WEIGHT CONTROL IS A JOURNEY, NOT A DESTINATION

The second half of the twentieth century witnessed major health transitions in the world, propelled by socio-economic and technological changes which profoundly altered life expectancy and ways of living while creating an unprecedented human capacity to use science to both prolong and enhance life. Dietary deficits and excesses and the lifestyle changes that accompany industrialization and urbanization with economic development make a significant contribution to the most globally pervasive change of the rising burden of obesity and non-communicable diseases (NCDs).

Obesity was identified as a disease thirty years ago when, the World Health Organization (WHO) listed obesity as a disease condition in its International Classification of Diseases in 1979. Analysis of mortality trends suggests that large increases in NCDs have occurred in developing countries, particularly those in rapid transition (e.g. Brazil, China and India). The epidemic of rapid nutrition transition and its adverse health consequences in the Asian region are now beginning to get noticed. These include insulin resistance, type 2 diabetes, hypertension, coronary artery disease, hyperlipidemia, metabolic syndrome (Syndrome X), stroke and certain cancers. Mortality from cardiovascular disease is expected to rise by about 60%, and overtake deaths from infectious diseases by 2015-2020. The prevalence of type 2 diabetes has increased by 40% in Chennai between 1988 and 1994. It is predicted that the prevalence of type 2 diabetes will rise from 4% to 5.4% by 2025, and the proportional rise will be greatest in developing countries (48%), especially India (59%). India will have more people with diabetes (~ 57 million), than any other country, with the greatest numbers in the 45-64 years age group. The economic and health consequences of obesity epidemic can spell disaster for the nation unless immediate remedial measures are instituted. The complex range of factors that interact to determine the nature and course of obesity epidemic needs to be understood in order to adopt preventive strategies to help developing societies like India deal with this burgeoning problem.

WHAT IS OBESITY?

Obesity is a state of excess adipose tissue mass that imparts health risk. (20% more than Ideal Body Weight). Lean but very muscular individuals may be overweight by arbitrary standards without having increased adiposity. Obesity is effectively defined by assessing its linkage to morbidity or mortality.

METHODS TO CALCULATE OBESITY

**Body Mass Index (BMI):** weight in Kg / height in meter 2 (kg/m²), skin-fold thickness, Densitometry (underwater weighing), Computed tomography (CT) or MRI, Waist to Hip Ratio (Central Obesity), Ideal Body Weight (Kg) = {(Height in cm-100) X 0.9).

**Body Mass Index (BMI):** BMI is recommended as a practical approach for assessing body fat in the clinical setting. It provides a more accurate measure of total body fat compared with the assessment of body weight alone. The typical body weight tables are based on mortality outcomes, and they do not necessarily predict morbidity. However, BMI has some limitations. For example, BMI overestimates body fat in persons who are very muscular, and it can underestimate body fat in persons who have lost muscle mass (e.g., many elderly).

**CLASSIFICATION OF BMI:**

- Underweight (<18.5 Kg/m²).
- Normal (18.5-24.9 Kg/m²).
- Overweight (25-29.9 Kg/m²).
- Obese (30-34.9 Kg/m²).
- Sever Obesity (35-39.9 Kg/m²).
- Morbid Obesity (>40 Kg/m²).

Several studies from India have attempted to modify the threshold for obesity and abdominal obesity using various metabolic abnormalities as gold standard. These studies have suggested cut-off for BMI ranging from 19-22Kg/m² while that of waist circumference ranges from 72-85cm in men and...
65.5-80 cm in women." Several reports suggest that for any given BMI, Indians tend to have increased waist circumference. Further Indians also tend to have excess body fat, abdominal and truncal adiposity. For any given waist circumference, Indians have increased body fat accumulation and for any given body fat, Indians have increased insulin resistance. These features have been referred to as the "Asian Indian Phenotype or Paradox." The WHO has revised the BMI cut-off for Asian Indians and suggested a BMI of 25kg/m² to define obesity against the 30kg/m² recommended for Europeans.

**IS INDIA REALLY GETTING FATTER- URBAN RURAL DIVIDE?**

The prevalence of obesity is increasing world wide. Data from the National Health and Nutrition Examination Surveys (NHANES) show that the percent of the American adult population with obesity (BMI > 30) has increased from 14.5% (between 1976 and 1980) to 30.5% (between 1999 and 2000). As many as 64% of U.S. adults 20 years of age were overweight (defined as BMI > 25) between the years of 1999 and 2000. Extreme obesity (BMI 40) has also increased and affects 4.7% of the population. As a consequence of rapid industrialization and urbanization leading to rise in living standards, prevalence of obesity is rapidly rising posing a greater threat to health of Indian nation. Obesity has reached epidemic proportions in India in the 21st century, affecting 5% of the country's population. India is following a trend of other developing countries that are steadily becoming more obese and is currently experiencing an increase obesity epidemic.

