NFI BULLETIN
Bulletin of the Nutrition Foundation of India
Volume 17 Number 3 July 1996

Diet-related Chronic Diseases In India: Changing Trends

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A disturbing feature of the ongoing developmental transition in India is that while nutritional deficiency diseases related to poverty and undernutrition are steadily declining, chronic diseases of adults, in the causation of which dietary factors are now known to play a part, are rapidly expanding! It would thus seem that what we may gain on the swing may be more than lost on the roundabout as far as our public health is concerned.

Since the ongoing developmental process cannot be halted, the challenge is to identify and address those deleterious attributes of the process (such as, dietary excesses and errors, changes in lifestyle and environmental degradation) which may be contributing to the escalation of chronic diseases, especially among the growing urban middle-class. In order that we respond to this challenge, there must be, in the first place, an awareness of the growing dimensions of the problem. Unfortunately, available data are inadequate and often incomplete. Despite this limitation, an attempt is made here to highlight changing trends with respect to these diseases, as revealed by a few well-controlled small-scale studies, in order to stimulate further studies.

Degenerative diseases and cancer are emerging as major causes of death not only in India but in other South and South East Asian countries as well. If present trends continue, India could emerge as one of the countries with the highest concentration of cases of diabetes mellitus and coronary heart disease (CHD) within the next three decades.

CORONARY HEART DISEASE

The traditional predominantly cereal-based diets of India; rich in fibre and low in saturated fats, cholesterol and meat are considered to favour a low incidence of CHD. Kestin, *et al*[1], had pointed out that, in general, vegetarians have lower serum lipid and blood pressures than omnivores, and that, substitution of conventional high fat, high meat diets by lacto-vegetarian diets could result in significant lowering of blood pressure, serum total cholesterol and low-density lipoproteins.

However, there are already indications of an escalation in the prevalence of CHD in the urban areas of the country. The results of a community-based survey of coronary heart disease in Delhi[2] and its environs in India are set out in Table 1. From these data, one could discern two distinct factors that are associated with increased prevalence of CHD in urban locations, namely (1) urbanisation *per se,* and (2) affluence. It will thus be seen that the prevalence rate (both sexes) for the poor-income urban group was 14.0 per 1,000 as against 5.9 per 1,000 for the rural population. The rural population in this study, though predominantly composed of poor income groups also included a small proportion of middle and high income group families. The diets of the urban population in this study, especially those of the poor groups, had lower energy and fat content than those of rural diets. The higher prevalence rate observed in the urban population despite these factors, must be considered as specially significant, and as reflecting the effects of some factors attributable to the urban environment as such rather than to dietary excesses alone.

In the case of the high-income groups in urban areas, the prevalence was 46.1 per 1,000 — a three-fold increase over the prevalence in the urban poor-income groups. This difference could be reasonably attributed to the affluence associated with sedentary occupations, with relatively low levels of physical activity, dietary errors and possibly other stress factors. Recent diet surveys in the same populations[3] showed that the diets of the urban poor who showed a significantly higher prevalence of CHD than the rural population, actually provided less energy and lower levels of fat than those of rural diets. The diets of the higher income urban groups had significantly higher levels of energy and fat content than the diets of the urban poor but again they did not

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TABLE 1
Coronary Heart Disease Prevalence Rate (1,000 adults, Delhi study)

Character	Urban (socio-economic group)			Rural
	All	High	Low	
Male	39.5	61.0	20.0	7.4
Female	25.3	30.2	8.5	5.1
Total	31.9	46.1	14.0	5.9

Source: Chadha, et al: Indian J Med Res *(B), 92:424-430, 1990.*

contain higher levels of fat and energy than the diets of well-to-do rural populations. They did not also contain high levels of *ghee* (clarified butter); the increased intake of which, because of its cholesterol oxides[4], had been suggested as a possible factor that could account for the observed higher vulnerability to CHD of Indian immigrants compared to the native British.

In the circumstances, attributing the higher prevalence of CHD, especially among the urban affluent section to dietary excesses and errors *alone* may be too facile and simplistic. It is in this context that the role of other factors in the urban environment — including lack of adequate physical exercise, greater stress arising from competitive occupations and intensive exposure to environmental pollution, especially air pollution[5], may be important.

