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Nutrition And Degenerative Diseases In India

C. Gopalan

The role of nutritional factors in evolution of chronic diseases, especially cancer, and degenerative disease states — for example, obesity, betes and coronary heart disease now attracting wide attention in prosperous industrialised countries. The fact that intensive research this area is already being pursued those countries, is, however, no ification for according low priority hese areas of research in the non research agenda of developing ntries like India. There are three or reasons for this.

Firstly, there is evidence of steep alation of the incidence of both betes and coronary heart disease ong Indian and Asian populations, ecially in the urban areas. Before turn of the century, these dises will emerge as India's leading lic health problems. They predomitly affect the middle-class who are, doubt, much smaller in number n the poor at the present stage of onal development; but the middle s is a highly productive segment he population, especially in this dern technological age. Their nums are steadily increasing.

Secondly, developing countries, compared to the rich countries, st rely much more heavily on prevtion rather than on therapeutic nagement of these diseases; their onal health systems can just not rd the massive cost of the therative care of these diseases on a e scale. Research in prevention would mostly consist in the identification of factors in diets and lifestyles which would favour the control of these degenerative diseases.

Thirdly, it is now becoming increasingly clear that the dietary errors responsible for the escalation of these diseases in India and Asia may not necessarily be the same as those operative in Europe or North America.

Research on dietary factors contributing to the escalation of diabetes and coronary heart diseases in India's urban population, whose numbers may well exceed 300 million by the turn of the century, must now demand major attention. This is a subject which falls as much in the area of nutrition as in the area of cardiology or diabetology. Some major aspects of these problems which seem to merit further research in the Indian (and Asian) context are briefly discussed here.

OBESITY

A convenient measure of body fat is the body mass index expressed as the ratio of weight to height square (BMI = weight (kg)\(height in m)^2). BMI of 20-25 has been proposed as a normal range for adults of developed countries. It has been suggested that a range of BMI 18.5 to 20 or 22 may, perhaps, be more appropriate for Indian subjects. These cut-off points are arbitrary approximations, but they may help to monitor changing trends with respect to obesity.

Chronic calorie deficiency is still widespread in India. Despite this, the annual data provided by the National Nutrition Monitoring Bureau (NNMB) show that 3.6 per cent of the rural population had a BMI exceeding 25[1]. In another study of high income groups, 9.5 per cent of males and 28 per cent of females had BMI levels exceeding 25 per cent[2]. Considering that the populations covered by the NNMB surveys are predominantly the low income groups, these figures must be considered significant. There has been a rapid increase in the proportion of the middle income group in recent years. The incidence of obesity in these sections may be expected to be much higher than the values reported for the low income group by the NNMB. These are the potential candidates for diabetes and coronary heart disease.

Abdominal obesity: There is growing evidence that obesity of the type in which fat is deposited centrally (abdominal obesity), as contrasted to obesity of the type where fat deposition occurs predominantly in the hips and gluteal region, is associated with greater hazards[3]. A waist to hip ratio

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Table 1: Prevalence of coronary artery disease in Delhi

Location	Year	Prevalence
Delhi* (urban)	1962	98\1000 (autopsy)
Delhi** (urban)	1990	32\1000 (clinical history) 97\1000 (ECG changes)

Sources: * Padmavati, S.: *Circulation*, 25:711-717, 1962.
** Chadha, S.L., Radhakrishnan, S., Ramachandran, K., *et al*: *Ind J Med Res*, 92:424-430, 1990.

of more than 0.85 is considered to indicate abdominal obesity[4]. There are differences in the metabolism of adipocytes of the abdomen and of the gluteal region[5]. It seems possible that the actual dietary composition of a high calorie diet may play a role in determining the site of predominant deposition of fat, though there is as yet no documented evidence to this effect. It is also likely that hormonal factors that may be genetically determined may play a role in this regard. It has been suggested that South Asians are more prone to abdominal obesity than Europeans or North Americans but this needs to be substantiated through well controlled studies.

Recent epidemiological evidence points to a high level of association of abdominal obesity with hypertension, coronary heart disease and diabetes[6]. For this reason, this condition has to be viewed as an important risk factor. The higher vulnerability of Asian migrants to coronary heart diseases reported from the UK could be related to this factor[7].

CORONARY HEART DISEASES

In Table 1, data on the prevalence of coronary heart disease in Delhi are presented. A study in 1962[8] (based on autopsy) showed a prevalence of 98/1,000. A recent community-based study[9] on a large sample of the urban population of Delhi, showed a prevalence rate of 32/1,000 (when based on clinical history) and 97/1,000 (based on ECG changes). The prevalence was three times higher in the high socio-economic group as compared to the poor group; the prevalence in urban Delhi was over four times that in rural Delhi. These observations provide disturbing evidence that with increasing urbanisation and affluence the problem could assume serious dimensions in the years ahead.