In 1990's National Nutrition Monitoring Bureau documented the prevalence of obesity in Indian women to be 4.1% and National Family Health Survey-2 (NFHS-2) reported obesity prevalence rates ranging from 3.5% to 4.1%. National Family Health Survey-3 (NFHS-3) reviled obesity as a substantial problem among several groups of women in India particularly older women, urban, well educated, women from households with high standard of living and among Sikhs. Data from NFHS-3 showed that 12.6% of Indian women were obese (23.5% urban and 7.4% rural). Among men the total prevalence of obesity was 9.7% (15.9% urban and 5.6% rural). The percentage of over-married women age 15-49 who are overweight or obese increased from 11% in NFHS-2 to 15% in NFHS-3. The percentage of women who are overweight or obese is highest in Punjab (30%), followed by Kerala (28%) and Delhi (26%). Similar variations are seen by state in the percentage of men who are overweight and obese. Further analysis of data showed that out of 12.6% obese women 9.8% were overweight (BMI of 25-29.9) and 2.8% were obese (BMI of ≥ 30). Similarly among 9.7% obese men, 8.4% were overweight and 1.3% were obese. Prevalence of obesity was directly related to the socio economic status where only 1.8% females with lowest wealth index were obese as compared to 30.5% in highest wealth index. In NFHS-3 Wealth Index has been classified as lowers, second, middle, fourth and highest Wealth Index groups according to several parameters representing family's socio economic status. Similar among men with lowest wealth index, prevalence of obesity was 1.4% and 23.6% among men with highest wealth index. (Table 1).

Available data on prevalence of obesity from different published studies suggest that the prevalence ranged from 10 to 50%. There are several reports from various parts of India mostly urban which provide some insight into the problem. A study from Bombay revealed the prevalence of obesity among young adult males varied from 10.7% to 53.1%. A report from Kashmir showed prevalence of obesity to be 15.0%, with 23.7% females and 7% males. A report from Nutrition Foundation of India Suggested that the prevalence of obesity varies with socio economic status in urban India, with those in upper strata having higher prevalence rates (32.2% among males, 30% among females) than middle class (16.2% among males, 30.3% among females) followed by the lower socio economic group (7% among males, 27.8% among females) and the poor in urban slums with the lowest (1% among males, 4% among females). In a study by Reddy, et al, more than 28% of adult males and 47% of adult females in urban Delhi were overweight by WHO standards. In the same study the corresponding figures for overweight in a neighboring Haryana rural area were 7% in males and 9% in females. Conversely, as many as 38% of males and 36% of females in the rural area were actually 'underweight' by BMI standards. A study from Punjab by Vitull et al concluded that prevalence of overweight was 5.1% in males and 3.4% in females and the prevalence of obesity in males was 0.3% and 0.4% in females was recorded in rural population which is quite less than that of prevalence reported in several urban studies. NFHS-3 data also reveal the extent of underweight population both male and female population which was more in rural and poor population. (Table: 2) Such an 'urban, rural divide' has been documented in other Indian studies too. The prevalence of underweight or malnutrition is really disturbing giving arises to double nutritional burden on Indians of obesity on one hand and malnutrition on the other.

Childhood obesity was considered a problem of affluent countries. Today the problem is started appearing even in developing countries. The calculated global prevalence of overweight (including obesity) in children aged 5-17 years is estimated by the International Obesity Task Force (IOTF) to be approximately 10%, but this is 'unequally distributed' with prevalence ranging from over 30% in Americas to <2% in sub Saharan Africa. Prevalence of overweight amongst Australian children has increased from 11% in 1985 to 20% in 1995. Childhood obesity has tripled in Canada in last 20 years. Currently the prevalence of obese school children is 20% in U.K and Australia, 15.8% in Saudi Arabia, 15.6% in Thailand, 10% in Japan and 7.8% in Iran. Societies like India, which are rapidly urbanizing, demonstrate life style changes resulting increase in energy intake, dramatic increase in fat intake along with increased level of sedentarianism are encountering increased prevalence of childhood obesity along with adult obesity. National representative data for childhood obesity in India is best represented by NFHS-3 data. Three standard indices of physical growth that describe the nutritional...
status of children are presented in NHFS-3 report are: Height-for-age (stunting), Weight-for-height (wasting) and Weight-for-age (underweight). BMI or weight for height index which measures body weight in relation to body length, describes current nutritional status in a better way. Children were considered thin and malnourished if their score was below minus two standard deviations (< -2SD) from median of the reference population, severely wasted if score was below minus three standard deviations (< -3SD) and overweight if score was above plus two standard deviations (+ 2SD) from median of the reference population. According to NFHS-3 data 1.7% male children and 1.4% female children were overweight (+ 2SD), 2.5% belonged to urban and 1.2% belonged to rural areas. Prevalence of childhood obesity increased with increase in socio economic status of the family being 1.0% in low wealth index group and 2.7% in high wealth index group. Conversely NFHS-3 data also revealed greater prevalence of underweight or malnourished (%age below -3SD and below -2 SD) child population which was more in males, rural and poor population. (Table: 3)

In children, the difference between the rich and the poor is fairly evident in urban studies. Ramachandran, et al. studied children from six schools in Chennai, two each from high, middle and lower income groups.25 The prevalence of overweight (including obese) adolescents ranged from 22% in better off schools to 4.5% in lower income group schools. In a Delhi school with tuition fees more than Rs. 2,500 per month, the prevalence of overweight was 31%, of which 7.5% were frankly obese.26 In Pune the figures for overweight children are 24% in a well off school and 6% in a ‘corporation’ school (unpublished data). Other studies of Chennai and Delhi have shown that prevalence of 6.2% and 7.4% respectively.26 27 There is a remarkable increase in prevalence of children with excess body fat.
GREAT NUTRITIONAL PUZZLE: URBAN/RURAL AND RICH/POOR DIVIDE:

Today India is confronted with a grave and great nutritional puzzle because on one hand India’s rich and urban population is facing an epidemic of obesity, metabolic syndrome, hypertension, cardiovascular diseases and is being projected to be the diabetic capital of the world resulting in increased morbidity and mortality from life style and NCDs and on the other hand India is home to largest number of malnourished population in the world especially the children confronting malnutrition, sanitation related, communicable, water born and poverty diseases.

