Food Habits: Some Relationship to Diabetes and Heart Diseases

Analava Mitra

INTRODUCTION

Prevalence of Diabetes in the Different Countries of World

Worldwide, a 122 % rise is projected, from the total of 135 to 300 million. This more than 2-fold global increase will occur because of population ageing and growth, as well as from obesity, unhealthy diets and a sedentary lifestyle. These latter factors are closely associated with urbanization and industrialization. In India currently about 50% of diabetics live in towns and cities, which are likely to see a 3-fold increase in the numbers in the next 30 years, due to migration. Table 1 shows prevalence of diabetes in different countries.

Prevalence of Diabetes in India

Prevalence of type 2 diabetes in India is on the rise and literally it can be said that India is facing a diabetic explosion. The exact causes of the same are unknown. The curious points in diabetes sufferers of India are incidence of diabetes happens to occur at an early age and mostly males are affected (Mitra et al., 2007). In Indian villages, from a sample survey of 12,000 people about 2 % have diabetes (Decan Herald, 2006). On the basis the ICMR estimates the prevalence of diabetes in adults to be 3·8% in rural areas and 11·8% in urban areas (Mitra and Bhattacharya, 2006). From a sample study of Medavakkam town near Chennai, which was a village a decade ago, that the prevalence of diabetes rose from 2.4 per cent to 5 per cent within five years of urbanization (The Hindu, Online edition, 2004). Migrant Asian Indians living in different parts of the world had shown a higher prevalence of diabetes than other ethnic groups living in the same countries (Ramachandran et al., 1990). Evidence showing that Indian migrants have a high tendency to develop diabetes led to several national epidemiological studies in India. Availability of uniform criteria for diagnosis and classification of diabetes made comparison between the studies possible (WHO, 1985). These surveys showed that diabetes was as common in urban India as among migrant Indians (Ramaiya et al., 1990). The Chennai Urban Rural Epidemiology Study (CURES), which sampled 26,001 persons, recorded a prevalence of 16 % (Mohan et al., 2005).

Table 2 (Prevalence of Diabetes and impaired glucose tolerance in different cities in India) showed that the prevalence of diabetes are more on the Southern parts of the country and was least in the Eastern parts. Nearly 12 per cent of the adult population in Delhi and Kolkata, nearly 10 per cent in Mumbai, 12.5 per cent in Bangalore, 13.5 per cent in Chennai and near 16 per cent in Hyderabad are patients of diabetes. The prevalence of diabetes had increased in Hyderabad with an average of 16 per cent above the age of 25 suffering from the disease as compared to five per cent in other cities and world average of three percent. However, in rural areas the prevalence was five per cent less. The Diabetes Awareness Survey in Hyderabad (DASH) study conducted in the twin cities has recently pointed out that the diabetes prevalence levels have grown significantly from 16.6 per cent as per the National Urban Diabetes Survey (NUDS) of 2001. Stating that the exact reasons for the growing prevalence rate of diabetes in Hyderabad were not yet ascertained, The DASH study has revealed that nearly 43 per cent of the Hyderabad population was unaware of a condition called diabetes and 65 per cent did not know that diabetes could affect the eyes, which could lead to decreased sight (The Hindu online, 2004). The increased prevalence of diabetes in India has a lot to do with a switch from a traditional to a Western diet (Deccan Herald, 2006; Hyderabad has emerged as diabetes capital of India: Expert Hyderabad, 2007)

Economic Impact of the Disease

The cost of treatment of this disease per se and its accompanying complications can ruin families. The median annual direct medical cost for patient with Type 2 Diabetes Mellitus without complications was Rs. 14,507/- (Bhaskaran et al., 2003).

Prevalence of Coronary Artery Disease

The prevalence of coronary heart disease increased from 1.05% in 1960 to 9.67% in 1995 in

Table 1: Prevalence of diabetes in different countries

Country/ Region	*Extrapolated Prevalence*	*Population Estimated Used*
Type 2 diabetes in North America (Extrapolated Statistics)		
USA	17,273,847	293,655,405[1]
Canada	1,912,227	32,507,874[2]
Type 2 diabetes in Europe (Extrapolated Statistics)		
Austria	480,868	8,174,762[2]
Belgium	608,722	10,348,276[2]
Britain (United Kingdom)	3,545,335	60,270,708 for UK[2]
Czech Republic	73,304	1,0246,178[2]
Denmark	318,434	5,413,392[2]
Finland	306,735	5,214,512[2]
France	3,554,365	60,424,213[2]
Greece	626,325	10,647,529[2]
Germany	4,848,506	82,424,609[2]
Iceland	17,292	293,966[2]
Hungary	590,139	10,032,375[2]
Liechtenstein	1,966	33,436[2]
Ireland	233,503	3,969,558[2]
Italy	3,415,145	58,057,477[2]
Luxembourg	27,217	462,690[2]
Monaco	1,898	32,270[2]
Netherlands (Holland)	959,894	16,318,199[2]
Poland	2,272,138	38,626,349[2]
Portugal	619,067	10,524,145[2]
Spain	2,369,457	40,280,780[2]
Sweden	528,611	8,986,400[2]
Switzerland	438,286	7,450,867[2]
United Kingdom	3,545,335	60,270,708[2]
Wales	171,647	2,918,000[2]
Type 2 diabetes in the Balkans (Extrapolated Statistics)		
Albania	208,518	3,544,808[2]
Bosnia and Herzegovina	23,976	407,608[2]
Croatia	264,521	4,496,869[2]
Macedonia	120,004	2,040,085[2]
Serbia and Montenegro	636,817	10,825,900[2]
Type 2 diabetes in Asia (Extrapolated Statistics)		
Bangladesh	8,314,145	141,340,476[2]
Bhutan	128,562	2,185,569[2]
China	76,402,799	1,298,847,624[2]
East Timor	59,955	1,019,252[2]
Hong Kong s.a.r.	403,242	6,855,125[2]
India	62,651,210	1,065,070,607[2]
Indonesia	14,026,643	238,452,952[2]
Japan	7,490,176	127,333,002[2]
Laos	356,948	6,068,117[2]
Macau s.a.r.	26,193	445,286[2]
Malaysia	1,383,675	23,522,482[2]
Mongolia	161,841	2,751,314[2]
Philippines	5,073,040	86,241,697[2]
Papua New Guinea	318,839	5,420,280[2]
Vietnam	4,862,517	82,662,800[2]
Singapore	256,111	4,353,893[2]
Pakistan	9,364,490	159,196,336[2]
North Korea	1,335,150	22,697,553[2]
South Korea	2,837,279	48,233,760[2]
Sri Lanka	1,170,892	19,905,165[2]
Taiwan	1,338,225	22,749,838[2]
Thailand	3,815,618	64,865,523[2]

Table 1: Contd....

