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Demographic Determinants of the Epidemic of Obesity

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There is an alarming increase in the incidence and prevalence of obesity and its adverse health consequences worldwide justifying its recognition by WHO as a "Global Epidemic"(1). Especially the increase in less affluent developing countries and economies in transition poses additional burden on their already fragile infrastructure. The rise in childhood obesity with attendant increase in Type 2 Diabetes and other components of the Metabolic syndrome is a matter of grave concern.

Magnitude of the problem

According to WHO estimates around one billion people in the world are overweight and over 300 million of them are obese (BMI > 30) (2). In developed countries of Western Europe, USA and Australasia the epidemic started in 1980's whereas in developing countries and economies in transition like India the increase in obesity started more recently (3, 4). Across the world statistics have shown rising incidence in all sections of the population (3). Though comprehensive national statistics are not available for our country representative data from different regions shows a definite rising trend (5). The worrisome aspect is the rise in childhood obesity especially in urban areas brought to light by several representative surveys of school children. Our country has to grapple with the twin burdens of traditional problems of infectious diseases and malnutrition as well as the rise in non-communicable diseases like diabetes and cardiovascular disease engendered by the change in lifestyle. According to the recent mortality and morbidity statistics non communicable diseases contribute to 53 % of deaths in our country (6). Even at lower levels of BMI conventionally regarded as non obese, Indians have higher body fat especially visceral fat contributing to the higher risk of metabolic syndrome and cardiovascular disease. This has led to the redefinition of BMI cutoff point for Asians as <23 (7).

Etiology of the Obesity Epidemic-Genes vs. Environment

Arguments for and against Nature vs. Nurture in the causation of obesity abound but there is consensus that interplay of genetic and environmental factors is crucial (8). The importance of genetic factors is attested by concordance of body weights of children with biologic parents in adoption studies and concordance between monozygotic twins in over feeding studies (9). Still the rapidity of progression of the

epidemic across the world cannot be explained by genetic factors and must be largely due to changes in lifestyle brought about by demographic changes, urbanization and consequent socioeconomic and behavioral changes in different countries (10, 11).

An attractive Thrifty gene hypothesis has been put forward to explain the gene-environment interaction (12). Evolutionarily the hunter-gatherer lifestyle of early man with inevitable fasting and feasting cycle contingent on availability of food provided hypothetical 'thrifty genes' favoring storage of energy in the form of adipose tissue to be used up in times of starvation and insulin resistance at the muscle level to divert fuel to vital organs like brain. These protective genes became detrimental when food supply became uninterrupted and abundant with progress in civilization (12).

Simplistically obesity is a consequence of positive energy balance with energy intake exceeding expenditure. It is an ongoing debate whether increased energy intake or decreased energy expenditure due to physical inactivity plays the dominant role in the causation of obesity.

Obesogenic modern environment

Is it increased energy intake?

There is a worldwide nutrition transition in which traditional diets are giving way to energy dense, high fat, high refined carbohydrate 'western diets' (13). Compared to the Paleolithic diet of prehistoric man the contemporary Western diet has 3 fold increase in fat especially saturated fat, high refined carbohydrate and less protein (12). Even though population data on overall caloric intake and dietary fat consumption provide mixed results, there is no doubt that increase in consumption of energy dense foods, number of meals eaten outside home and consumption of sugary aerated drinks are major factors linked to obesity (13). The seeds for the epidemic are sown in early childhood by early weaning and introduction of formula foods followed later by affinity to energy dense, high fat, high glycemic index, low fiber junk foods (13). The relative low cost of these foods, attractive packaging, lure of increased portion sizes and aggressive marketing by fast food outlets fuel the epidemic. Social and environmental factors like conducive school milieu, peer pressure and busy working parents using food as reward or substitute for quality time with children compound the problem further.

Is it decreased physical activity?