In India there is a tremendous ‘Urban/Rural’ and ‘Rich / Poor’ divide which is further increasing in this era of globalisation resulting in much higher prevalence of obesity in the urban rich than in rural areas and poor communities. Complications of adult obesity are made worse if the obesity begins in childhood. Obesity is harder to treat in adults than in children. Women suffer from a dual burden of malnutrition with nearly half of them being either too thin or overweight. As undernutrition decreases, overnutrition increases by about the same amount. Malnutrition levels are higher among young girls. Almost half of the girls in age 15-19 are undernourished. NFHS-3 data show undernutrition declines and overnutrition increases with age of women. The percentage of women who are too thin is particularly high in Bihar (45%), Chhattisgarh, and Jharkhand (43% each). Malnutrition levels are lowest in Delhi, Punjab, and several of the small northeastern states. The prevalence of underweight and overweight among men shows similar variations by age, education and wealth index. Obesity is rising in India at a worrisome rate both in adult and child population. The relationship between obesity and poverty is complex: being poor in one of the world’s poorest countries (i.e., in countries with a per capita gross national product [GNP] of less than $800 per year) is associated with underweight and malnutrition, whereas being poor in a middle-income country (with a per capita GNP of about $3,000 per year) is associated with an increased risk of obesity. Some developing countries face the paradox of families in which the children are underweight and the adults are overweight.28

PATHOPHYSIOLOGY OF OBESITY:

Detailed etiology and pathophysiology of obesity is not in preview of this chapter but a brief account is given here. In a world where food supplies are intermittent, the ability to store excess energy is essential for survival. Fat cells are adapted to store excess energy efficiently as triglyceride and when needed to release stored energy as free fatty acids. In the presence of nutritional abundance and a sedentary lifestyle, genetic predisposition this system increases adipose energy stores and produces adverse health consequences. Obesity is a complex, multifactorial disease that develops from the interaction between genotype and the environment. Our understanding of how and why obesity occurs is incomplete; however, it involves the integration of social, behavioral, cultural, physiological, metabolic, and genetic factors.29 Though more and more knowledge of the molecular pathways regulating energy balance are beginning to be available still the causes of obesity remain elusive. The pathophysiology of obesity seems simple: a chronic excess of nutrient intake relative to the level of energy expenditure. So obesity can result from increased energy intake, decreased energy expenditure or a combination of the two. However, due to the complexity of the neuroendocrine and metabolic systems that regulate energy intake, storage, and expenditure, it has been difficult to quantitate all the relevant parameters (e.g., food intake and energy expenditure) over time in human subjects.30

Etiology of obesity is influenced by several factors like genetic, environmental, cultural, neuroendocrine and metabolic factors. Genetic Factors leads to prevalence of obesity commonly seen in families. Inheritance is usually not Mendelian. It is difficult to distinguish the role of genes and environmental factors. Adoptees usually resemble their biologic rather than adoptive parents with respect to obesity, providing strong support for genetic influences. Genetic effects appear to relate to both energy intake and expenditure. Environmental Factors play a key role in obesity. As evidenced by the fact that famine prevents obesity even in the most obesity-prone individual. Cultural factors relate to both availability and composition of the diet and to changes in the level of physical activity in a community. Wealthier people including women, children are more often obese. Obesity correlates to socio economic status, time spent watching television, sedentary life style, fast foods and traditional diets which are rich in fats & simple carbohydrates content. Because of different life styles and affluence, urban India is getting fatter as compared to the rural India.

There is increased interest in the concept of a body weight “set point” a physiologic sensing system in adipose tissue that reflects fat stores and a receptor or “adipostat,” in the hypothalamic centers. When fat stores are depleted, the adipostat signal is low and hypothalamus responds by stimulating hunger and decreasing energy expenditure to conserve energy and vice versa. The recent discovery of the ‘ob’ gene and its product leptin provides a molecular basis for this physiologic concept. Adipocyte-derived hormone leptin, is a major regulator of these adaptive responses, which acts through brain circuits (predominantly in the hypothalamus) to influence appetite, energy expenditure, and neuroendocrine function. Appetite is influenced by many factors that are integrated by the brain, most importantly within the hypothalamus.30 Signals that impinge on the hypothalamic center include neural afferents, hormones, and metabolites. Vagal inputs bringing information from viscera. Hormonal signals include leptin, insulin, cortisol, gut peptides including ghrelin, peptide YY (PYY) and cholecystokinin. These diverse hormonal, metabolic, and neural signals act by influencing the expression and release of various hypothalamic peptides that are integrated with serotonergic, catecholaminergic, endocannabinoid, and opioid signaling pathways. Psychological and cultural factors also play a role in the final expression of appetite. Energy expenditure includes the following components: (1) resting or basal metabolic
Is India really getting fatter—Urban Rural Divide? How to Manage Obesity?

rate; (2) the energy cost of metabolizing and storing food; (3) the thermic effect of exercise; and (4) adaptive thermogenesis, which varies in response to chronic caloric intake (rising with increased intake). Basal metabolic rate accounts for ~70% of daily energy expenditure, whereas active physical activity contributes 5–10%. Thus, a significant component of daily energy consumption is fixed. The average total daily energy expenditure is higher in obese than lean individuals when measured at stable weight. However, energy expenditure falls as weight is lost, due in part to loss of lean body mass and to decreased sympathetic nerve activity. The physiologic basis for variable rates of energy expenditure (at a given body weight and level of energy intake) is essentially unknown.