Country/ Region	*Extrapolated Prevalence*	*Population Estimated Used*
Type 2 diabetes in Eastern Europe (Extrapolated Statistics)		
Azerbaijan	462,846	7,868,385[2]
Belarus	606,501	10,310,520[2]
Bulgaria	442,233	7,517,973[2]
Estonia	78,921	1,341,664[2]
Georgia	276,111	4,693,892[2]
Kazakhstan	890,806	15,143,704[2]
Latvia	135,665	2,306,306[2]
Lithuania	212,229	3,607,899[2]
Romania	1,315,032	22,355,551[2]
Russia	8,469,062	143,974,059[2]
Slovakia	319,033	5,423,567[2]
Slovenia	118,321	2,011,473 [2]
Tajikistan	412,444	7,011,556 [2]
Ukraine	2,807,769	47,732,079[2]
Uzbekistan	1,553,553	26,410,416[2]
Type 2 diabetes in Australasia and Southern Pacific (Extrapolated Statistics)		
Australia	1,171,361	19,913,144[2]
New Zealand	234,930	3,993,817[2]
Type 2 diabetes in the Middle East (Extrapolated Statistics)		
Afghanistan	1,677,275	28,513,677[2]
Egypt	4,477,495	76,117,421[2]
Gaza strip	77,940	1,324,991[2]
Iran	3,970,776	67,503,205[2]
Iraq	1,492,628	25,374,691[2]
Israel	364,647	6,199,008[2]
Jordan	330,070	5,611,202[2]
Kuwait	132,796	2,257,549[2]
Lebanon	222,189	3,777,218[2]
Libya	331,269	5,631,585[2]
Saudi Arabia	1,517,408	25,795,938[2]
Syria	1,059,816	18,016,874[2]
Turkey	4,052,583	68,893,918[2]
United Arab Emirates	148,465	2,523,915[2]
West Bank	135,953	2,311,204[2]
Yemen	1,177,933	20,024,867[2]
Type 2 diabetes in South America (Extrapolated Statistics)		
Belize	16,055	272,945[2]
Brazil	10,829,476	184,101,109[2]
Chile	930,820	15,823,957[2]
Colombia	2,488,869	42,310,775[2]
Guatemala	840,035	14,280,596[2]
Mexico	6,174,093	104,959,594[2]
Nicaragua	315,279	5,359,759[2]
Paraguay	364,198	6,191,368[2]
Peru	1,620,253	27,544,305[2]
Puerto Rico	229,291	3,897,960[2]
Venezuela	1,471,610	25,017,387[2]
Type 2 diabetes in Africa (Extrapolated Statistics)		
Angola	645,797	10,978,552[2]
Botswana	96,425	1,639,231[2]
Central African Republic	220,145	3,742,482[2]
Chad	561,090	9,538,544[2]
Congo Brazzaville	176,355	2,998,040[2]
Congo kinshasa	3,430,413	58,317,030[2]
Ethiopia	4,196,268	71,336,571[2]

Table 1: Contd....

Country/ Region	*Extrapolated Prevalence*	*Population Estimated Used*
Ghana	1,221,001	20,757,032[2]
Kenya	1,940,124	32,982,109[2]
Liberia	199,449	3,390,635[2]
Niger	668,266	11,360,538[2]
Nigeria	1,044,138	12,5750,356[2]
Rwanda	484,627	8,238,673[2]
Senegal	638,361	10,852,147[2]
Sierra leone	346,111	5,883,889[2]
Somalia	488,505	8,304,601[2]
Sudan	2,302,833	39,148,162[2]
South Africa	2,614,615	44,448,470[2]
Swaziland	68,778	1,169,241[2]
Tanzania	2,121,811	36,070,799[2]
Uganda	1,552,368	26,390,258[2]
Zambia	648,569	11,025,690[2]
Zimbabwe	215,991	1,2671,860[2]

1.US Census Bureau, Population Estimates, 2004
2. US Census Bureau, International Data Base, 2004

(Gupta and Gupta, 1996). Most of the studies on the coronary heart diseases (CHD) in India have been community-based studies. The largest study that has looked into the prevalence of CHD is by Chaddha et al. (1990) among 13,500 urban dwellers in Delhi. The estimated prevalence rate was around 9.7 per cent, and the estimates were based on clinical and ECG criteria. Reddy and Yusuf (1998), based on a cross-sectional survey of urban Delhi, found that a higher prevalence of CHD in the urban sample was associated with higher levels of body mass index, blood pressure, fasting blood lipids (total cholesterol, ratio of cholesterol to HDL cholesterol, triglycerides), and diabetes.

Gupta and Gupta (1996) and Ramachandran et al (2001) find that individuals with lower levels of income or education are at higher risk of coronary heart disease, suggesting that for some

Table 2: Prevalence of Diabetes and impaired glucose tolerance (IGT) in different cities in India

City	*n*	*Males:Females*	*Diabetes % (95% CI)*	*IGT % (95% CI)*
Chenni	1668	708:960	13.5 (11.8-15.2)	16.8[b,f] (14.6-19.0)
Bangalore	1359	638:721	12.4[b] (10.5-14.3)	14.9[b,f] (12.8-16.9)
Hyderabad	1427	685:742	16.6 (14.6-18.6)	29.8[f] 9 (26.9-32.8)
Calcutta	2378	1163:1215	11.7[a,b](10.4-13.0)	10.0[a,b,d] (8.7-11.4)
Mumbai	2084	987:1097	9.3[a,b,c](7.7-10.1)	10.8[a,b,d] (9.3-12.2)
New Delhi	2300	1107:1193	11.6[a,b](10.3-12.9)	8.6[a,b,d,e,f] (7.4-9.7)

P<0.001:[a] vs Chennai;[b] vs Hyderabad;[c] vs New Delhi;[d] vs Bangalore;[e] vs Calcutta; [f] vs Mumbai

Table 3: Age distribution of prevalence rate of heart diseases in India, 1994 (per 100,000) population (Gupta et al., 2006)

States	*0-4*	*5-14*	*15-44*	*45-59*	*60+*
India	1	2	27	81	432
AP	0	1	31	71	493
Bihar	0	0	0	0	0
Gujarat	0	0	43	98	650
Haryana	0	3	33	78	260
Karnataka	0	7	38	87	487
Kerala	20	5	35	163	1074
Maharashtra	0	0	23	75	305
Punjab	0	2	51	117	642
Rajastan	9	5	18	66	183
Tamil Nadu	4	0	51	93	967

urban populations. In rural areas, the prevalence increased from 2.03% in 1974 to 3.7% in 1995. Table 3 shows age distribution of prevalence rate of heart diseases in India as in 1994 (per 100,000 population). In urban areas there was a significant increase in the prevalence of coronary heart disease in men in the age groups 20-29 and 30-39 years and in women in the age groups 20-29, 30-39 and 40-49 years. In rural areas the increase in men was in the age groups 20-29 and 30-39 years

population groups in South Asia, prevalence followed a pattern seen with advanced epidemics in developed countries and the observed shift from the rich countries to the poor countries.