It is reasonable to expect that because of the prevailing environmental situation in urban areas, the demands for dietary antioxidants would be higher in urban than in rural areas; where urban diets fail to meet this increased requirement, increased vulnerability to CHD may be expected. There is currently no evidence that urban diets provide higher levels of antioxidants.

Genetic Factors: In a comparative study of CHD factors in a randomly selected group of migrants from India living in London and their siblings living in India, it was found[6] that serum Lp(a) levels in Indians — migrants as well as their siblings in India — were significantly higher than those obtaining in white European populations in the UK. This would indicate genetic susceptibility. The migrants showed greater proneness to Syndrome X characterised by higher levels of BMI; higher prevalence of abdominal (central) obesity, systolic blood pressure, serum cholesterol, triglyceride, apolipoprotein B (apo B), fasting blood glucose levels; increased insulin resistance;[7] and lower HDL; as compared to their siblings in India. These data have been interpreted as indicating that "excess CHD mortality and increased prevalence of NIDDM in migrant Asians" relate to a "conspiracy of genetically acquired risk factors that are potentiated and supplemented by Westernisation"[8]. Studies among rural and urban populations in India[2,9] would show that migration from rural to urban areas in India could bring about an even greater significant increase in CHD and NIDDM prevalence than that following on migration to foreign lands. Considering the rapid pace of ongoing urbanisation, this is indeed a highly disturbing finding.

There is a need to further elucidate the nature of the genetic susceptibility — if indeed it exists. There is now evidence[10] that differences in the apolipoprotein E (apo E) profile of populations could account for differences in susceptibility to CHD. Apo E is polymorphic with multiple alleles. Populations with a preponderance of apo E4 (such as the Finns) have been shown to be more susceptible to CHD than populations with a preponderance of apo E2 (such as the Japanese). We do not have any information on the apo E profile of Indians.

The possibility that the escalating incidence of CHD in relatively affluent Indians may be attributable to increased genetic susceptibilities, makes the observance of discipline, with respect to diets and lifestyles, even more important because genetic susceptibility will find actual expression only when precipitating factors are superadded.

DIABETES

Several epidemiological studies carried out in different parts of India in the 1960s and 1970s had generally indicated a prevalence rate of diabetes of about 2.4 per cent. Because of considerable variability in sample selections, small sample size, and lack of uniformity with respect to diagnostic criteria in these different studies, these earlier surveys may be considered to be of limited value.

A major multicentric study[11] of the prevalence of diabetes was carried out under the auspices of the Indian Council of Medical Research in the late 1970s, on a large, fairly representative sample of the Indian people. The study revealed an overall prevalence rate of 2.1 per cent in the urban population and 1.5 per cent in the rural population. The results of a further breakup of the data on the basis of age, sex and location set out in Table 2 indicate the urban male (>40 years of age) as being the most vulnerable.

At the time when this survey was done (almost 20 years ago), less than 20 per cent of India's population was urban. Today, nearly 35 per cent of India's population is urban and the population over 40 years of age, as per recent estimates, accounts for 22.2 per cent of the total population. Even if the prevalence rates reported in the

TABLE 2
Prevalence of Diabetes Mellitus in India (1972-75)

Age group (years)		Prevalence rate/100 Urban	Rural
15-29		0.3	0.7
30-39		1.0	1.0
Above 40		5.0	2.8
Total	T	2.1	1.5
	M	2.6	1.8
	F	1.5	1.4

* T: Both Sexes, M: Male, F: Female

Source: Ahuja, M.M.S. (Ed): Epidemiology of Diabetes in Developing Countries, *New Delhi, 1979.*

ICMR study still hold good, it may be estimated that the number of subjects with diabetes in India would exceed 10 million by1996.

In more recent (1992) studies on populations of smaller size in South India, Ramachandran, *et al*[9], have claimed that the age-adjusted prevalence of diabetes was as high as 8.2 per cent in the urban areas as against 2.4 per cent in the rural areas. If this finding applies to other parts of India as well, it would imply that in the years in between the surveys, not only has the overall prevalence rate but also the urban-rural difference has further increased and sharpened and that the prevalence rate among Indians in urban India is just as high as that reported among Indian immigrants to foreign countries.