One newly described component of thermogenesis, called non exercise activity thermogenesis (NEAT), and has been linked to obesity. It is the thermogenesis that accompanies physical activities other than volitional exercise, such as the activities of daily living, fidgeting, spontaneous muscle contraction, and maintaining posture. NEAT accounts for about two-thirds of the increased daily energy expenditure induced by overfeeding. The wide variation in fat storage seen in overfed individuals is predicted by the degree to which NEAT is induced. The molecular basis for NEAT and its regulation is unknown.

CAUSES OF OBESITY EPIDEMIC IN INDIA:

Along with other factors which play an important part in pathophysiology of obesity, obesity epidemic in India has its roots in urbanization, industrialization and drastic change in the life style especially urban and rich who in recent years have urbanized to western levels. Unhealthy processed food has become much more accessible following India’s continued integration in global food markets. Indians are genetically susceptible to weight accumulation especially around the waist.

The important components of lifestyle changes are:

- Unhealthy eating patterns, wrong choices of food: Traditional micronutrient rich foods are being replaced by energy dense highly processed micronutrient poor foods with greatly increased portions ‘Dil Mange More’. High calorie snacks, junk food revolution, cool cola (‘thanda matlab’) colonization, and food as rewards or demonstration of love are all part of new obesogenic lifestyles. As against food as rewards, ironically exercise is meted out as a punishment - ‘100 sit ups,’ ‘run round the field.’

Secondary causes of obesity: relate to diseases like Cushing’s syndrome, Hypothyroidism, Insulinoma Cranioopharyngioma and Other Disorders Involving the Hypothalamus and male hypogonadism,

HOW TO MANAGE OBESITY

The prevalence of obesity is increasing rapidly throughout most of the developed and the developing world. Children and adolescents are also becoming more obese, indicating that the current trends will accelerate over time. Obesity is an independent risk factor for increased mortality and is associated with an increased risk of multiple health problems, including hypertension, type 2 diabetes, dyslipidemia, degenerative joint disease, and some malignancies. Thus, it is important for physicians to routinely identify, evaluate, and treat patients for obesity and associated comorbid conditions.

Treatment of an overweight or obese person incorporates a two step process: assessment and management. Assessment includes determination of the degree of obesity and overall health status. Management involves not only weight loss and maintenance of body weight but also measures to control other risk factors. Obesity is a chronic disease; patient and practitioner must understand that successful treatment requires a lifelong effort.

The U.S. Preventive Services Task Force recommends that physicians screen all adult patients for obesity and offer intensive counseling and behavioral interventions to promote sustained weight loss. Following five main steps mentioned below provide important solutions to challenges faced in management of obesity:

1. The Obesity Focused History: Questions directed towards weight history, dietary habits, physical activities, and medications may provide useful information about the origins of obesity in particular patients. History of the patient provides most important disease related information which helps clinician to device management strategies. Obesity focused history should include questions like: What factors contribute to the patient’s obesity? How is the obesity affecting the patient’s health? What factors lead the patient to seek weight loss now? What is the obesity level of risk from obesity? What
are the patient's goals and expectations? Is the patient motivated to begin a weight management program? What kind of help does the patient need? History can very useful to suspect the cause of obesity whether behavioral causes that affect diet and physical activity patterns or secondary causes like polycystic ovarian syndrome, hypothyroidism, Cushing's syndrome, and hypothalamic disease. Drug-induced weight gain by antidiabetes agents (insulin, sulfonylureas, thiazolidinediones); steroid hormones; psychotropic agents; mood stabilizers (lithium); antidepressants (tricyclics, monoamine oxidase inhibitors, paroxetine, mirtazapine); and antiepileptic drugs (valproate, gabapentin, carbamazepine) can be detected by a thorough history best obtained by using a questionnaire in combination with an interview.

2. Physical Examination to Determine the Degree and Type of Obesity: Three key anthropometric measurements are important to evaluate the degree of obesity—weight, height, and waist circumference. The BMI is used to classify weight status and risk of disease. (Table 4)

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Obesity Class</th>
<th>Disease Risk* (Relative to Normal Weight and Waist Circumference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men &lt;40 in (≤102 cm)</td>
<td>Women &lt;35 in (≤88 cm)</td>
<td></td>
</tr>
<tr>
<td>&gt; 40 in (&gt; 102 cm)</td>
<td>&gt; 35 in (&gt; 88 cm)</td>
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<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
<td>Healthy weight# 18.5–24.9</td>
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<tr>
<td>Healthy weight#</td>
<td>18.5–24.9</td>
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<tr>
<td>Overweight</td>
<td>25.0–29.9</td>
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<td>Obesity</td>
<td>30.0–34.9 I High</td>
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<td>Obesity</td>
<td>35.0–39.9 II Very high</td>
<td></td>
</tr>
<tr>
<td>Extreme Obesity</td>
<td>≥40 III Extremely high</td>
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</table>

* Disease risk for type 2 diabetes, hypertension, and CVD.
# Increased waist circumference can also be a marker for increased risk even in persons of normal weight.

3. Obesity Associated Comorbid Conditions: The evaluation of comorbid conditions should be based on presentation of symptoms, risk factors, and index of suspicion. All patients should have blood pressure, fasting lipid panel and blood glucose measured at presentation. Patients at very high absolute risk include: established coronary heart disease; presence of other atherosclerotic diseases such as peripheral arterial disease, abdominal aortic aneurysm, and symptomatic carotid artery disease; type 2 diabetes and sleep apnea.