Epidemiological studies on Coronary Diseases in India begin as early as the 1960s, and continuing to date. However, with a few exceptions, these studies are small and region-specific studies, and do not have a country level analysis. Also, many of these studies have looked into specific components of Coronary Diseases or at risk factors like hypertension, cholesterol or diabetes.

Economic Costs of Coronary Vascular Diseases

The American Heart Association estimated the economic costs of Coronary Vascular Diseases in the United States in 2001 at $298.2 billion. This includes health expenditures (the direct costs incurred by CVD – services provided by doctors and other health professionals, hospital and nursing home costs, medications, home health expenses, and other medical durables), estimated at $182 billion, and lost productivity from CVD

morbidity and mortality (the indirect costs of the disease), estimated at $116 billion. The mean expenditures on diabetes, diseases of the heart and blood pressure in India were Rs. 5,484, Rs 9,180 and Rs. 2,736 respectively for 1985-86. The mean expenditure for all chronic illnesses was Rs. 5,414. For heart failure under acute illness, the mean expenditure was Rs. 502, which was much higher than the mean expenditure for all acute illnesses, Rs. 134 (Gupta et al., 2006). The goals of a heart-healthy diet are to eats foods that help obtain or maintain healthy cholesterol and lipid levels - to reduce overall levels and low-density lipoproteins (LDL) and to increase high-density lipoproteins (HDL). Reducing other lipids, such as triglycerides and Lp(a) lipoproteins are also important. Any diet should also help keep blood pressure under control.

The Hyperinsulinemic/Insulin Resistant State

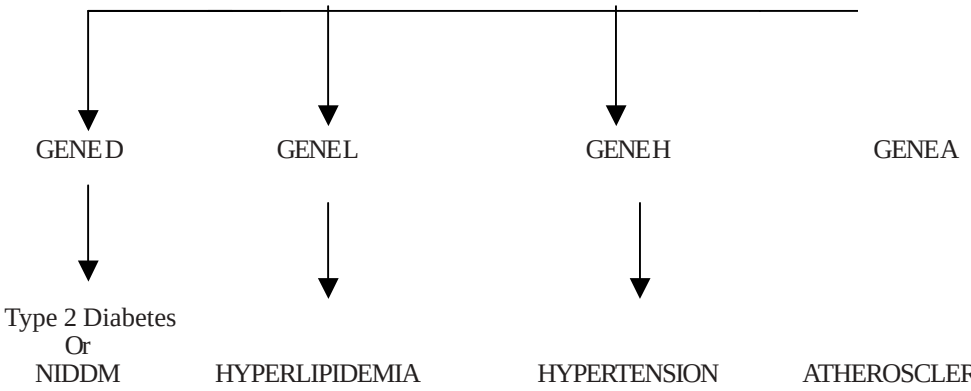
The hyperinsulinemic/insulin resistant state is a metabolic condition linked to such wide-spread and heterogenous clinical syndromes like hypertension, obesity, Type 2 diabetes. About 25% of the non-diabetic population shows abnormalities of insulin sensitivity and compensatory hyperinsulinaemia. Rural population of South Asia including rural Indians are found to have an increased incidence of Type 2 diabetes or popularly known as Non Insulin Dependent Diabetes Mellitus (NIDDM) and other associated conditions like obesity, hypertension, coronary artery disease (CAD), dyslipidaemia (King, 1998). The cause of the disease is due to nature and nurture effects (Enase et al., 1992) The presence of a genetic factor (nature) and environmental causes (nurture)- such as faulty dietary intake in excess, proneness to infections, poverty, malnutrition, improper concepts of hygiene and health and reduced physical activities etc. may lead to increased incidence of the condition. Usually hyperinsulinaemia is adaptive but it becomes maladaptive if the individual has inherited a gene, which limits the activity of the pancreas or increase insulin resistance (IR) leading to frank diabetes. Atherogenic lipoprotein phenotype for Asians has been characterized by elevated triglycerides, LDL, APO B-100, low HDLC and APO A-1 levels (Enase, 1997). Lipoprotein A levels above 30 mg/dl have been found to be an independent risk factor for CAD in Indians. Fasting serum triglycerides were highest in the south Asian patients (Krishnaswamy, 1989), who also had the most insulin resistance and frank diabetes. CAD is present in Indians with normal or low cholesterol level (Enase, 1997).

In India population is vast and there is hetrogenicity of origin or race, geography and habit, socio-economic status, dietary habits, methods of cooking and preservation, use of pesticides. These factors, along with known variables like age, sex etc. influence lipid profile of individuals. The South Asian population is known to be at risk of atherosclerosis even though the subject does not have the clinical evidence of CAD. In a study with 3000 patients found that CAD occurred in 50% with cholesterol level of 152 mg% and in 5% even if that was below 140 mg%. The significant finding was elevated triglycerides (>196 mg%) and low HDLC (39 mg%). The lipid profile in Indians may appear benign but the high triglycerides and low HDL levels actually increase the rate of CAD. Persons with high LDL, high triglyceride and low HDL have a 3-fold higher rate of CAD (Krishnaswamy, 1989).

While body mass index in Indians was not higher, they had a significantly higher waist-hip ratio (Gupta et. al., 1995) indicating that although Indians have no more general obesity than the others they tend to put it on centrally or abdominally. They also had more hyper-insulinaemia, glucose intolerance and increase plasma activator inhibitor 1 (PAI-1). Regarding the antioxidants, Indians had a lower level of plasma vitamin C and selenium (Enase, 1997). These factors could be due to food habits, especially prolonged cooking at higher temperatures, and cooking with ω-6 oils as the main oil medium with a myth to reduce cholesterol level (Raheja, 1970) and a more vegetarian diet. Average Indian diabetic and CAD patients were younger (Enase, 1997).

