to the cutaneous production of Vitamin D₃. Melanin evolved as an effective natural sunscreen. Because it efficiently absorbs UVB photons, people with increased skin melanin pigmentation require longer exposures to sunlight to make the same amount of Vitamin D₃ compared with light-skinned people. Indians have a high prevalence of Vitamin D deficiency despite abundant sunshine because of the skin color and heliophobia. The lack of Vitamin D in children leads to rickets, whereas in adults, it causes secondary hyperparathyroidism and osteoporosis. Vitamin D deficiency has been linked with many extraskeletal disorders such as DM, obesity, multiple sclerosis, rheumatoid arthritis, and many common cancers.^[17] Sunlight exposure is a double-edged sword with excessive exposure leading to skin cancer, especially basal cell carcinoma.^[18]

SEDENTARY BEHAVIOR

The research on physical activity has suggested that at least 30 min exercise in daily routine is essential to improve the physical and mental health of an individual. Modern day world promotes the sedentary behavior and associated consequences. Sedentary time is defined as the time spent sitting during the nonexercising wake hours. The health authorities are trying to promote the awareness to increase the leisure time physical activity as a strategy to prevent the spread of the NCD.^[19] The focus is to increase the physical activity during the office hours, traveling time, and also during the leisure time. Majority of the individuals

Box 2: Measures to reduce sedentary behavior

Reduce the screen time to <30 min/day
 Take staircase instead of lift
 Walk in the office for at least 5 min every hour
 Avoid prolonged sitting in the outpatient department
 Use cycle for nearby activities
 Daily physical activity

spend <5% of their time doing a vigorous physical activity and other time is spent in the less intensity activity or idle sitting. Running has a metabolic value of equivalent to 8 metabolic equivalents (METs), whereas the sedentary time metabolic expenditure is 1–1.5 METs. Many observational studies have shown that the sedentary behavior is associated with obesity, diabetes, CVD, and other NCD.^[19] Similar trend is also observed in the pediatric age group with an increase in the prevalence of the obesity and metabolic syndrome in the children.^[20] The preventive measures to overcome the sedentary behavior are given in Box 2.

CONCLUSION

To conclude, excess of the required factors are the main culprits behind the global rise in the prevalence of the NCD. The pandemic of NCD is going to clog the health-care delivery systems in both the developed and developing nations. The time has come to follow the footsteps of Mahatma Gandhi and do a reverse Dandi March to reduce the footprints of unhealthy eating habits. The preventive measures have to be established at the individual and community level with an active support from the government and other health-care providers.

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There are no conflicts of interest.

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