4. Physical Fitness: It is very important to take exercise history because several prospective studies have demonstrated that physical fitness, reported by the patient or measured by a maximal treadmill exercise test, is an important predictor of all-cause mortality independent of BMI and body composition. So physical activity as a treatment approach should also be strongly emphasized.

5. Assessing the Patient's Readiness to Change: Assessment includes patient motivation and support, stressful life events, psychiatric status, time availability and constraints, and appropriateness of goals and expectations. Readiness can be viewed as the balance of two opposing forces: (1) motivation, or the patient’s desire to change; and (2) resistance, or the patient’s resistance to change. An attempt to initiate lifestyle changes when the patient is not ready usually leads to frustration and may hamper future weight-loss efforts.

TREATMENT

The primary goal of treatment is to improve obesity-related comorbid conditions and reduce the risk of developing future comorbidities. The decision of how aggressively to treat the patient, and which modalities to use, is determined by the patient’s history, physical examination, investigations, risk status, expectations, and available resources. Therapy for obesity always begins with lifestyle management and may include pharmacotherapy or
surgery, depending on BMI risk category. (Table: 5) Setting an initial weight-loss goal of 10% over 6 months is a realistic target.

National Institutes of Health guidelines suggest that nonpharmacological therapies should be attempted for 6 months and drugs should be considered if weight loss is unsatisfactory that is less than 0.45 kg/month. Drugs should be initiated with the expectation that long-term use will most likely be needed. Behavioral treatment combined with drug therapy may result in better outcome than drug treatment alone. It is better to maintain a moderate weight loss over a prolonged period than to regain weight from a marked weight loss. The latter is counterproductive in terms of time, cost, and self-esteem.

Effective weight control involves multiple techniques and strategies including dietary therapy, physical activity, behavior therapy, pharmacotherapy, and surgery as well as combinations of these strategies. Relevant treatment strategies can also be used to foster long-term weight control and prevention of weight gain.

LIFE STYLE MANAGEMENT

Three essential elements of lifestyle are: dietary habits, physical activity, and behavior modification. Life style modifications are essential part of obesity management and all patients must learn how and when energy is consumed (diet), how and when energy is expended (physical activity), and how to incorporate this information into their daily life (behavior therapy).

Dietary Therapy: Overall reduced caloric intake is the cornerstone of obesity treatment. A deficit of 7500 kcal will produce a weight loss of approximately 1 kg. The rate of weight loss on a given caloric intake is related to the rate of energy expenditure. With chronic caloric restriction, metabolic rate diminishes and slows the rate of weight loss on a constant diet. The NHLBI guidelines recommend initiating treatment with a calorie deficit of 500–1000 kcal/d compared to the patient’s habitual diet is consistent with losing approximately 1–2 lb per week. It is important that the dietary counseling remains patient-centered and that the goals are practical, realistic and achievable. The macronutrient composition of the diet will vary depending on the patient’s preference and medical condition, but should include a diet rich in whole grains, fruits, vegetables, and dietary fiber consisting 45–65% of calories from carbohydrates, 20–35% from fat, and 10–35% from protein. Daily fiber intake of 38 g (men) and 25 g (women) for persons over 50 years of age and 30 g (men) and 21 g (women) for those under 50 is recommended.

No medical condition has generated as many dietary remedies as obesity. All diets have their followers, but hard data on the efficacy of the diets are scarce. A current area of controversy is the use of low-carbohydrate, high-protein diets for weight loss. Most low-carbohydrate diets (e.g., South Beach, Zone, and Sugar Busters!) recommend a carbohydrate level of approximately 40–46% of energy. The Atkins diet contains 5–15% carbohydrate, depending on the phase of the diet. Meta-analysis of trials found Low-carbohydrate, non-energy-restricted diets appear to be at least as effective as low-fat, energy-restricted diets in inducing weight loss for up to 1 year. Several randomized, controlled trials of these low-carbohydrate diets have demonstrated greater weight loss at 6 months with improvement in coronary heart disease risk factors, including an increase in HDL cholesterol and a decrease in triglyceride levels.

Another dietary approach is the concept of energy density, which refers to the number of calories (energy) a food contains per unit of weight. Adding water or fiber to a food decreases its energy density by increasing weight without affecting caloric content. Examples of foods with low-energy density include soups, fruits, vegetables, oatmeal, and lean meats. Diets containing low-energy dense foods have been shown to control hunger and result in decreased caloric intake and weight loss.

Alcohol consumption provides unneeded calories and displaces more nutritious foods so it not only increases the number of calories in a diet but has been associated with obesity in epidemiologic studies as well as in experimental studies. The impact of alcohol calories on a person’s overall caloric intake needs to be assessed and appropriately controlled.

Occasionally, very-low-calorie diets (VLCDs) are prescribed as a form of aggressive dietary therapy to promote a rapid and significant (13–23 kg) short-term weight loss over a 3–6 month period. These proprietary formulas typically supply 800 kcal, 50–80 g protein, and 100% of the recommended daily intake for vitamins and minerals. Indications include well-motivated individuals who are moderately to severely obese (BMI >30), have failed at more conservative approaches to weight loss, and have a medical condition like poorly controlled type 2 diabetes, hypertriglyceridemia, obstructive sleep apnea, and symptomatic peripheral edema that would be immediately improved with rapid weight loss. Contraindications include pregnancy, cancer, recent myocardial infarction, cerebrovascular disease, hepatic disease, or untreated psychiatric disease. Side effects are fatigue, constipation or diarrhea, dry skin, hair loss, menstrual irregularities, orthostatic dizziness and difficulty in concentrating. Because of the need for close metabolic monitoring, these diets are usually prescribed by physicians specializing in obesity care. There is no scientific evidence to validate the utility of specific “fad diets.” The main stress should be on: Restriction, Moderation and Selection of food.