SYNDROME OF INSULIN RESISTANCE

The link with hypertension may be due to hyperinsulinaemia rather than insulin resistance itself. Insulin has been shown to influence a number of different processes involved in blood pressure regulation, e.g. cation transport, sodium absorption by the kidney, activity of the sympathetic nervous system. Elevated insulin levels enhance renal sodium absorption and stimulate the sympathetic nervous system to the skeletal muscles and probably to other organs. Insulin resistance plays a key role in eliciting several



metabolic and fibrinolytic abnormalities in hypertension. Hypertensive individuals have an increased risk profile for cardiovascular diseases even in the absence of obesity or diabetes. The salient features are higher levels of glucose, insulin, and triglycerides while HDL cholesterol is lower. Fibrinolytic activity is impaired due to elevations in PAI-1. Fibrinogen is also elevated. These aberrations probably provide the basis for the repeatedly reported finding that hypertension is a major risk factor for cardiovascular diseases.

Another factor with enormous public health implications is the difference in age structure of the insulin resistant populations. It has been reported that hyperinsulinaemia occurs at a younger age in the developing countries. In the developed world, most people with diabetes are over 65 years of age while in developing countries the majority is in the age group 45-64, a trend that will accentuate (Mitra and Bhattacharya, 2007).

Diet and Coronary Artery Disease

Diet has important role to play in Indians as they are prone to cardiac diseases particularly atherosclerosis related ischaemic episodes. *Bhatia* (1995) have shown that the important risk factors of CVD are smoking, high BP, cholesterol level and diabetes. Although there are now newer risk factors like abdominal obesity, high triglycerides, insulin resistance, homocysteinaemia, fibroginen factors etc. these are yet to be proven (Padmavathi, 2002). Cholesterol phantom in mid-seventies (Raheja, 1970) in Indian kitchen leads to increased consumption of omega-6 fatty acids in the form of sunflower oil, saffler oil or kardi oil etc increases omega-6 to omega- 3 ratio from 4:1 to even 16:1 (Mitra and Bhattacharya, 2006). This caused alteration of viscosity and rheologic properties of blood (Chow, 1992). Diet in rural India contains about 80% of carbohydrates and is diabetogenic in nature and increases insulin resistance (Mitra and Bhattacharya, 2005). Contrary to the findings of Ghafoarunissa (1996) Mitra and Bhattacharya (2006) concluded that fat intakes in the diet did not depend on income in rural sectors. Diet has a profound role in the control of insulin resistant syndrome particularly Coronary artery disease (Raheja et al., 1970; Sanders et al., 1985; Ghafoarunissa, 1996; Luscombe et al., 2002; Mitra and Bhattacharya, 2005 and 2006). Mitra and Bhattacharya (2007) found while rural diet is diabetogenic in nature, increase in protein content in the diet was easier to comply and more satiating. It caused reduction of abdominal fat in males. Ghafoarunissa (1996) observed that in Indian rural diet fat intake, particularly intake of omega-3 fatty acid, is low and intake of fat is directly proportional to income. Sanders et al. (1986) showed that with a low fat intake the difference in effects of omega-3 and omega-6 fatty acids are marginal. Hence, the view expressed by Sanders et al. was contrary to the view expressed by Raheja et al. (1970) who links the diabetic explosion in India, to increase in consumption of omega–6 fatty acids which started from mid 70s in order to reduce blood cholesterol levels and subsequent coronary artery diseases therein. Ornish (1996) had advocated a low fat diet is beneficial for health but it has the disadvantage of low HDL level in blood. Hence, a diet with adequate fat and with

omega-3 and omega-6 fatty acids is good for health.

Benefits of Vegetarianism

Finally in vegetarians, factors other than the diet may also be involved in lowering the risk of heart disease, diabetes, obesity, hypertension, atherosclerosis and various conditions of insulin resistance. These include i) the nonsmoking and the non-alcoholic status of vegetarians, which may affect HDL-cholesterol levels, ii) their physically active lives, which may favorably alter apo-lipoproteins as well as HDL cholesterol, iii) their relatively low weights, which may decrease risks of hypertension and non-insulin dependent diabetes. It is also worth noting that the reduction in risks of coronary heart disease seems to be associated with the type of vegetarian diet that is followed rather than some genetic protective effect of vegetarianism (Sacks et al., 1975; Ruys and Hickie, 1976; Burslem et al., 1978; Vessby et al., 1980; Lock et al., 1983; Masarei et al., 1984). In India a lot of work has already been done on the role of garlic and onion in lowering blood cholesterol (Jain, 1975; Sainani et al., 1976). Maize bran has also been shown to have a protective effect on the cardiovascular status (Gupta et al., 1987). Increase in fibre content reduces the blood sugar and cholesterol levels (Ng, 1997; Mitra and Bhattacharya, 2006). Vegetarian diet is economic and ecologically balanced. Economic realities have to be taken into consideration. This includes, both, the finances to make comprehensive and acceptable diabetes care services available to the people, and more importantly, the capacity of the people to afford these services. The Indian government spends around 1.2% of its annual budget on health and as communicable disease prevention and management is still an important aspect of health in India, the money routinely allocated to non communicable diseases, and especially diabetes, is sparse. 1998 Nobel Prize winner in Economics Amartya Sen has said in the context of famines, “the root cause of starvation in famines is not the lack of food, but the capacity of the average person to buy the food”, it can be said that the root cause of a failure of a diabetes program is not only the availability of services, but the capacity of the average person to afford these services. The per capita income of an Indian has been estimated to be Rs.15,000 per year. In view of the significant disparity in incomes, most people earn much less than this. The 1998 World Development Report says that 52% of the Indian people live below the accepted poverty line. This is based on the rupee value vis a vis the dollar at 1985 rates. At that time, the rate was around Rs 14 to the dollar, whilst today it is around Rs 43 to the dollar. Consequently, the number of people who live below the poverty line is estimated by economists to be more than 75%. The Inequality Index in India is extremely high, and this again shows that although the per capita income may be reported as Rs. 15,000 per year, more than three fourths of the people earn less than this. The economic realities must be taken into account when drawing up any diabetes care programme. Any programme must only be available to the common people, but must also be accessible and affordable to them (http://www.diabetesindia. com/diabetes/itfdci.htm).