The predominant type of diabetes in India is the type 2 — Non Insulin Dependent variety (NIDDM). Insulin Dependent Diabetes Mellitus (IDDM) is rare and Malnutrition Related Diabetes (MRDM) is a debatable entity. Obesity (based on BMI criteria) appears to be a much less common feature of diabetes in India as compared to Europe and the USA. Thus, according to Yajnik[12], only 22 per cent of men and 47 per cent of women diabetics in their study were obese as against the 80 per cent reported in the West. On the other hand, Indian diabetics exhibited the Insulin Resistance Syndrome (Syndrome X) characterised by elevated waist/hip ratios (abdominal obesity), serum triglyceride levels, low density lipoprotein, blood pressures, fasting plasma immuno reactive insulin levels; and low levels of high density lipoproteins (HDL).

There are striking ethnic differences with respect to the prevalence of NIDDM in world populations. Available evidence points to the special vulnerability of Indians[13] (Table 3). It had earlier been postulated that the proneness of Indians to Syndrome X may be explained on the basis of the 'thrifty genotype' hypothesis, for which however, no supportive evidence is available. On the basis of epidemiological studies, Barker[14] had postulated that intrauterine growth retardation (IUGR) reflected in low birth weights could so 'programme' foetal tissues that they become prone to Syndrome X in adult life, such proneness actually finding expression when other precipitating factors such as those associated with affluent lifestyles are superadded in adult life. In this scheme, as Yajnik[12] had pointed out, both IUGR attributable to maternal malnutrition and affluent lifestyles in adult life may be important. Barker's[14] postulate demands special attention in view of the fact that the incidence of low birth weights is especially high in India.

OSTEOPOROSIS

This is currently a public health problem of major concern in the countries of North America and Europe. According to one estimate[15], by the age of 70 years, nearly 40 per cent of American women will experience at least one osteoporotic fracture and in 12 to 20 per cent of them, the fracture and its complications could prove fatal, while in the majority of the rest, prolonged supportive care would be necessary. The incidence among women is nearly double that among men.

In contrast to the above experience, osteoporosis has so far been generally viewed as a problem of minor Public Health importance in India and other countries of the Third World, in general. For this reason, studies on osteoporosis and its clinical and Public Health implications have not figured prominently in medical research in developing countries, including those of South and South East Asia.

The apparently low incidence of osteoporotic fractures in Asian populations, thus far, could have been partly attributable to their relatively low life expectancy. With increasing life expectancy, and with the sex ratio favouring the female after 40 years of age, there could be a significant expansion in the pool of potential candidates for osteoporotic fractures in the years ahead; and these could emerge as an important health problem.

Recent studies suggest that this problem may not after all be so rare even today. Thus, Shatrugana, *et al*[16], found that over 70 per cent of the fractures observed by them in Indian women over 40 years of age were those of the neck and of the femur. This study, however, was carried out in Andhra Pradesh, India, where fluorosis is endemic. The possible role of fluorosis in the pathogenesis of these fractures must also be borne in mind.

There is convincing evidence[17] that Africans and Blacks in the USA are relatively immune to vertebral and hip fractures related to osteoporosis because of genetic factors. There is no evidence of such 'genetic' protection as far as Asians are concerned.

In the development of osteoporosis, not only is the level of peak bone

TABLE 3
Prevalence (%) of NIDDM in Migrant Indians Compared to Other Ethnic Groups

Country	Europeans	Africans	Melanesians	Malays	Chinese	Creoles	Indians
Trinidad	4.3 (M) 10.2 (F)	8.2 (M) 14.8 (F)	–	–	–		19.5 (M) 21.6 (F)
Fiji	–	–	3.5 (M) 7.1 (F)	–	–		12.9 (M) 11.0 (F)
South Africa	–	3.6	–	6.6	–	–	10.4
Singapore	–	–	–	2.4	–	–	6.1
Coventry (UK)	2.8 (M) 4.3 (F)	–	–	–	–	–	11.2 (M) 8.9 (F)
Mauritius	–	–	–	–	11.5	10.4	12.4
Tanzania	–	1.9	–	–	–	–	7.1