Physical Activity Therapy: An increase in physical activity is an important component of weight loss therapy. Although it will not lead to a substantially greater weight loss than diet alone over 6 months. Exercise is an important component of the overall approach to treating obesity. Increased energy expenditure is the most obvious mechanism of exercise.

The impact of an exercise regimen as a sole therapy of obesity has been difficult to document but the combination of dietary modification and exercise is the most effective behavioral approach for the treatment of obesity. A meta-analysis of randomized controlled trials by the international Cochrane Collaboration found that “exercise combined with diet resulted in a greater
weight reduction than diet alone”. The most important role of exercise appears to be in the maintenance of the weight loss. Recommendation is 30 min of moderate intensity physical activity on most and preferably all days of the week. Examples include walking, using the stairs, doing home and yard work, and engaging in sport activities. A regimen of daily walking is an attractive form of physical activity. The patient can start by walking 10 minutes, 3 days a week, and can build to 30 to 45 minutes of more intense walking at least 3 days a week and increase to most, if not all, days. The American College of Sports Medicine recommends that overweight and obese individuals progressively increase to a minimum of 150 min of moderate intensity physical activity per week as a first goal. However, for long-term weight loss, a higher level of exercise (e.g., 200–300 min or 2000 kcal per week) is needed. Other advantages of exercise include increases fitness, increases insulin sensitivity, decreases blood pressure, lipids, and calcium loss along with improving mental and physical wellbeing. 

Behavioral Therapy: The principles of behavior modification provide the underpinnings for many current programs of weight reduction used to help change and reinforce new dietary and physical activity behaviors. Behavior therapy provides methods for overcoming barriers to compliance with dietary therapy and/or increased physical activity. Typically, the patient is requested to monitor and record the circumstances related to eating and rewards are designed to modify maladaptive behaviors. Patients may benefit from counseling offered in a stable group setting for extended periods of time including after weight loss. Behavioral treatments help obese persons to develop adaptive thinking, eating, and exercise habits that enable them to decrease their weight and avoid regaining weight. When recommending any behavioral lifestyle change, have the patient identify what, when, where, and how the behavioral change will be performed. The practitioner must assess the patient’s motivation to enter weight loss therapy and the patient’s readiness to implement the plan, and then take appropriate steps to motivate the patient for treatment. Because these techniques are time-consuming to implement, they are often provided by ancillary office staff such as a nurse clinician or registered dietitian. The importance of individualizing behavioral strategies to the needs of the patient must be emphasized for behavior therapy, as it was for diet and exercise strategies.

**DRUG THERAPY**

A majority of patients who lose weight regain it. So the challenge to the patient and the practitioner is to maintain weight loss. Because of the tendency to regain weight after weight loss, the use of long-term medication to aid in the treatment of obesity may be indicated for carefully selected patients. Drug therapy is used only as part of a program that includes diet, physical activity, and behavior therapy in carefully selected patients with a BMI ≥ 30 or ≥ 27 with other risk factors or diseases.

When prescribing an antiobesity medication, patients should be actively engaged in a lifestyle program that provides the strategies and skills needed to effectively use the drug since this support increases total weight loss. Not every patient responds to drug therapy. Trials have shown that initial responders tend to continue to respond, whereas initial nonresponders are less likely to respond, even with an increase in dosage.

There are several potential targets of pharmacologic therapy for obesity. The most thoroughly explored treatment is suppression of appetite. A second strategy is to reduce the absorption of selective macronutrients from the gastrointestinal (GI) tract, such as fat. These two mechanisms form the basis for all currently prescribed antiobesity agents. A third target, selective blocking of the endocannabinoid system, has also been identified.

**DRUGS INCLUDE**

- Drugs reducing appetite or increasing satiety (appetite suppressants).
- Drugs decreasing nutrient absorption.
- Drugs Increasing energy expenditure. (includes ephedrine, which is not currently approved as a treatment for obesity in the United States)
- Other investigational compounds

**Appetite-Suppressant Medications:** Appetite-suppressing drugs, or anorexiants, act by increasing satiety and decreasing hunger, help patients reduce caloric intake without a sense of deprivation.

Noradrenergic Agents: Include phentermine, diethylpropion, phendimetrazine, and benzphetamine.

All of the above medications are approved by FDA for use of “a few weeks” only (generally 12 weeks or less). Amphetamines are no longer recommended and approved. Side effects include insomnia, dry mouth, constipation, euphoria, palpitations, and hypertension. The only over-the-counter appetite-suppressant medication approved for the treatment of obesity, phenylpropanolamine, was recently withdrawn from the market because of concern about an association with hemorrhagic stroke in women.

Serotonergic Agents: Fenfluramine and dexfenfluramine were withdrawn from the market in the United States in 1997 because of associations with valvular heart disease and pulmonary hypertension. Some selective serotonin-reuptake inhibitors have induced weight loss in short-term studies. Fluoxetine (60 mg) for 6 months lost more weight than those who received placebo, steady regain occurred during the next 6 months despite the continuation of medication. Sertraline evaluated as an adjunct for weight maintenance after a very-low-calorie diet, showed a similar lack of long-term efficacy.