Diet in Selective Parts of India

South Indians are essentially rice-eating people and they have preparations made of rice for all the meals of the day. Lentils too are consumed extensively, as accompaniment to the rice preparations. Being on the seacoast, coconut is also used a lot in kitchens, as are fish and other seafood. While tamarind is used for adding that distinctive tang, peppercorns and chili, both green and red, are used to make the food hot. To neutralize the effect of the chili, and soothe the stomach, curd is used in a variety of dishes. Other spices like mustard, cumin, garlic etc. are used for tempering and seasoning. Though several communities in the state are strictly vegetarian, there is a whole range of non-vegetarian dishes - exotic, succulent, and full of fire. Fish and other seafood like crab are also cooked in the traditional Tamil kitchen with spices and traditional seasoning. In Southern parts of India, food has a ritual purpose that reminds the individual exactly where he or she belongs on the culinary map of community consciousness. This is best seen during those occasions when members of any family or community get together to celebrate an occasion (http://www.kuttyjapan.com/tamil recipes/idly.asp). Region-wise analysis showed a high prevalence of diabetes in the Andhra and Rayalaseema regions where rice is traditionally consumed more, hypertension in the Andhra region, and smoking in the Rayalaseema region. Lipid disorders were equally prevalent in all the

regions (Reddy et al., 2002). In Karnataka and Kerala dietary habits are slightly different from Tamils and Telugus. The impingement of western culture to the traditionals is less. Cooking patterns are different and sedentary activities are less. It has been reported that the incidence percentage of diabetes mellitus and cancer in India, parallel each other. However, we observed a low incidence of diabetes mellitus patients also having cancer in south Karnataka. Though the exact reason for this remains unclear an attempt has been made here to explain this phenomenon, hypothetically using information in literature, which suggests a suppression of cellular regene-rative activity by sugar and sugar phosphates. Cellular regenera-tive activity is well known to be a prerequisite for cancer (Maliyannar and Shrinivas, 2004). Kerala is facing a huge challenge these days in the form of growing incidence of diabetes and coronary disease. Kerala has now begun a unique campaign in the capital of Kerala, in the wake of acquiring the dubious status of being the epicentre of the country's diabetic population. Some estimates say close to Rs 5000 crore are spent each year to treat diabetes in the state, whose annual budget is just a little higher at Rs 5600 crore (http://www.my-kerala.com/n/health.shtml). Despite a fast proliferating diabetic and coronary disease affected population, Governmental efforts in dealing with it continue to be dismal and target lacking (http://www.dailyexcelsior.com/01may07/inter.htm). One of the main reasons for proliferating diabetic and coronary disease affected cases in Chandigarh is the sedate lifestyle, in take of junk food, obesity and inactive routine. Chandigarh scores high on all these ills. Unhealthy eating with increasing dependence on the "energy dense food" or simply put the junk food, is the main reason for increasing lifestyle ailments in the city. Statistics, however, prove the deplorable eating patterns in the city. As high as 51 per cent of the city's population rely on fried food (paranthas) in their daily diet, (as compared to nearby township area 43% and two per cent in villages), Physical inactivity is found in 50% of both male and female, 28 per cent in the age group of 35 to 54 years and 17 per cent above the age of 55 years are regular smokers and more than 40 per cent of the city's adult population consumes alcohol regularly (Chandigarh Tribune, 2005).

Difference in Dietary Pattern on Socio-Cultural Domains

Interpopulation differences exist in both diet and the socio-cultural factors both within and outside the subcontinent. Diversity of Indian population in intake of food, life-styles, socio-cultural beliefs etc are possibly due to different socio-cultural backgrounds. Type 2 diabetes prevalence rates are higher on the east coast of Andhra Pradesh, particularly Eluru and Tenali, where rice is traditionally consumed as only cereal compared with urban and rural Hyderabad, mainly wheat eating community. The dietary pattern, eating and methods of cooking vary in different parts of India (Ramaiya et al., 1990). Reddy et al. (2002) had shown that a high prevalence of diabetes in the Andhra and Rayalaseema regions, hypertension in the Andhra region, and smoking in the Rayalaseema region. Lipid disorders were equally prevalent in all the regions. The long term effects of intermittent starvation and the pathological metabolic stress consequent to it on the course of glucose tolerance are not known still yet though some populations in India, where incidence of diabetes is on higher side (tribal belts of Rajasthan and Gujrat) consume very little protein on some days and an alternate starvation-excess cycle exists (Ramachandran et al., 1990).

Difference in Prevalence of Diabetes and Coronary Artery Disease

Mitra and Bhattacharya (2006) observed that while studying rural Bengalee populace that in certain regions incidence of diabetes and Coronary Artery Disease were less, though major dietary ingredients and life-style factors were not altered (Bose, 1895). On careful analysis it was observed that in those selective pockets people are taking different herbal ingredients and also genetic factors are important.

Control Through Diet

The major portion of the fat in the diet comes form either refined vegetable oils as seen in the lacto vegetarian Indian diet or in combination with storage animal fats as seen in the western type of diet. All these fats are deficient in omega 3 fats and have elevated omega 6/ omega 3 ratios. To avoid this toxicity, it would be prudent to resort to the low fat dietary Pattern. Cooking fat may be limited to ½ kg/month/person. The diet may be supplemented with a small intake of fish or fish oil or flax oil, which provides omega 3 fat. This simple approach can save from the present day epidemics. Vegetables steamed or cooked with

very little oil, would ideally be the remaining one fourth of diet.

Since, oil and water does not mix, various emulsifying strategies are adopted by the body, using cholesterol, lecithin, and bile, to form complexes with the lipids initially very low density lipoproteins (VLDL), then low density lipoprotein (LDL) and finally to high density lipoproteins (HDL). The relative quantity of the later in the blood is a fair measure of the efficiency with which fat transfer has occurred, and is thus a positive indicator for the prevention of fat deposition in the blood vessels (Brennar, 1981).

People on high fat diets usually eat less fresh vegetables and fruits and thus may lack in the protective factors contributed by these foods. They are at increased risk for colon cancer. To decrease cancer risks plenty of fresh, different colored, seasonal fruits and vegetables are to be consumed. Aim should be for at least 5 servings of vegetables and fruits per day. Plenty of high fiber foods e.g. whole grains, whole fruits and vegetables, can supplement a daily fiber intake of 20-30 grams. Fat intake should be adjusted to 30% or less of total energy consumed. Fast food should be avoided as far as practicable. It is admitted that the enzymes of foods cooked at temperature higher than 50°C ordinarily get destroyed. Under these circumstances, if one fourth of the intakes of food were cooked, temptation of glands would make available digestive chemicals in large quantities.