Source: Ramaiya, et al: Int J Diab Dev Countries, *1991.*

mass that is attained in early adulthood important, but also the rate of subsequent bone loss — especially in the post-menopausal period. There are currently no studies on the rates and patterns of bone loss in the post-menopausal period as between American White subjects on the one hand, and American Blacks and Asians on the other. It is possible that the extent and pattern of post-menopausal decline of oestrogen levels may have an important role in determining the loss of bone mass in the post-menopausal period; and there could be genetic differences in this regard as between Asian and American women, but we have no evidence on these aspects yet.

The relative rarity of osteoporotic fractures in India, despite the low levels of calcium intake in diets is intriguing. In this connection, it may be important to investigate the role of phyto-oestrogens in plant foods, which form part of the traditional diet of Asian populations. It is tempting to speculate that the relative infrequency of osteoporotic fractures as also the relatively lower incidence of breast cancers among Indian women, may both be attributable to higher dietary intake of phyto-oestrogens in traditional diets; but clear evidence to this effect is as yet not available. Osteoporosis and fractures of the neck and femur may still not be a major public health problem in the country, but the situation needs to be watched.

CANCER

In India, nearly six to seven hundred thousand new cases of cancer are estimated to occur every year with an estimated prevalence of 1.5 to 1.8 million. The age-adjusted incidence rates for all types of cancers in India is currently estimated at about 130 per 100,000 in males and 120 in females. The overall age-specific incidence of cancer in males exceeds that in females in the age-groups <25 years and >55 years; the picture is reversed in the age-groups 25 to 55 years, with females showing a higher incidence. Nearly 35 to 40 per cent of cancers in India are related to tobacco-chewing and the sites of occurrence are the oral cavity, oesophagus, stomach and larynx in men. In women, cancers of the cervix predominate. The incidence of breast cancers in women in India (Table 4), though not infrequent, appears to be less than in Europe and the USA. Lung cancers also appear to be less frequent in India and other Asian countries than in Europe and the USA. However this picture could change rapidly because of the increasing air pollution and addiction to smoking. Apparently, this is already happening.

Food and dietary practices apparently play an important role. The possible effect of prevailing food and dietary practices in India on cancer risks is indicated in Table 5. While in cancers of the breast, colon, rectum, endometrium ovary and gall bladder, excess calorie intake, low dietary fibre, and high saturated fat intakes associated with raised BMI are considered as possible risk factors, cancers of the stomach, cervix and oesophagus in India are commonly seen among poor income groups and are inversely related to low BMI. Other factors such as high salt intake, nitrate/nitrite intake of sun-dried fish have all been claimed to be related to stomach and oesophageal cancers. Micronutrients such as beta-carotene, vitamin A, riboflavin, folic acid, vitamin C, iron, zinc and selenium which are now claimed to be potent protective agents that act by suppressing carcinogenesis are often deficient in the diets of the poor segments of India's population — a deficiency now likely to be further aggravated by soil micronutrient deficiencies induced by intensive agricultural technology. It is also unfortunate that in the countries of South Asia, despite rich biodiversity and the availability of vegetables and fruits, the dietary intake of vegetables and fruits is very low. The possible benefits that could accrue from the phytochemicals with anticarcinogenic properties present in these food sources are currently not being availed of.

The role of food contaminants, especially fungal food contaminants such as aflatoxin in the pathogenesis of liver cancers has attracted some attention because of the presence of aflatoxin contamination of several foods arising from poor storage[18]. In Thailand, parasitic diseases are also believed to play a possible contributory role in liver cancers. Nitrosamines in chillies and salted tea consumed in Kashmir are believed to increase the risk of the oesophageal cancers frequently seen in that state.