Mixed Noradrenergic–Serotonergic Agents: Sibutramine is an inhibitor of both norepinephrine reuptake and serotonin reuptake that also weakly inhibits dopamine reuptake. Sibutramine is the only anorexiant that is currently approved by FDA for long-term use. It produces an average loss of about 5–9% of initial body weight at 12 months and has been demonstrated to
maintain weight loss for up to 2 years. Common well tolerated mild adverse effects are headache, dry mouth, insomnia, and constipation. A dose-related increase in blood pressure and heart rate may require discontinuation of the medication so all patients should be monitored closely and evaluated within 1 month after initiating therapy. Contraindications to Sibutramine use include uncontrolled hypertension, congestive heart failure, symptomatic coronary heart disease, arrhythmias, or history of stroke.

**Drugs That Reduce Nutrient Absorption:** The only FDA-approved medication that reduces nutrient absorption is orlistat which was approved for long term use in April 1999 and for over-the-counter use in 2007. Orlistat is a synthetic hydrogenated derivative of a naturally occurring lipase inhibitor, lipostatin, produced by the mold Streptomyces toxytrici. Orlistat is a potent, slowly reversible inhibitor of pancreatic, gastric, and carboxylester lipases and phospholipase A2, which are required for the hydrolysis of dietary fat into fatty acids and monosacylglycerols. The drug acts in the lumen of the stomach and small intestine by forming a covalent bond with the active site of these lipases. Taken at a therapeutic dose of 120 mg tid, orlistat blocks the digestion and absorption of about 30% of dietary fat. Orlistat has no systemic side effects because it is <1% absorbed from the GI tract. GI side effects reported in at least 10% are related to the malabsorption of dietary fat and passage of fat in the feces which include flatus with discharge, fecal urgency, fatty/oily stool, and increased defecation. Psyllium mucilloid is helpful in controlling the orlistat-induced GI side effects when taken concomitantly with the medication. Fat-soluble vitamins supplements are recommended to prevent potential deficiencies.

**The Endocannabinoid System:** Cannabinoid receptors and their endogenous ligands have been implicated in a variety of physiologic functions, including feeding, modulation of pain, behavior, and peripheral lipid metabolism. The first selective cannabinoid CB1 receptor antagonist, rimonabant, was discovered in 1994 and was first selective CB1 receptor blocker to be approved for use anywhere in the world. In Europe, it was indicated for use in conjunction with diet and exercise for patients with a body mass index greater than 30 kg/m², or patients with a BMI greater than 27 kg/m² with associated risk factors, such as type 2 diabetes or dyslipidemia. As of 2008, the drug was available in 56 countries. On October 23, 2008, the European Medicines Agency (EMEA) released a press release stating that its Committee for Medical Products for Human Use (CHMP) had concluded that the benefits of Rimonabant no longer outweighed its risks and subsequently recommended that the product be suspended from the UK market. It has also been withdrawn from Indian market also. Major concern was side effects of severe depression and suicidality.

**Dietary Supplements & Herbal Preparations:** Herbal preparations are not recommended as part of a weight loss program. These preparations have unpredictable amounts of active ingredients and unpredictable, and potentially harmful, effects. Some dietary supplements have mechanisms of action that could lead to weight loss or have shown promising results in small-scale studies in humans or animals but there is insufficient data to provide evidence of either the safety or the efficacy of any of these compounds as agents promoting weight loss. Herbal compounds containing ephedra alkaloids and caffeine are the only types for which there are data from randomized, double-blind, placebo-controlled trials indicating efficacy in promoting weight loss. However, all such studies have been short-term (six months or less). Dietary supplements containing ephedra alkaloids frequently contain a dosage that differs substantially from that indicated on the product label. Case reports concerning ephedra alkaloids have noted serious CVS and CNS events including hypertension, cardiac arrhythmia, stroke, seizure, myocardial infarction and sudden death.

**WEIGHT LOSS SURGERY**

Weight loss surgery is an option for weight reduction in patients with clinically severe obesity, i.e., a BMI ≥40, or a BMI ≥35 with comorbid conditions. Weight loss surgery should be reserved for patients in whom other methods of treatment have failed and who have clinically severe obesity. Bariatric surgery has continually evolved since its initial sporadic and tentative introduction in the 1950s. The first Bariatric procedure to be preceded by animal studies and subsequently presented to a recognized surgical society and published in a peer reviewed journal was that of Kremen and associates in 1954. (Kremen, Linner et al. 1954)

**Bariatricsurgical procedures** reduce caloric intake by modifying the anatomy of the gastrointestinal tract. These operations are classified as either restrictive or malabsorptive. Restrictive procedures limit intake by creating a small gastric reservoir with a narrow outlet to delay emptying. Malabsorptive procedures bypass varying portions of the small intestine where nutrient absorption occurs.

Restrictive procedures include gastric stapling (gastroplasty), adjustable gastric banding (wrapping a synthetic, inflatable band around the stomach to create a small pouch with a narrow outlet), or a combination of these two approaches. Adjustable gastric banding is a relatively new operation that includes the insertion of a subcutaneous reservoir so that gastric restriction can be adjusted by means of saline injections. The procedure can be performed laparoscopically, and the band can be removed in an outpatient setting without anesthesia. Another recently developed procedure is the vertical restrictive (sleeve) gastrectomy in which resection of much of the gastric body leaves a narrow tube of stomach as an alimentary conduit.