Malnutrition of protein particularly at growing ages leads to M.R.D.M (malnutrition related diabetes mellitus). The studies on clinic children in Uganda where classical kwashiorkor is the prevailing form of PEM, showed a beautiful parallelism between plasma concentration of albumin and insulin observe Lunn and Whitehead (1973). Milward (1970) suggested that protein is a more important stimulus than carbohydrate. Fasting plasma insulin levels are generally low in severe PEM, rising during recovery and peaking during the phase of rapid growth. The subnormal insulin response to a glucose load as mentioned by James and Coore (1970) or to stimulation with glucagons, as stated by Milner (1971) may persist for many months after recovery. There is impaired glucose tolerance in some studies and that may be alleviated by addition of chromium. The insulin resistance may be a further factor contributing to glucose intolerance. Possible causal factors are the raised concentration of cortisol, growth hormone, and free fatty acids and reduction in binding site affinity rather than their number. As per Mitra and Bhattacharya (2005) the best indicator to prevent diabetes is to follow ADA guidelines regarding diet.

Recommended Dietary Factors for the Control of Type 2 Diabetes (Kahn and Weir, 1998, based on ADA guidelines)

Calories: Should be prescribed to achieve and maintain a desirable body weight.

Carbohydrate: Ideally should comprise 55-60% of the calories, with the form and amount to be determined by individual eating patterns and blood glucose and lipid responses. Unrefined carbohydrates should be substituted for refined carbohydrates to the extent possible modest amounts of sugars may be acceptable as long as metabolic control and desirable body weight are maintained.

Protein: The recommended dietary allowance of 0.85 g/kg body weight for adults is an appropriate guide for those with diabetes. Some reduction in protein intake from previously high consumption levels may help prevent or delay the onset of the renal complications of diabetes.

Fat/Cholesterol: Should comprise ω 30% of total calories, and all components should be reduced proportionately. Replacement of saturated with polyunsaturated fat is desirable to reduce cardiovascular risk. Cholesterol should be restricted to ω 300 mg/day to reduce cardiovascular risk. People should try to limit even reduced-fat foods and fat substitutes in their diets. Although one might believe that eating reduced-fat or fat substitute products means consuming fewer calories, this is often not the case. People who consume foods that contain fat substitutes do not learn to dislike fatty foods, while people who learn to cook using foods naturally lacking or low in fat eventually lose their taste for high fat diets.

Alternative Sweeteners: Both nutritive and non-nutritive sweeteners are acceptable in diabetes management.

Sodium: Should be restricted to 1000 mg/ 10000 kcal, not to exceed 3000 mg/day, to minimize symptoms of hypertension. Severe sodium restriction may, however, be harmful for persons whose diabetes is poorly controlled and for those with postural hypotension (low blood pressure and consequent dizziness when first standing up) or fluid imbalance.

Alcohol: Should be used in moderation and may need to be restricted entirely by persons with diabetes and insulin induced hypoglycemia, neuropathy, poor control of blood sugar blood lipids, or obesity.

Vitamins/Minerals: Should meet recommended levels for good health. Supplements are unnecessary for persons with diabetes except when caloric intake is exceptionally low or the variety of foods consumed is limited. Calcium supplements may be necessary under special circumstances.

Different Type of Diets Recommended for Healthy Heart

Currently, there is much controversy over the best balance of carbohydrates, fats, and protein. The three major cholesterol reduction diets are the following: the Step 1 and Step 2 diets recommended by the American Heart Association; the Mediterranean Diet; and very low-fat diets, such as the Ornish Program (Reversing heart disease: Rating the different diets, May 1997). Some experts believe that either the Step 1 or the Mediterranean diet is probably adequate for people with no coronary artery disease and normal LDL levels (<160 mg/dl) and for those with low LDL levels (<130 mg/dl) with only one or two risk factors for heart disease, such as low HDL levels and smoking. For those with higher cholesterol levels, the Step 2, Ornish, or Mediterranean diets may be effective depending on individual conditions. In general, most patients find it difficult to comply even with fat restrictions recommended under the Step 2 diet, which calls for fat intake being 20% of daily calories. The Ornish program is far stricter. It was reported that restricting fat intake to only 26% of calories reduced LDL levels as effectively as restricting fat intake to 18%. Consuming more fats (46% of their calories) had no greater risk, in general, for heart disease than those who ate less (29%). However, consuming trans-fatty acids had more than double the risk of a heart attack compared to those whose diets were low in this dangerous fat. The type of fat is more important than the amount (Mitra and Bhattacharya, 2006). Low-fat diets, in fact, have recently been associated with a higher risk for stroke. The Mediterranean diet has great appeal, then, because of the foods allowed, including olive oil and wine (Red, white, and beer, 1997). It significantly reduced the risk for a second heart attack after an average of four years compared to a conservative Western diet. Of great concern with the Mediterranean diet, however, is the risk for weight gain, and it is recommended only for people who are reasonably lean. A fourth heart-healthy diet is called the Dietary Approaches to Stop Hypertension (DASH) diet, which has been designed specifically to help people reduce blood pressure (Reversing heart disease: Rating the different diets, 1997).

Fat-restrictive diets may even be harmful. Some have reported that high-carbohydrate and low-fat diets can reduce HDL levels and increase blood sugar and triglyceride levels. Very low-fat diets may also increase the risk for stroke. Many people who reduce their fat intake may also not consume enough of the basic nutrients, including vitamins A and E, folic acid, calcium, iron, and zinc (Daviglus et al., 1997). People on low fat diets should consume a wide variety of foods and take a multivitamin if appropriate. Still, low-fat diets that is high in fiber, whole grains, legumes, and fresh produce offer health advantages in addition to their effects on cholesterol. They are effective in keeping weight off and they protect against high blood pressure and possibly against certain cancers.

Effects of Eating Less

Clinical studies involving different species of animals have shown that eating less (caloric restriction or CR) reduces the risk of cancer, diabetes, stroke and heart disease. Larsen (2004) reported a study of 18 volunteers who had been practicing CR and compared the results to 18 people who are eating a normal diet for an average of six years while performing identical activities. The members of the CR group were found to have significantly lower blood pressure and formation of atherosclerotic plaque in their arteries with lower levels of triglycerides, cholesterol and C-reactive protein. This leads to reduce risk of Stroke, Heart failure and Other Heart Diseases, Hypertensive Nephropathy, Cancer and Type 2 diabetes.