Studies on energy balance in obesity have shown resting metabolic rate in obese subjects is unchanged or actually increased and likewise energy expenditure of physical activity may be actually increased whereas energy dissipation by thermogenesis is decreased (10, 13). Hence efficient energy storage mechanisms may be operative. Many researchers conclude after analysis of dietary patterns of

communities over time that decrease in physical activity is a more important cause of obesity than increased caloric intake (11, 13). Urbanization and a switch from agrarian to industrial economy have led to more sedentary physically less demanding work (14). Increased use of automated transport and energy saving technologies at home have led to reduction in energy expenditure of day to day activities. Passive leisure time pursuits have increased because of television and computers. Especially in children time spent on TV viewing and computer gaming is directly correlated to the risk of obesity in many studies (15). In a nutshell the creations of civilization and industrialization that contribute to physical inactivity are two types of machines -those that reduce the energy cost of work or transport (electric appliances and cars) and those that promote passive recreation (Television, videos) (16).

Nutrition Transition in the developing world

Evolution of the human race and Civilization have brought in their wake several transitions from time to time (17). These can be classified into (i) Demographic transition (From high fertility and high mortality to low fertility and low mortality) (ii) Epidemiologic transition (From Infectious diseases and malnutrition to chronic non-communicable diseases) and (iii) Nutrition Transition (from Traditional diet to "Western diet") (17). The pace of change in these areas has accelerated especially in the last 3 centuries.

In evolution Man has progressed from the age of hunting and collecting food to the age of continuous food supply and concomitant chronic degenerative diseases and this has been brought about by agricultural and industrial revolutions (17).

Determinants of Nutrition Transition

Nutrition transition is attributable to a complex interplay of changes in several sectors namely agriculture, demography, socio-economic and health. Of these socioeconomic changes are key contributors. Changes in role of women especially with respect to time allocation to household chores because of increase in the number of working women is found to be one of the major determinants by demographic researchers (14, 17). Changes in income patterns, household food preparation technology, food production and processing technology and alterations in family and household composition are the other contributors. This has led to increase consumption of more processed instant foods with less fiber and more refined carbohydrates and fats which are obesogenic (14, 17).

Urbanization is the culprit!

Progressive increase in the urban population through migration from rural areas is witnessed in the developing world. The urban population in India had increased from 10.84% in 1901 to 25.72 %

in 1991 (18). The number of mega cities (cities with more than 8 million population) is showing an exponential increase in developing countries, while it remains almost constant in developed countries (19). This is largely because of internal migration of people from rural to urban areas. This brings about a switch of work force from agriculture to industrial and service sectors with more sedentary occupations contributing to weight gain.

Urbanization leads to increase in continuous availability of food with a wide variety, a significant percentage of it from processed commercial food sector. Shift in occupation patterns leads to reduced compatibility of jobs with home food preparation and necessitates eating out of home (14, 17). Socioeconomic factors also contribute equally. Direct correlation between annual per capita income and consumption of fats and refined carbohydrates is noted in several countries of the developing world (17). National nutrition surveys in our country have shown almost 2 fold difference in fat intake between urban and rural areas of the country (4).

The urban structure necessitates automated transport and constraints of time, space and safety constraints discourage simple physical activities like walking and cycling (13). High rise apartments and luxury hotels promote use of elevators and discourage or actually do not have free access to stairs (16). In children these problems of urbanization are compounded by long hours spent in school and coaching classes necessitated by the academic rat race.

Prevention /reversal of the obesity epidemic- The population approach

The salutary effects of lifestyle modification on reversing obesity and metabolic syndrome have been shown already in select populations and interventional studies for prevention of Type 2 Diabetes (20). For this we need to alter the obesogenic milieu through measures starting from early childhood. Education through mass media regarding adverse health consequences of junk food and sedentary habit, promotion of optimum maternal nutrition and breast feeding, inculcation of healthy feeding practices from infancy, incorporation of healthy life style advice in school curriculum and provision of opportunities for increasing physical activity in the urban milieu are some of the measures in this direction (15, 16, 21). This will require conviction, commitment and coordinated efforts from scientists, health care providers, school authorities, food industry and policy makers. In a nutshell large scale lifestyle changes brought about by demographic and socioeconomic changes and the consequent nutrition transition are fueling the obesity epidemic. Addressing lifestyle issues is the only way to stall the epidemic.

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