Although no recent randomized controlled trials compare weight loss after surgical and nonsurgical interventions, data from meta-analyses and large databases, primarily obtained from observational studies, suggest that bariatric surgery is the most effective weight-loss therapy for those with clinically severe obesity. These procedures generally produce a 30–35%
average total body weight loss that is maintained in nearly 60% of patients at 5 years. In general, mean weight loss is greater after the combined restrictive-malabsorptive procedures compared to the restrictive procedures. An abundance of data supports the positive impact of bariatric surgery on obesity-related morbid conditions, including diabetes mellitus, hypertension, obstructive sleep apnea, dyslipidemia, and nonalcoholic fatty liver disease.\textsuperscript{24, 25, 30}

Lifelong medical monitoring after surgery is a necessity. Perioperative complications vary with weight and the overall health of the individual. In the published literature, young patients without comorbidities with a BMI < 50 kg/m\textsuperscript{2} who have undergone surgery have mortality rates less than 1 percent, whereas massively obese patients with a BMI > 60 kg/m\textsuperscript{2} who are also diabetic, hypertensive and in cardiopulmonary failure may have mortality rates that range from 2 to 4 percent. Operative complications, including anastomotic leak, subphrenic abscess, splenic injury, pulmonary embolism, wound infection, and stoma stenosis, occur in less than 10 percent of patients.\textsuperscript{26} An integrated program that provides guidance on diet, physical activity, and psychosocial concerns before and after surgery is necessary. Most patients fare remarkably well with reversal of diabetes, control of hypertension, marked improvement in mobility, return of fertility, cure of pseudotumor cerebri, and significant improvement in quality of life. Late complications are uncommon, but some patients may develop incisional hernias, gallstones, and, less commonly, weight loss failure and dumping syndrome. Patients who do not follow the instructions to maintain an adequate intake of vitamins and minerals may develop deficiencies of vitamin B12 and iron with anemia. Neurologic symptoms may occur in unusual cases. Thus, surveillance should include monitoring indices of inadequate nutrition. Documentation of improvement in preoperative comorbidities is beneficial and advised.\textsuperscript{27}

CONCLUSION:

This chapter has attempted to look at the nutritional transition that is occurring in India to answer all important question: Is India really getting fatter – the urban/rural divide? The demographic and epidemiological transition, the forces of rapid urbanization and industrialization, the changes in food consumption and physical activity patterns that in turn are contributing to increasing sedentarianism, definitely answers the question. Yes India is getting fatter facing an epidemic of obesity and of other NCDs. Today India is confronted with a grave and great nutritional puzzle because on one hand India’s rich and urban population is facing an epidemic of obesity, metabolic syndrome, hypertension, cardio vascular diseases and is being projected to be the diabetic capital of the world resulting in increased morbidity and mortality from life style and non communicable diseases and on the other hand India is home to largest number of malnourished population in the world especially the children confronting malnutrition, sanitation related, communicable, water born and poverty diseases. In India there is a tremendous ‘Urban/Rural’ and ‘Rich / Poor’ divide which is further increasing in this era of globalisation resulting in much higher prevalence of obesity in the urban rich than in rural areas and poor communities. India is in the midst of an escalating epidemic of lifestyle disorders associated with adult as well as childhood obesity. The important causes of the epidemic in India appear to be: - unhealthy eating patterns, reduced physical activity, increased sedentary pursuits and possibly ‘constitutional predispositions’; ‘early origins’. Prevention must begin early in the form of a public health campaign directed towards lifestyle changes of the family / society as a whole. The campaign requires strong social and political will. Health professionals must think ‘prevention of obesity’ at all visits, monitor BMI and ensure that ‘nutrition messages’ are not conflicting and confusing.

Standard treatment approaches for overweight and obesity must be tailored to the needs of various patients or patient groups. Large individual variation exists within any social or cultural group; furthermore, substantial overlap occurs among subcultures within the larger society. There is, therefore, no “cookbook” or standardized set of rules to optimize weight reduction with a given type of patient. However, obesity treatment programs that are culturally sensitive and incorporate a patient’s characteristics are most likely to be successful. Treatment of an overweight or obese person incorporates a two-step process: assessment and management. Obesity is a chronic disease; patient and practitioner must understand that successful treatment requires a lifelong effort. Therapy for obesity always begins with lifestyle management and may include pharmacotherapy or surgery; depending on BMI risk category Effective weight control involves multiple techniques and strategies including dietary therapy, physical activity, behavior therapy, pharmacotherapy, and surgery as well as combinations of these strategies. Relevant treatment strategies can also be used to foster long-term weight control and prevention of weight gain.

Obesity affects almost every aspect of life and medical practice. The rise in obesity and its complications threatens to bankrupt the healthcare system. Early treatment and prevention offer multiple long term health benefits, and they are the only way towards a sustainable health service. Doctors in all medical and surgical specialties can contribute to manage the great Indian nutritional puzzle of epidemic of obesity on one hand and grave danger from undernutrition on the other.

ACKNOWLEDGEMENT

We must appreciate the hard work done by Varun Gupta (2nd Prof. MBBS Student, Adesh Medical College and Research Institute, Bhatinda) in helping us with typing, editing and reviewing the literature in an effort to present evidence based medical facts and quality information in the chapter ‘Is India really getting fatter-Urban Rural Divide? How to Manage Obesity?’

REFERENCES

2. IAP National Task Force for Childhood Prevention of Adult Diseases: The Effect of Childhood Physical Activity on Prevention of Adult Diseases, INDIAN PEDIATRICS, VOLUME 41, JANUARY 17, 2004; 37-62
Is India really getting fatter- Urban Rural Divide? How to Manage Obesity?


5. National Family Health Survey (NFHS-3), 2005–06: India


13. National Family Health Survey (NFHS-2), 1998-99 India


31. IAP National Task Force for Childhood Prevention of Adult Diseases: Childhood Obesity Indian Pediatrics 2004; 41:559-575