However, eating less can result in nutrient deficiencies (Larsen, 2004). Das et al. (1984) showed that the undernourished have lower levels of plasma lipids and a favorable distribution of cholesterol among the lipid fractions from the point of view of vulnerability to development of atherosclerosis. Sanders et al. (1984) showed that with a low fat intake the difference in effects of omega-3 and omega-6 fatty acids are marginal. Asgary et al.

(2000) report a study with fifty healthy 30-60 year-old men intending to fast during the holy month of Ramadan. Results showed that the malondialdehyde (MDA), Triglycerides (TG) and Cholesterol levels decreased significantly during Ramadan. The levels of Fasting Blood Sugar (FBS) decreased too, but this reduction was not significant. The level of Conjugated Dienes (CDs) was increased significantly. Since MDA is significantly decreased during Ramadan, it seems that fasting for a month may have preventive effects on atherosclerosis, considering that LDL-oxidation plays an important role in the production of atherosclerotic plaques.

High cholesterol levels can lead to heart disease. American diabetes association recommends that in a diabetic LDL cholesterol should be below 100mg/dl, triglycerides below 150-mg/dl and HDL cholesterol above 40mg/dl. It is reported that an intake of fat as per ADA recommendation is not harmful to Indian Rural diabetic particularly living in Bengal (Mitra and Bhattacharya, 2005 and 2006).

Other Lifestyle Changes with a Healthy Diet

Obesity and Weight Gain

Spectrum of insulin resistance includes obesity, dyslipidaemia, atheroscerosis and coronary or cerebro-vascular diseases, type 2 diabetes and hypertension. Obesity is associated with rise in total cholesterol and triglyceride levels and lower HDL levels. An average increase of one pound of fat a year, as people aged, caused total cholesterol to rise and HDL levels to drop.

Exercise

Dietary changes improve cholesterol levels only when an aerobic exercise program is also included. In addition to having a beneficial effect on cholesterol, exercise is critical to maintaining a healthy heart; it helps keep weight off and lowers the heart rate and blood pressure. People who maintain an active lifestyle have a 45% lower risk of developing coronary heart disease than do sedentary people. Regular aerobic exercises like brisk walking, jogging, swimming, biking, aerobic dance etc are the best forms of exercise for lowering LDL and raising HDL levels. It may take up to a year of sustained exercise for HDL levels to show significant improvement. Mitra and Bhattacharya (2007) found that that routine of brisk walks for an hour at a speed of 6 km/hour is better for reduction of blood sugar and bad cholesterols (LDL and VLDL) and improve in good cholesterol (HDL). Resistance (weight) training offers a complementary benefit by reducing LDL levels. After a high-fat meal, triglycerides can be lowered either with a single, prolonged (about 90 minutes) aerobic session or by several shorter sessions during the day (Stefanick et al., 1998). Active yoga or breathing exercises as a part of exercise programme reduces stress of all kinds and different stress relieving procedures are in practice and recorded even in ancient Indian literatures.

Different Types of Diets as per Religious Believe

According to Srimad Bhagabat Gita persons are of three dispositions- Satvic, Rajsic and Tamsic. Foods which promote longevity, intelligence, vigor, health, happiness and cheerfulness, and which are juicy, bland, sustaining and naturally agreeable are dear to the satvic (virtuous, gentle and those endowed with goodness) type of person. Foods, which are bitter, acidic, salty, over hot, pungent, dry and burning and which cause suffering, grief or sickness, are dear to the 'Rajsic' type of persons. Foods which are half cooked or half ripe, insipid, putrid, stale and polluted, and which are impure too, are dear to persons of a 'Tamsic' disposition. Rajsic (endowed with passion) and tamsic (malignant, wicked) are the two lower categories of humans. Islam and Christianity grades food according to its source and quality- some foods are considered pious and some forbidden.

Yoga and Food

Yoga is a healthy life-style pattern widely used in India, as one of her traditional heritage having immense role in mind and disease control. According to the science of yoga, a person who has not controlled his sense organ of taste cannot control his other sense organs. Human body has two main mechanisms, one that nourishes the body and the other that cleanses the body by eliminating the remaining refuse. By taking excess food, life span decreases (http://www.abc-of-yoga.com/beginnersguide/yogasystem.asp). The subjects under consideration, therefore, are: what to eat, how much to eat, when to eat and how to eat. According to the science of yoga, human body has two main mechanisms, one that nourishes the

body and the other that cleanses the body by eliminating the remaining refuse. By taking excess food, health goes down, life span decreases. It is considered to be bad. A person who has not controlled his sense organ of taste cannot control his other sense organs. The subjects under consideration, therefore, are: what to eat, how much to eat, when to eat and how to eat.

General Considerations of Intake

Adequate quantity of food should be taken only once a day. Other meals should be small. It is more appropriate to take adequate quantity of food during the daytime. There is a well-known saying, "Those who eat only once are Yogis, those who eat twice always remain happy and those who eat thrice remain acutely diseased". Eating between meals should be stopped. One major meal and one or two small refreshments are good enough for the body. There are many benefits in taking food at fixed hours. Ayurved (Bhattacharya, 1977) prescribes: "When urine and stool have been properly eliminated, when mind is at peace, elements are balanced, stomach is free of wind, body is light, cognitive sense organs are efficient, and appetite is there, only then may you take food!" Food should be taken one hour after moderate or severe exercise. If good nutritious food is not eaten the right way, the body cannot derive full benefit from it. It is necessary to cultivate right habits of taking food. Almost all the fruits are eaten raw. Cucumber, gourd, and tomatoes, though vegetables, are used like fruits. Dried fruits, nuts, kernels of fruits and seeds of various types are also eaten without cooking. Dried seeds of sour pomegranate, mint, coriander, tamarind, amla etc. are eaten in the form of chutnees. Carrot, radish, cabbage, turnip, beet, sweet potato and onion etc. can be eaten raw in salads. Soybean, bathua *(C. album)*, pumpkin, and squash etc. are very tasty when grated and taken with curd. Wheat, gram, mung, peanut (ground nut), methi (fenugreek) etc. can be sprouted and eaten. The above-mentioned foods, milk and yogurt formed three fourth of requirements, foods not fried and vegetables steamed or cooked with very little oil would ideally be the remaining one fourth of diet. Vegetables should not be combined with fruits, and fruits shouldn't be combined with a protein meal. Therefore the very important vegetables could accompany lunch and dinner, which often include proteins. Fruit should be taken for dissert only after the meal has had time to digest. Fruit may be taken in the morning whereas vegetables are appropriate for the evening and night. As far as snacks are concerned, nuts are excellent, and can be taken earlier to fruits as they are harder to digest. Bitter digestive remedies are usually discouraged though the bitters stimulate the digestive activity, including secretions of protective fluids, such as bicarbo-nates from the liver and pancreas (Bhattacharya, 1977).