Apart from the low intake of saturated fats in Indian diets, it is possible that phyto-oestrogens in plant foods like soya may also play a role in protection against breast cancers. This could perhaps explain the relatively lower incidence of breast cancers in women of South and South Asian countries as compared to the USA, as also perhaps, as was mentioned earlier, the relatively low incidence of osteoporotic fractures. However, we have no clear evidence as yet to support

TABLE 4
Comparison of Age-adjusted Incidence Rate (AAR) per 100,000 Breast (F) and Lung Cancer

Year Studied	Country	AAR Breast (F)	AAR Trachea, bronchus and lung (M)	AAR Trachea, bronchus and lung (F)
1978-82	USA (Connecticut)			
	(White)	77.8	64.3	25.3
	(Black)	61.3	89.8	21.9
1979-82	UK (Oxford)	61.3	68.8	19.5
1978-81	Japan (Miyanzi)	25.0	–	–
1989	India			
	(Delhi)	28.3	11.9	2.2
	(Mumbai)	26.1	14.6	3.7
	(Madras)	24.6	11.1	1.7
	(Bangalore)	22.3	8.6	1.6
	(Barshi)	6.8	2.0	0.0
	Rural			

Sources: 1. *Cancer incidence in five continents, Vol V, 1987.*
2. *NCRP, Biennial Report, ICMR, New Delhi, 1988-89.*

TABLE 5
Diet and Cancer

Protective Factors

- Dietary fibre — colon cancer
- Micronutrients — epithelial cancers of alimentary and respiratory tract (carotene, riboflavin, vitamin C, iron, zinc and selenium)
- Chinese green tea, soya products, curcumin (turmeric)
- Indoles, isothiocyanates and phenols in foods (eg, garlic)

Deleterious Factors

- High saturated fats — (rectal and breast cancers)
- High animal protein — (prostate, uterine and ovarian cancers)
- Salt/nitrate and nitrosamine — (stomach and oesophageal cancers)
- Fungal contaminants
  - aflatoxin — (liver cancer)
  - ochrotoxin — (kidney cancer)

such a hypothesis. The possible role of curcumin derived from turmeric, a commonly used food item, in protection against certain types of cancers also merits consideration.

Thus it will be seen that some aspects of the prevailing dietary profile and practices among poor sections of the population could favour the development of certain types of cancer, indicating that the current lack of affluence in a majority of these populations does not confer freedom from cancer risks. On the other hand, there are other aspects of traditional diets which are beneficial.

With rising affluence and a burgeoning middle class, cancer risks associated with affluence, and high intakes of saturated fats and animal proteins, of the types seen in developed countries could emerge as important risk factors among India's populations as well. Indeed, this is already happening; and it would appear that the profile of cancers is changing. A comparison of the data on age-adjusted incidence rates in India between 1981 and 1991, as reported by the Indian Cancer Registries, provides evidence of the rising incidence of cancers of the breast, lung and colon which, thus far, have been relatively low in India in comparison to the west.

Thus, while we have not as yet shed our problems of poverty and of cancers associated with traditional practices, we will soon face the double burden of having to combat cancers arising from dietary errors and excesses and unhealthy lifestyles as well. The decades ahead will thus pose formidable challenges with respect to the control of chronic degenerative diseases and cancer.

CONCLUDING COMMENT

The changing profile of diseases discussed above, carries highly disturbing far-reaching implications for our health system. The emerging chronic diseases, generally far more expensive to treat, require a much longer duration of treatment and yield far less rewarding results as compared to acute communicable diseases. Together with increasing demands for the care of the aged whose numbers are also gradually increasing, the overall cost of health care in the country will escalate very sharply in the coming decades. All this is the price of 'development'. The resources available for health care are currently far too meagre even to meet basic health needs. Policy-makers and planners, in the next few decades will be hard put to make agonising choices with respect to the allocation of meagre resources between the care of the old and chronically ill on the one hand, and the young and acutely ill on the other; and between the rural poor and the expanding urban middle class. This cruel dilemma will underscore the need for the institution, and vigorous implementation, of appropriate preventive measures consisting in the avoidance of dietary errors and excesses and the promotion of healthy lifestyles.

Based on a lecture delivered at the London School of Hygiene and Tropical Medicine at the sixth Annual Public Health Forum (April 1996).

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