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RESEARCH ARTICLE

DUAL BURDEN OF MALNUTRITION

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ABSTRACT

Malnutrition is the manifestation of the inadequate or improper nutrition. The co-existence of under and over nutrition within the population is termed as dual burden of malnutrition. The emergence of the dual burden is a result of the nutrition transition along with epidemiological transition is underway in the populations. This phenomenon is not limited to upper-income developing countries, but is occurring across the globe in countries with very different cultures and dietary customs. Stuffed and starved both the extremes are responsible for dual burden paradox of under nutrition and obesity. Under nutrition and over nutrition co-exist in developing countries undergoing rapid nutrition transition, and women are susceptible to this double burden of "dysnutrition" often cumulating stunting or micronutrient malnutrition with obesity or other nutrition-related chronic diseases. Improving women's resources, including health, nutrition, education, and decisional power, is critical for equity and for the health of children and adults of future generations, since poor fetal and infancy nutrition is another risk factor for chronic diseases, in particular abdominal obesity, type 2 diabetes, hypertension, and cardiovascular disease. Addressing malnutrition and nutrition-related chronic diseases simultaneously is a challenge facing developing countries, and examples of promising initiatives are provided. Focusing on women along the lifecycle, according to the continuum of care approach, is essential to achieving the Millennium Development Goals and to breaking the intergenerational cycle of poverty, malnutrition, and ill-health.

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INTRODUCTION

"Malnutrition" is the manifestation of the inadequate or improper nutrition. The co-existence of under and over nutrition within the house hold and the population is termed as dual burden of malnutrition. The emergence of the dual burden is a result of the nutrition transition, epidemiological transition, economic transition urbanization, demographic shifts, sedentary lifestyles underway in the populations (Doak, 2005). The phenomenon is not limited to upper-income developing countries, but is occurring across the globe in countries with very different cultures and dietary customs. Stuffed and starved both the extremes are responsible for dual burden paradox of the under nutrition and obesity (Parasher, 2011). Malnutrition is the condition that results from taking an unbalanced diet in which certain nutrients are lacking, in excess (too high an intake), or in the wrong proportions. A number of different nutrition disorders may arise, depending on which nutrients are under or overabundant in the diet.

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In most of the world, malnutrition is present in the form of under nutrition, which is caused by a diet lacking adequate calories and protein. A transition in the socio-economic, demographic, nutritional and health platforms is going on rapidly. Although India has not yet overcome the problems of poverty, under nutrition and communicable diseases, it is increasingly facing additional challenges related to the affluence that results from industrialization, urbanization and economic betterment. Over the last two decades, over nutrition and obesity have emerged as public health problems; there have been increases in the prevalence of diabetes and cardiovascular disease (CVD), especially in urban areas. The magnitude of these problems varies among states and socio-economic status between urban and rural areas, and it is a matter of concern that these disease occurs a decade earlier in India than elsewhere and that they affect poor segment of the population and those in rural areas. Case fatality rates are reported to be higher in poor and rural populations, probably because of poor access to health care and consequent delayed diagnosis and treatment. The impact of ongoing nutrition transition, socio-economic fluctuations, demographic and epidemiological changes and prevalent life styles can be observed as the paradox in the nutritional and the health status

of the population. Adults in India suffer from a dual burden of malnutrition (abnormal thinness and Overweight or obesity). Almost half of Indian women age 15-49 (48 percent) and 43percent of Indian men age 15-49 have one of these two nutritional problems. Although the percentage of women and men who are overweight or obese is not nearly as high as it is in many developed countries, this is an emerging problem in India that especially affects women and men in urban areas, those with higher educational attainment, and those living in households in the highest wealth quintile. Malnutrition is defined as a "pathological state resulting from absolute or relative deficiency or excess of one or more of the essential nutrients". It may be "Primary" malnutrition associated with lack of primary health care and other social/environmental factors and "Secondary malnutrition due to presence of some underlying diseases. It is one of the leading causes of morbidity and mortality in children globally. Malnutrition categorized into three state on basis of weight.