Fat increases the risk of cancer. People on high fat diets usually eat less fresh vegetables and fruits and thus may lack in the protective factors contributed by these foods. They are at increased risk for colon cancer. To decrease risks of cancer, plenty of fresh, different colored, seasonal fruits and vegetables are to be consumed. Aim should be for at least 4 to 5 servings of vegetables and fruits per day. Plenty of high fiber foods like whole grains, whole fruits and vegetables should be taken, so that daily fiber intake is of 20-30 g/day. Obesity can be avoided through physical exercise and lower energy intake. Fat intake should be adjusted to 30% or less of total energy consumed (Macrae et al., 1993).

Cooking though has some advantages but it reduces the concentrations of vitamins, enzymes and some mineral salts. Despite some of the advantages accruing from cooking, it must be conceded that uncooked food is much better for healthy living. Cooking should preferably be done in earthenware or stoneware utensils, enamelled vessels, brass or copper vessels. Aluminium foil should not be used to any preparation involving liquid food. It has not yet been established if stainless steel utensils are safe. Steaming, boiling and banking are acceptable. Roasting if it involves color changes is bad and frying is the worst because the oil penetrates the food through and through. High temperature-short time methods of cooking are considered better. Steam pressure-cooking also preserves nutrients better. For minimizing nutrient losses during cooking, fresh foods that are not cut or bruised should be chosen. If the peel or outer layer is palatable, the whole food should be cooked without cutting. If cutting is necessary, then the pieces should be kept large and should be cut just before cooking. In case of boiling, food should be added to the minimum quantity of water and could possibly be used as soup. Food should be cooked at high temperatures for the shortest time possible using a tight fitting lid. Bacteria do not multiply in the

cooked food straight away due to its "lag phase" - generally estimated at about an hour and a half. Bacteria can multiply rapidly at any temperature between 5°C and 63°C. So the strategy should be never to leave the food between these two temperatures for more than 90 minutes at a time. While heating the food, temperature of more than 75°C must be reached to ensure that all bacteria are killed. This will also destroy most of the enzymes that may have by any chance been left in that food. Food that has not been cooked on fire has a great importance for diet. Their vitamins are not destroyed and their enzymes also remain intact. It is admitted that the enzymes of foods cooked at temperatures higher than 50°C ordinarily get destroyed but then this is also scientifically proven that if the food is such that it does not tempt some one, then the glands do not release the enzymes needed for digestion. Under these circumstances, if one fourth of the food is cooked and tempting glands will make available digestive chemicals in large quantities (Chaudhuri, 1986).

Sprouts relatively contain the largest amount of nutrients per unit of any food known to man. Enzymes are produced. Starch gets converted into glucose. Protein is transformed into amino acids. Vitamin value increases (Macrae et al., 1993). The vitamin C value of wheat increases 600 percent in the early sprouting period, vitamin B increase over 1000 percent in the sprouted seeds, cancer was inhibited up to 90% when healthy bacteria were exposed to a cancer causing substance in the presence of a juice made from wheat sprouts (Bhattacharya, 1977). Sprouts are nutritionally complete, economically sound and for survival a great food, for instance alfalfa sprouts are an excellent and soft food. They are easily digested and assimilated even by infants and the elderly. They contain every known vitamin in perfect balance, necessary for the human body (Macrae et al., 1993).

CONCLUSION

Exact cause of increase prevalence of diabetes in persons of Indian origin is unknown. Nature and nurture both may have a role. While we have a little to do, at present with nature, we can definitely modulate nurture for desirable results. Dietary control in insulin resistance, intake of culturally acceptable yet diabetic preventive food and not encouraging sedentary habits help to reduce the prevalence of diabetes and is most beneficial in Indian context, as it is cost-befitting. The rich cultural reservoir of traditional Indian medicine is supported by diverse cultural sources, which have to be evaluated fully. The popular therapeutic habits and successes have to be retrieved and validated in order to use this information to develop new cost-effective, safe and efficacious system of medicines. A national congress on traditional sciences and technologies of India during 1993 was organized specifically to comprehend and evaluate our traditions in diverse domains of knowledge and practice. This was considered an important issue in our developmental efforts at the grass-root levels, as many of these living traditions still have the potential to contribute to the physical well being of our people. Interpopulation differences exist in both diet and the socio-cultural factors both within and outside the Indian subcontinent. Available data suggest that diet is one of the main culprits; other important ones are life-style and stress. The dietary pattern, eating and methods of cooking vary in different parts of India.

Although dietary approaches differ in important aspects, they have some recommendations in common: all stress in the value of fiber-rich whole grains, legumes, and fresh fruits and vegetables, and when fats are recommended, they are monounsaturated and polyunsaturated. Weight control and exercise are essential companions of any diet program. Reduction of all kinds of stress through stress reduction programmes is beneficial. A combined approach will play a rich dividend in control of cardiac diseases.

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KEYWORDS Diet. Food Habits. Type 2 Diabetes. Heart Disease

ABSTRACT Incidence of type 2 diabetes and cardiac diseases are on the rise and are at alarming rate in Indian subcontinent. Diet, life-style factors and stress are the cardinal factors in the aetiogenesis of those diseases. Other important risk factors are CVD, smoking, high BP, cholesterol level, abdominal obesity, high triglycerides, insulin resistance, homocysteinaemia and increase in fibroginen with defects in fibrinolysis. Interpopulation differences exist in both diet and the socio-cultural factors both within and outside the Indian subcontinent. The dietary pattern, eating and methods of cooking vary in different parts of India. Currently, there is much controversy over the best balance of carbohydrates, fats, and protein. Although dietary approaches differ in important aspects, they have some recommendations in common: all stress in the value of fiber-rich whole grains, legumes, and fresh fruits and vegetables, and when fats are recommended, they are monounsaturated and polyunsaturated. Weight control and exercise are essential companions of any diet program. Reduction of all kinds of stress through stress reduction programmes is beneficial. A combined approach will play a rich dividend in control of those diseases.

Author's Address: **Analava Mitra,** *Assisstant Professor,* School of Medical Science and Technology, Indian Institute of Technology, Kharagpur 721 302, West Bengal, India
Telephone: 03222-282657, *Fax:* 03222-282631, *E-mail:* amitra@adm.iitkgp.ernet.in