Recent contributions to the epidemiology of diabetes mellitus in India

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"Today on the eve of the twenty first century, we see that the world health situation is no longer that clear cut and simple. Many developing countries have made great progress in combating infectious diseases and malnutrition, thereby improving the length and quality of life of their people. But rapid urbanization and industrialization in those same countries, together with the adoption of modern life style that adversely effect health have brought new problems in the form of chronic non-communicable diseases. In many developing countries these new problems are arriving before the old one's are resolved leading to a double burden of the disease," Nakajima H, Director General, WHO 1991 (1).

"Diabetes Mellitus (DM) can no longer be considered a disease of affluent nation alone, it has become a global problem, a major epidemic of the twentieth century, and one which shows no sign of abating" (2). DM now affects a higher proportion of persons in many developing countries than it does in Western countries where two or three percent of the population is affected. This trend has been linked with the increasing life expectancy, rural urban shifts, moves from traditional to modern life style, changes in diet and physical inactivity and obesity (3). DM today affects over 50 million people in the world and about one half of them are living in the developing world. While in the West, epidemiological studies indicate one unknown diabetic for every known case, the situation in developing countries is vastly different. For every known diabetic, there may be upto four others who are undiagnosed.

Insulin dependent diabetes mellitus (IDDM) assumed to be very rare among Asians, is probably due to the fact that many children who develop DM die undiagnosed especially if they live in remote or rural areas where medical care facilities are sparse. The onset of NIDDM often cannot be precisely known. In developing countries with absence of regular health check-up programmes, persons with NIDDM come for medical attention only when a vascular complication brings in physical disability, a major cause of early death in such diabetics.

There is now a growing awareness at the International level to recognise the risk factors for non communicable diseases in different populations. As an initial step the attempt is to define the extent of the existing problem in each ethnic group. The adoption of methodology and criteria for the diagnosis of DM by WHO (Technical Report series 6,5,7, 1985) (4) has contributed considerably toward standardisation and uniformity in epidemiological studies in different populations. Such studies provide data wherein comparison between different population variables as anthropometry, nutrition or social attainments can be arrived at.

To transcribe results of any epidemiological study and its relevance, it is pertinent to gain information regarding the reference population profile and its characteristics.

According to the recent census data of 1990 (5), age profile of population in India is as follows:

Age-related population distribution is <15 yrs 40%, 15-54 yrs 50% and >55 years 9.0%, Expectation of life is 58 yrs.

The per capita income is Rs. 2000 (dollars 100) per annum, literacy rate is 40%. Seventy-five per cent population is rural while 25% is urban. Medical care facilities are variable and range from doctor population ratio of 1 :1000 to 1 : 1 5000 (average 1 :4000). The energy intake is on an average 2000 k cal/day. Major food available is cereal and lentils and constitutes the bulk of total calories; vegetables and fruits are the next items available. Milk and milk products form 1/6-1/8 of total calories and oil or cooking fat are in a similar proportion. Animal proteins are available sparingly. In terms of dietary constituents with an average calorie intake of 2000 Kcal/day carbohydrates are 65-70% fats 20-25% and proteins 10-15%. It has been observed from the earlier studies that recognised risk factors for DM especially NIDDM type are miniscule for a developing country like India e.g. population base has a lower body mass index, lower mean serum cholesterol value, low mean blood pressure, and shorter life span.

With this background information, data will now be presented from some of the recent epidemiological studies in India in the following contexts.

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A) rural locale
B) high altitude
C) urban (industrial setting)
D) endemic area with chronic pancreatitis
E) migrant Indians

A) RURAL LOCALE

Rural areas from different parts of the country were selected (Ahmedabad, Calcutta, Delhi and Trivandrum) for this study. In an earlier study in 1975 the same regional areas were selected, except that Pune and Calcutta could not be included in the present study due to financial constraint. In the selection of this particular section of the population, the interest was that the majority living in the rural areas are dependent on agricultural economy, are actual farmers and follow a traditional life style. The main findings of the study based on WHO criteria are shown in table 1.