- Weight for age 70-80% = first degree malnutrition
- Weight for age 60-69% = second degree malnutrition
- Weight for age below 60% = third degree malnutrition

UNDERNUTRITION

Cause and prevalence

The term "malnutrition" refers to under-nutrition, which includes stunting, wasting, and deficiencies of essential vitamins and minerals (micronutrients) (Lancet 2008). Under-nutrition is the underlying cause of 3.5 million preventable maternal and child deaths each year. It is also responsible for 35 per cent of the disease burden in children under the age of five (Ibid). Globally, an estimated 200 million children under the age of five are chronically under normal height for their age (stunting) and another 26 million suffer from being severely underweight (wasting). (UNICEF, 2009). Inadequate feeding practices for children make it difficult to achieve the needed improvements in children's nutritional status, and nutrition programmes have been unable to make much headway in dealing with these serious nutritional problems.
The percentage of children under age five years who are underweight is almost 20 times as high in India as would be expected in a healthy, well-nourished population and is almost twice as high as the average percentage of underweight children in sub-Saharan African countries. Young children in India suffer from some of the highest levels of stunting, underweight, and wasting observed in any country in the world, and 7 out of every 10 young children are anemic. Although poverty is an important factor in the poor nutrition situation, nutritional deficiencies are widespread even in households that are economically well off.

Demographic transition

Demographic transition is a global phenomenon. Technological advances and improved quality and coverage of health care have resulted in a rapid fall in India's crude death rate, from 25.1 per 10 000 population in 1951 to 9.8 in 1991. The reduction in crude birth rate has been less steep, falling from 40.8 per thousand in 1951 to 29.5 in 1991 (RGI, 1951 to 2001). As a result, the annual exponential population growth rate was more than 2 percent from 1971 to 1991. The census of 2001 confirmed that the pace of demographic transition in India has been steady, albeit slow, and that India has joined China in having a population of more than 1 billion. The population is projected to increase from 934 million in 1996 to 1264 million in 2016. Between 1996 to 2001 and 2011 to 2016 there will be declines of:

- crude birth rate, from 24.10 to 21.41;
- crude death rate, from 8.99 to 7.48;
- natural growth rate, from 1.51 to 1.39 percent;
- Infant mortality rate, from 63 to 38 per 1 000 live births for males; and from 64 to 39 for females.

Health transition

Over the last five decades, there have been steady but slow reductions in the rates of births, deaths, infant mortality and under-five mortality (RGI, 1971 to 2000). India still has high infant, perinatal and neonatal mortality but there has been a steady reduction in the death rate and an improvement in longevity.

Consumption pattern:

Nutritionists view agriculture as an input for dietary intake, while farmers look for returns on their investments. The green revolution showed that food grain production can be increased fourfold when farmers are assured of returns on investment. However pulse and coarse grain production has stagnated (Ministry of Agriculture, 2002a).

Cereals and pulses

Over the last five decades, the per capita net availability of cereals has been improving, and by 1991 it was sufficient to meet the recommended dietary allowance (RDA). However, per capita pulse availability and consumption have declined. Pulses are a major source of protein among poorer segments of the population, so this trend must be reversed (Ministry of Agriculture**).**

Consequences due to under nutrition

Mean energy consumption as a percentage of RDA is lowest among preschool children. Time trends in the intra-family distribution of food indicate that although the proportion of families in which both adults and preschool children have adequate food has remained at about 30 percent over the last 20 years, the proportion of families with inadequate intake has decreased substantially. However, the proportion of families in which preschool children receive inadequate and adults adequate intakes has nearly doubled, even though the RDA for preschool children forms only a very small proportion (an average of 1 330 kcal/day) of the family's total intake of about 11 000 kcal/day (assuming a family size of five). It therefore appears that poor young child feeding and care practices and not poverty is the factor responsible for inadequate dietary intake. The Tenth Five-Year Plan (Planning Commission,