The precise factors that underlie the escalation of the incidence of coronary heart disease, especially in urban populations in India and in Asian immigrants to industrialised countries of Europe, are still not clear. The greater proneness to coronary heart disease of immigrants from the Indian subcontinent to the UK had been attributed, among other factors, to high levels of ghee (clarified butter) in their diets[10]. It was suggested that peroxides in ghee may be atherogenic and contribute to high blood cholesterol. However, the incidence of coronary heart diseases among the urban middle class in Delhi has apparently not shown any striking associations with excessive ghee consumption.

Profile of fats and fatty acids in Indian diets: While animal foods such as meat, milk, ghee, butter and cheese, contain saturated fats, plant foods such as cereals, pulses, spices and vegetable oils (except coconut), which most Indians consume, contain polyunsaturated and monounsaturated fatty acids and no cholesterol. Vegetable oils and plant foods contain more linoleic acid (n-6) than alpha-linolenic acid (n-3)[11]. Great interest in the beneficial effect of fish oil had been sparked off by the pioneering study of Bang *et al*[12]. Recent studies have shown that since the body can synthesise long chain n-3 PUFA (the beneficial component of fish oil) from alpha-linolenic acid present in plant foods and vegetable oils (especially rapeseed/mustard oils), these latter can substitute for fish[11].

Another important finding is that green leafy vegetables provide about seven times more alpha-linolenic acid than fresh beans and other vegetables[13]. In cereal-pulse based lacto-vegetarian diets, inclusion of green leafy vegetables will ensure adequate intake of n-3 fatty acid[13]. Thus green leafy vegetables are important not only for infants and women in the reproductive age but for adult men as well. Research on the fatty acid profiles of inexpensive plant foods readily available in the country must find an important place in the future nutrition research agenda.

High intakes of fat, especially saturated fats, are associated with coronary heart diseases in Europe and the USA. However, as far as India is concerned, high dietary fat intake, while it may be important, does not seem to be the major causative factor[14]. Dietary intake of fats, and especially saturated fats, in Indian communities with high incidence of coronary heart disease are nowhere as high as those reported for European and North American affluent communities. Serum cholesterol levels in coronary heart diseases in Indian subjects are rarely as high as those reported in Europe and the USA. Rela

Table 2: Age-adjusted prevalence (%) of NIDDM in migrant Indian populations

	Urban		Rural	
	Men	Women	Men	Women
Madras (India)*	8.4	7.9	2.6	1.6
Fiji Indians**	14.4	12.6	13.7	13.2
Mauritian Hindus***	11.9	9.0	–	–
Southall Asians****	8.9 (Total)	–	–	–

Sources: * Ramachandran *et al*: *Diabetes Care*, 15 (10):1,348-1,355, 1992.
** Zimmet, P., Taylor, R., Ram, P.: *Am J Epidemiol*, 118:673-88, 1983.
*** Ohlson, L.O. *et al*: *Diabetes*, 34:1,055-58, 1985.
**** Mather, H.M., Keen, H.: *Br Med J*, 291:1,081-84, 1985.

able 3: Chromium and zinc content of some common foods

ame of the oodstuffs	Chromium (mg/100 gm)	Zinc (mg/100 gm)
Millets		
Ragi (*Eleusine coracana*)	0.028	2.3
Bajra (*Pennisetum typhoideum*)	0.023	3.1
Jowar (*Sorghum vulgare*)	0.008	1.6
Cereals		
Rice, parboiled, hand-pounded (*Oryza sativa*)	0.009	1.4
Rice, milled, 10%	0.003	1.3
Wheat, whole (*Triticum aestivum*)	0.012	2.7
Wheat, flour (whole)	0.006	2.2
Wheat, flour (refined)	0.001	0.6

Source: Nutritive Value of Indian Foods, Indian Council of Medical Research, 1991.

tively low cholesterol levels (with low HDL cholesterol) is the general feature[15]. However, there appears to be a strong association between 'abdominal obesity' on the one hand and hypertension, diabetes and coronary heart disease on the other hand.

DIABETES

Diabetes is closely linked to diet and nutrition, both with respect to its causation and management. There are apparently important and significant differences with respect to the pathogenesis and course of diabetes as between tropical developing countries and developed countries.

A multicentric study carried out by the Indian Council of Medical Research (ICMR), which covered six regions of India, showed that the prevalence rate in urban areas was 2.5 per cent, as against 1.5 per cent in rural areas[16]. Recent epidemiological studies[16,17,18,19] document a prevalence rate of 3 to 5 per cent. The reported prevalence of diabetes in migrant Indians is indicated in Table 2.

In earlier papers in this Bulletin, several aspects of the diabetes problem had been highlighted [20,21,22]. Much of the high incidence of diabetes in urban populations in India is accounted for by Non-Insulin Dependent Diabetes Mellitus (NIDDM). Indian diets are predominantly cereal-based. Millets, once the staple of poor rural groups, are now being steadily replaced by wheat and rice, especially of the highly milled varieties. Earlier studies had shown that post-prandial blood glucose levels after millet diets are lower than those achieved after a wheat or rice diet[23].