Comments

This is the first study in rural India on the prevalence of DM employing the WHO criteria. In the early study of 1975, the glucose load given was 50 g p.o. and capillary blood glucose value of 130 mg% or over was employed for the diagnosis of abnormal glucose tolerance. In the last decade and a half the scene of the rural India does not seem to have altered. The overall prevalence of DM is 1.96%. The economic betterment and the developmental changes in the life style seem not to have reached the rural sector of the country as yet (6).

B) HIGH ALTITUDE

High altitude is defined as a height of 6000 ft. above sea level. Area selected was Kalpa in Kinaur district of Himachal Pradesh. Total eligible population was 1203 of village Chini. House to house survey was conducted. Total number screened were 999 (432 males 567 females). The results based on WHO criteria are shown in table 2.

Comments

Some of the characteristics of the population in this study need comments: Family history of DM in parents or siblings was forthcoming in 0.7% instances. BMI exceeding 25 was observed in 3.7% male, and 3.2% female subjects. Activity score indicated more than 90% with moderate or light activity, nearby 60% being farmers. All the diabetics in the study population were above 45 years, as such increasing age seems to be a contributory factor. In men family history was more likely, while women appear to acquire DM due to sedentary habits and environmental factors (7).

Table 1.

Location	Total Population screened	Known DM	Detected DM in Survey	Detected IGT* in Survey	Total DM
Ahmedabad	1294	11 (0.85%)	40 (3.09%)	6 (0.46)	3.9%
Calcutta	2375	9 (0.37%)	11 (0.46%)	8 (0.33%)	0.83%
Delhi	992	11 (1.1%)	4 (0.4%)	3 (0.3%)	1.5%
Trivandrum	1488	17 (1.14%)	18 (1 .2%)	3 (0.20%)	1.34%
Total	6149	48 (0.78%)	73 (1.18%)	20 (0.32%)	1.96%

*Impaired glucose tolerance

Table 2.

Total Population screened	Known DM	Detected DM in Survey	Detected IGT* in Survey	Total DM
999	2 (0.2%)	2 (0.2%)	10 (1.0%)	0.4%

*Impaired glucose tolerance

Table 3.				
Total Screened	Known DM	Detected DM in Survey	Detected IGT* in Survey	Total DM
2572	53 (2.0%)	55 (2.1%)	63 (6.3%)	4.1%
*Impaired glucose tolerance				

Table 4.				
Total Screened	Known DM	Detected DM in Survey	Detected IGT* in Survey	Total DM
555	29 (5.3%)	22 (4.0%)	56 (10.0%)	9.2%
*Impaired glucose tolerance				

C) URBAN INDUSTRIAL SETTING

In an industrial setting in the neighbourhood of Delhi, a prospective study on glucose tolerance and cardiovascular profile was carried out in the adult population on voluntary basis. WHO criteria were employed for the assessment of glucose tolerance and modified Minnesota code for ECG interpretation. Total individuals screened were 2572. Results are shown in table 3.

Cardiovascular status was as follows: Hypertension: control group 0.6%, IGT 13%, DM 23.2%. Coronary probable: control group 0.8%, IGT 1.8%, DM 4.6% coronary possible, control 1.6%, IGT 10.4%, DM 20.3%.

Comments

Status of the subject was reviewed every six months. At the end of 3 years follow up complete data on the following groups was available for the interpretation. Normal subjects (186) selected on age/sex matched basis, IGT (43) and DM (39). Of the normal group on repeat glucose tolerance 4.8% had developed IGT and 1.2% were diabetics. Of the IGT group, on repeat assessment, 13.9% had become diabetics in 3 years. In the IGT group, coronary artery disease was observed in 4.6% and in those with DM it was 7.7% (8).

D) ENDEMIC AREA WITH CHRONIC PANCREATITIS:

The area selected was Kottarakkara Taluk in Quilon district in Kerala State (9). In Kottarakkara the total population is 28,567. Prevalence of chronic calcific pancreatitis is in 1020 and if non-calcific pancreatitis included it is 1 :793. 483 persons had been selected from this population for the study, 157 with abdominal pain suggesting pancreatitis, 266 with DM and 60 with malabsorption or malnutrition.