2002) emphasizes the importance of health and nutrition education to ensure proper intra-family distribution of food, based on needs. Indian children are short compared with the National Center for Health Statistics (NCHS) norms; even when they have appropriate weight for height they are classified as undernourished according to these norms. The so-called South Asian paradox (high under nutrition rates but comparatively good health status) disappears when the body mass index (BMI)-for-age is the criterion for defining under nutrition. Early detection and correction are needed if wasting is to be reduced so that Indian children can achieve their growth potential. There are considerable interstate differences in the dietary intake and nutritional status of children. Although dietary intake is a major determinant of nutritional status in children, it is not the only one. Energy intake is low and under nutrition high in Uttar Pradesh, Bihar and Rajasthan. However, in spite of low energy intakes, the prevalence of under nutrition in Kerala and Tamil Nadu is low, probably because there is more equitable intra-family distribution of food based on needs, and better access to health care. The combination of high energy intakes and high under nutrition prevalence in Madhya Pradesh and Orissa is probably due to inequitable food distribution and poor access to health care. Poor dietary intake, poor care practices and poor access to health care are some of the major factors responsible for under nutrition and a high under-five mortality rate (U5MR). In most of the states where under nutrition is high (e.g., Orissa), U5MR is also high; in states where under nutrition is low (e.g., Kerala), U5MR is also low. There are exceptions to this, however; in Maharashtra U5MR is relatively low, in spite of relatively high under nutrition rates - this might be because access to health care is relatively good. In Punjab, in spite of high per capita income and dietary intake and good access to health care, both under nutrition and U5MR are relatively high. The heights and weights of adolescent girls and boys from affluent income groups are comparable to NCHS norm, and higher than those of adolescents surveyed by NNMB. NFI data on height and weight distribution (compared with NCHS norms) in Delhi schoolchildren from affluent families. Even in these affluent segments of the population, some children are stunted (-2 SD height for age). There are overweight children in all classes and age groups. Among children over ten years of age there is a reduction in overweight because children of this age try to lose weight through exercise or skipping meals (NFI, 2004). However, the adolescents have inconsistent eating and exercise habits and tend therefore to have cyclical weight gain and loss, thereby incurring the health hazards associated with this pattern.

The prevalence of under nutrition in adults is higher in rural than urban areas. Over nutrition is higher in urban areas. Over the last three decades there has been a progressive decline in under nutrition and some increase in over nutrition in both urban and rural areas. The prevalence rates of both under- and over nutrition are higher in women than men. The prevalence of under nutrition among women in urban areas is half that of rural areas. Over nutrition is four times higher in urban than in rural areas. In women, as age increases, the prevalence of under nutrition declines while that of over nutrition increases although under nutrition continues to be high among women in poorer segments of the population, over nutrition and obesity are emerging as major problems in all states of India. There are substantial differences in the prevalence of under- and over nutrition among states, but all states have to prepare to detect and manage this dual nutrition problem in women.
Over the past three decades there have been:

- a very small (2 to 4 cm) increase in adult height;
- a significant increase in mean body weights, mostly owing to increased body fat as shown by increased fat fold thickness, which is greater in urban than rural areas.

In the absence of increased energy consumption, increased fat deposition is attributed to reduced physical activity. Very few studies have documented changes in physical activity patterns over the last three decades, but it is documented that over this period there have been:

- Reduction in the number of people engaged in manual work.
- Substantial improvement of mechanical aids in agriculture, industry and allied activities.
- Improved access to water and fuel near households, in both urban and rural areas.
- Improved availability of urban transport at affordable costs, resulting in fewer people walking or cycling to work, school or market.
- More mechanical aids that reduce physical activity during cooking and household tasks.
- TVs and computers in affluent urban households, which contribute to steep reductions in physical activity.

These lifestyle changes have led to reductions in energy requirements. Unchanged energy intakes combined with reduced energy requirements are associated with a positive energy balance and fat deposition.

OVERNUTRITION

Cause and prevalence

- Over nutrition is defined as the overconsumption of nutrients and food to the point at which health is adversely affected.
- Over nutrition can develop into obesity, which increases the risk of serious health conditions, including cardiovascular disease, hypertension, cancer, and type-2 diabetes.
- Problems of over nutrition are increasing even in countries where hunger is prevalent. WHO report of poverty in a growing number of nations, including Brazil and Mexico.