The prevalence of diabetes in urban populations in India is much higher than in rural populations. The major dietary changes that urbanisation and affluence bring about are substitution of unrefined wheat or rice or millets by highly polished wheat or rice, and possibly, increased intake of fat in some income groups.

High calorie intake in Indian high income groups is largely achieved through high intakes of such refined cereals, and carbohydrates, rather than through fats and meat as in Europe and North America. It is possible that this may account for the greater predilection to abdominal obesity; and/or there may be genetically determined hormonal factors that favour deposition of fat preferentially in the abdominal region.

The constellation of insulin resistance, impaired glucose tolerance, high blood pressure, hypertriglyceridemia, and low HDL levels, commonly encountered in Indian subjects, has been designated 'Syndrome X'[24]. This is reported to be associated with a high prevalence of morbidity and mortality due to cardiovascular disease and diabetes in Indian subjects[25].

The possible role of chromium deficiency: The substitution of millets or undermilled cereals in rural diets by highly polished wheat and rice in the diets of the urban affluent would result in marked reduction in the dietary content of fibre, chromium and zinc. Evidence that chromium deficiency results in insulin resistance and that insulin resistance can be ameliorated by chromium supplementation has been adduced[26]. Chromium has been shown to potentiate the action of insulin in vivo and in vitro. The potentiation of the in vitro activity has been attributed to a special chemical form, termed Glucose Tolerance Factor, tentatively identified as Cr-nicotinic acid complex. Chromium deficiency has also been implicated as a risk factor for cardiovascular disease[27].

Data on the chromium content of unrefined and refined cereals presented in Table 3 would show that the overall chromium level in the urban diets based on highly refined and polished cereals is likely to be lower than that in the rural diets based on undermilled cereals and millets. Apart from chromium, another trace element present in undermilled cereals, which is lost as a result of refining, is zinc. What role, if any, these factors play in the escalation of diabetes in the urban population can, at the present state of our knowledge, only be speculated upon. Further research is necessary in this respect as also on the significance of other aspects of dietary changes following on urban migration.

The possible role of undernutrition in early life: An important new observation bearing on the subject of the reported proneness of Indians to Syndrome X, is that of Barker *et al*[28]. In a remarkable study which involved 5,654 men born in Hertfordshire, England, between 1911-1930, these authors found that the standardised mortality ratio for cardiovascular diseases fell from 125 for men who had weighed 2.5 kg or less at birth, to 68 for men who had weighed more than 3.8 kg. Their studies in Preston[29] also showed that subjects who had low birth weights, in relation to period of gestation, were significantly more prone to develop Syndrome X later in life. The authors postulate that maternal

undernutrition and consequent intrauterine growth-retardation could "programme body structure, physiology and metabolism" in a manner that increases the individual's susceptibility to degenerative cardiovascular disease in later life.

Whatever the explanation, these observations must be considered as of great significance in the context of the high incidence of low birth weights in Indian infants (nearly 33 per cent) on the one hand and the disturbing evidence of greater proneness of Indians to diabetes and cardiovascular disease on the other. These observations indicate that environmental factors (namely, maternal undernutrition and consequent unfavourable intrauterine environment) rather than genetic predisposition (as is generally believed) may account for the suspected greater degree of proneness of Indians to diabetes and cardiovascular disease.

As we move to the next century, it is likely that research on factors underlying the escalation in the incidence of diabetes and coronary heart disease in relatively affluent sections of India's urban population may demand increasing attention. As was pointed out earlier, this subject falls as much in the area of nutrition as in the area of cardiology or diabetology, and must therefore find an important place in any meaningful future nutrition research agenda.

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NUTRITION NEWS

★ XV International Congress of Nutrition was held at Adelaide, Australia, September 26 to October 1, 1993. Nearly 2,350 delegates (including 43 from India) from 93 countries participated.

★ XX Kamla Puri Sabharwal Memorial Lecture was delivered by Dr Nevin S. Scrimshaw on 'Malnutrition, Brain Development, Learning and Behaviour' at Lady Irwin College, New Delhi, on November 23,1993.

★ NIN Platinum Jubilee Symposium and the XXVI Annual Meeting of the Nutrition Society of India were held on November 25 to 27, 1993, at the National Institute of Nutrition, Hyderabad.

★ Expert Consultation on 'Lessons Learned in Implementing the Expanded Mandate on the Food Security Assistance Scheme' took place at FAO headquarters in Rome, December 6 to 10, 1993. Dr C. Gopalan participated.

★ First Dr Soundaram Memorial Lecture in commemoration of Dr Soundaram, Founder of the Gandhigram Institute of Rural Health, was delivered by Dr U. Ko Ko, Regional Director, WHO, on December 13, 1993. Dr Rajammal P. Devadass, Vice Chancellor, Avinashalingam Institute for Home Science, Coimbatore, declared open the Dr Soundaram Auditorium. Dr C. Gopalan, Chairman, Gandhigram Institute of Rural Health and Family Welfare Trust, presided at the function.

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