The diagnosis of chronic pancreatitis was based on radiological or ultrasonic evidence of calculi or hyperechogenicity. 50% of the NIDDM in this group were controlled by diet or oral hypoglycemic agents.

The total population was 28567, DM was present in 0.88% and chronic pancreatitis in 18.6%.

Comments

48.1 % of pancreatic diabetics were below the age of 30 yrs. This brings out the distinction from the atypical young ketosis resistant group as all of the diabetics in this group required insulin therapy, were below 30 yrs. and have a BMI less than 19. No denominator in the nutritional habits could be deciphered as contributing to pancreatic diabetes in the group evaluated by 24 hr recall dietary history.

E) MIGRANT INDIANS

This study has been conducted in palm oil state of Klang in Malaysia. Indians form 18.5% of total population and are the third largest ethnic group after Malaysians and Chinese. The group originally came from South India and are at present 2nd or 3rd generation of the original settlers. Total eligible population and analysis of results is shown in table 4.

Comments

High prevalence of DM amongst migrant Indians was confirmed though it was less than reported from Fiji or Mauritius in migrant Indians. Correlation analysis of IGT and DM with clinical variables brings out significant ($p < 0.05$) association with age, family history, waist hip ratio and blood pressure. In women, there was relationship to parity (number of pregnancies) and age at last delivery (10).

OVERVIEW OF EPIDEMIOLOGICAL STUDIES

The overall assessment of the studies brings out the following features:

Employing uniform methodology and standard criteria of WHO, significant variability in the prevalence of DM in different parts of the country is present. The prevalence varies from 4.1% to 0.4% (within the country) and upto 9.2% amongst the migrants. Endemicity index (IGT/DM ratio) is lowest in the rural India while in all other areas it is more than unity indicating a potential risk of increase in future as being observed in the urban or in migrant Indians.

Age has a definite relationship to appearence of DM. While this effect becomes apparent after the age of 40 yrs, longevity being 60 yrs. in India, the proportion of aged population forms only 10% of total inhabitants, and as such do not add much to the burden of DM in the country at present.

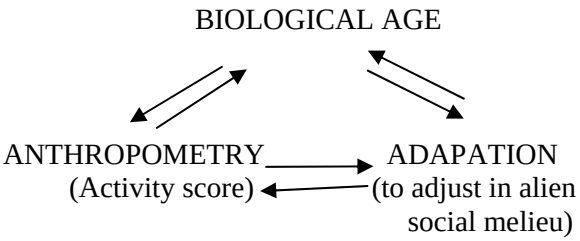
Relationship of glucose tolerance to body fat distribution, W/H ratio was worked out in migrants. It is positively associated with the presence or absence of DM in both sexes on linear correlation but not on multiple regression analysis. Activity score as assessed by the nature of locale and occupation (high altitude, agriculture, labour intensive) would be suggestive of inverse relationship with DM, prevalence rising with the lower activity score. With the presently available data, relationship with family history, sex, caloric intake, and body mass index is not forthcoming. In the select area of chronic calcific pancreatitis, the overall prevalence of DM is as in rural India.

From the prospective study, IGT has three times more risk of evolving in DM in three years than the normal control. Perhaps much more serious is the risk of coronary artery disease, which is 5 times more than the normal population.

With further economic development and social change, there is a possibility of increase in prevalence of DM as has been the experience in the developed countries.

With increase in longevity, there will be an increase of DM in our ageing population as well. Further characterization of risk factors peculiar to India need to be elaborated. Migration in the country (rural-urban) or intracountry (in-land to foreign land) is significantly affecting the prevalence of DM. The contributory factors for this need further in depth studies. In our experience IGT is indicative of endemicity index as well as the risk of coronary artery disease.

The presently held hypothesis of thrifty gene, nutrition and obesity causing DM (especially NIDDM) seems quite outdated. There is emerging evidence now from the present studies that increasing susceptibility to DM relates to increase in biological age span, acquired a thropometric features relating to activity score and capability of adaptation in a new social melieu.



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