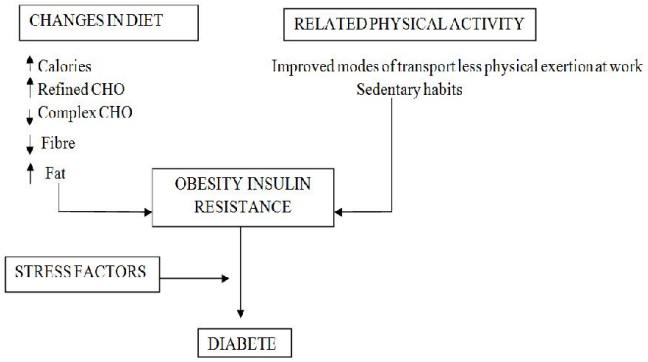
At the same time, increasing urbanization and changing dietary patterns and lifestyles are contributing to a rapid rise in overweight and diet-related chronic diseases. Large increases in intakes of fish, meat and poultry (except in rural India) increasing intakes of sugars and sweets increasing intakes of fruits and vegetables.

Prevalence of non-communicable diseases: Soon after independence, India established systems for assessing per

capita income, purchasing power, poverty, under nutrition and micronutrient deficiencies. Data from these surveys were used to assess interstate differences and time trends. A similar system for tracking over nutrition and the risk of non-communicable diseases (NCDs) was not established until the 1990s, and even now the coverage of this is not as extensive as that of other surveys. In view of this, for documenting time trends in prevalence of NCDs related to over nutrition, India has to depend on research studies carried out in different parts of the country. The differences in methodology of data collection, criteria used for case definition and parameters reported make it difficult to make comparisons among studies and to draw conclusions regarding time trends. However, from the existing data, it is clear that there has been an increase in prevalence rates of diabetes, hypertension and CVD over the last two decades, especially in affluent urban segments of the population. Prevalence of these diseases is lower in poorer segments and in rural areas, but case fatality rates may be higher in these areas because of poor access to health care.

Diabetes and impaired glucose tolerance

Community-based studies on prevalence of diabetes in urban and rural areas have been conducted in all regions of the country. There has been progressive increase in prevalence of diabetes in both urban and rural areas over the last three decades. Data from the Chennai on time trends in prevalence of diabetes and impaired glucose tolerance (IGT) in urban and rural urban populations, both have increased at escalating rates in urban and rural areas (Ramachandran, 2005). Potential factors associated with the higher prevalence of diabetes in urban areas. Diabetes Epidemiology Study group initiated a multicentre community-based study using the stratified random sampling method to assess the prevalence of diabetes and IGT in Bangalore, Chennai, Mumbai, Delhi, Kolkata and Hyderabad. The oral glucose tolerance test was carried out on 11 216 people (5 288 men and 5 928 women) aged 20 years and over in a representative sample drawn from all socio-economic strata. Information on socio-economic status, physical activity and anthropometric data were collected (National Urban Diabetes Survey, 2001). Diabetes is not usually listed as a predisposing cause of death in death certificates in India; data from hospital-based studies suggest that major causes of death in patients with diabetes are infections, renal failure, IHD and stroke. Summary results of ICMR's estimates of the disease burden of diabetes in 2000 and 2015 the number of cases increased from 58.35 million in 2000 to 66.58 million in 2015 (37.73 million in urban and 28.85 million in rural areas).



By 2015, diabetes accounted for 100 000 deaths a year, and is responsible for 1.15 million years of life lost (YLLs) to disease and 2.26 million disability-adjusted life years (DALYs) (ICMR, 2015).

Factors responsible for the emerging problem of over nutrition

On this study food and nutrient intake indicate that over the last three decades there has not been any significant change in the energy intake of the Indian population, except in affluent families, especially in urban areas; even in this segment; however, most of the increase in consumption of energy-dense fast foods is among adolescents and youth. It is therefore obvious that increase in dietary intakes of fats, oils and sugar is not a major factor in over nutrition in India. Over this period, there has been a progressive reduction in physical activity in all segments of population. Reduction in energy expenditure and unchanged dietary intake results in a positive energy balance, and could be a major factor responsible for the rising prevalence of over nutrition in adults in India.

Recommendation to Overcome Dual Burden of Malnutrition

- From household food security and freedom from hunger to nutrition security for the family and the individual;
- From untargeted food supplementation to screening of all the people in vulnerable groups, identification of those with various grades of under nutrition and appropriate management;
- From ad hoc unfocused interventions addressing the prevention of over nutrition to the promotion of appropriate lifestyles and dietary intakes for the prevention and management of over nutrition and obesity.

Consequences due to over nutrition

Morbidity	Risk factor	References
Hypertention	Nutrition foundation of India carried out studies exploring relationship between over nutrition and cardiovascular diseases in persons belonging to different income groups working in government Institutions. In this group prevalence of abdominal obesity (higher waist hip ratio) was higher(50.3%) as compare to over nutrition (BMI>25;30.8%).Higher the BMI and WHR the higher were the prevalence of hypertension both in men and women. The prevalence of high blood pressure in normal andoverweight subjects was higher when WHR was higher. Obese subjects of both gender with abdominal adiposity had higher systolic and diastolic blood pressure.	
Stroke	WHO defines stroke as "rapidly developed clinical signs of focal disturbances of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin". The 24-hour threshold in the definition excludes transient ischaemic attacks. Stroke is the acute severe manifestation of cerebrovascular disease, and is one of the leading causes of mortality and morbidity in developed countries. The weighted average of stroke prevalence was 1.54 per thousand. Estimated prevalence of stroke is lower in India than in developed countries. it may increase proportionally with increasing longevity. The prevalence rates, stroke-specific mortality rates, case fatality rates, all-cause mortality rates and age distribution of population (1998) were inputs for a DISMOD analysis of stroke data.	ICMR,2004

SUMMARY AND CONCLUSIONS

There has not been much change in the predominantly cereal-based dietary intake in India over the last three decades, except among affluent segments of the population. In spite of increasing per capita income and reduced poverty, dietary diversity is seen mainly among the affluent. Under nutrition rates remain high; starting before birth, they are aggravated throughout infancy by poor infant feeding practices and perpetuated in childhood by poor intra-family distribution of food and poor access to health care. There has been a substantial reduction in severe under nutrition, most of which is due to improved access to health care. India can achieve substantial improvement in nutritional status through health and nutrition education and improved access to health and nutrition services. Prevention of intrauterine growth retardation through antenatal care, and early detection and correction of under nutrition so that children attain appropriate weight for height are essential to promoting linear growth; they can be achieved through the effective implementation of ongoing intervention programmes utilizing the available infrastructure. Low intakes of vegetables and fruit, poor bioavailability of iron and limited use of iodized salt are responsible for micronutrient deficiencies' being major public health problems even today. Dietary diversification, better coverage under the national anaemia control programme, massive-dose vitamin A administration and universal access to iodized, and later iron and iodine-fortified, salt are some of the interventions that could help the country to achieve rapid reductions in micronutrient deficiencies.

Over the last decade, there has been a progressive increase in over nutrition. Reduced physical activity is the major factor behind this. In affluent urban segments, increased energy intake from fats, refined cereals and sugar, combined with simultaneous reductions in physical activity have contributed to steep increases in over nutrition in all age groups. Nutrition education on healthy dietary patterns containing plenty of fruit and vegetables, maintenance of energy balance through regulation of dietary intake, and increasing energy expenditure through physical activity as part of the daily routine will promote muscle and bone health and prevent the development of adiposity in all age groups. Such information can be passed on to large segments of the urban upper- and middle-income groups through the media (television, Internet) that this segment has access to. Indians appear to have a predisposition for adiposity - especially abdominal - insulin resistance and diabetes, hyper-triglyceridaemia and CVD. This predisposition could be genetic or environmental, and can manifest itself at birth, in childhood, during adolescence and in adult life. It is never too early for Indians to start practising healthy lifestyle and dietary habits. It therefore seems that India could combat the dual nutrition burden through efficient implementation of time-tested, effective and inexpensive interventions to achieve significant reductions in both over- and under nutrition and their adverse health consequences within the next two decades.

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