Population based family history analysis of Brahmins in a small town in India for the prevalence of type-2 diabetes mellitus

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OBJECTIVES: The objective of this study is to determine the inheritance pattern of type-2 diabetes and make stratification for the general population risk.

MATERIALS AND METHODS: A questionnaire was developed for obtaining the family history. Analysis of the data was carried out by using student and Chi-square tests and for stratification; the guidelines of Scheuner et al. were followed.

RESULTS: The pattern of inheritance is the male sex specific (χ² =13.44). The mean age of onset of diabetes in parents was 58.61 ± 2.94 and in offspring 46.75 ± 2.54. In all 47.22 ± 11.53% families were found in high risk and 31.94 ± 10.77% in the moderate risk category. In female diabetics, the onset was in the age range of 41-60 years.

CONCLUSION: We found a high-risk of diabetes and familial clustering in successive generations of Brahmins with prominent male sex specificity. In females onset of diabetes was coinciding with the period around menopause.

Key words: Brahmin community, family history, inheritance pattern, risk stratification, type-2 diabetes

Introduction

Rahuri is a small town located on the banks of Mula River North of Ahmednagar city in the state of Maharashtra in India. It has latitude of 19°24’ and longitude of 74°29’.

There are 120-130 families belonging to the Brahmin caste in this town. It is a minority caste that is economically and socially advanced. The population size of this community is estimated to be 2500-3000.

Diabetes mellitus is a group of metabolic disorders with a partial or absolute insufficiency of insulin secretion and with various degrees of insulin resistance. The type-2 form of diabetes is one of the most common non-communicable diseases in the world. The so called diabetes epidemic is related to type-2 diabetes (non-insulin-dependent diabetes mellitus), which is spreading both in developed and developing nations.¹² Non-communicable diseases such as diabetes have become the serious public health challenge of this century due to its impact on individual and national health. The world-wide prevalence of diabetes is predicted to reach 4.4% in 2030 by the World Health Organization (WHO).³ The WHO has predicted that India would experience the largest increase in prevalence of type-2 diabetes and would have the greatest number of a diabetic individuals living by the year 2030.

From a genetic perspective, the population of India is unique in size and level of diversity. It is multi-religious with a majority of the population following the Hindu religion. In this country, there are many castes sub-castes and further subdivisions in all religions. As a result, the Indian population is composed of many endogamous subpopulations. Naturally various genetic pools have been formed in the Indian society. The clinical consequences of such complex differentiation have been largely ignored.⁴
Data on the prevalence of type-2 diabetes in India is very limited and very little information is available for the caste and sub-caste wise break up. Not only this, even the data considering socio-economic, rural-urban and geographical disparity on the prevalence of type-2 diabetes is limited.[5]

Kumar et al.[6] have observed a high prevalence of type-2 diabetes in urban areas of Assam state of India. In South India, most of the studies are focused on the urban areas in cities such as Hyderabad and Chennai. However, recent studies have shown an increase in diabetes in peri-urban villages and rural areas in South India.[7,8] In Western India, majority of studies on the prevalence of type-2 diabetes have been conducted in Mumbai and Ahmedabad. The conclusion of all these studies is that there is an explosion of type-2 form of diabetes in India irrespective of rural or urban population even though the prevalence of diabetes in rural India is lower than the urban parts.[9] Recent studies carried out by Kothari et al.[10] have observed a very high prevalence of type-2 diabetes in the “Bhargava” sub-caste of the Brahmin population in India.

Family history is the most easy and relevant way of forecasting prevalence of diabetes. In fact, some studies have suggested that the contribution of family history could be an independent guide for assessing risk of the disease.[11-13]

Population based family history analysis for type-2 diabetes and its stratification as per the Scheuner et al. guidelines is important in India for differentiating susceptible castes and sub-castes for improving the health standard. The present analysis is on a sample data of 72 Brahmin families of the Rahuri town.

Materials and Methods

A core of set of questions was developed in the local language for collection of the family history for type-2 diabetes mellitus from the head of the family. In the questionnaire, maternal family history was also obtained since it is also a strong independent risk factor.[14]

A door-to-door approach was preferred for filling the questionnaire. The face-to-face interview with the family head made us easy to construct pedigrees including three generations and in some cases even four generations.

The questions were phrased precisely for obtaining the desired information. The reporting accuracy was confirmed from grandparents, aunts, uncles and other relatives for the validity. The medical reports, prescriptions, diagnosis, the age of onset etc., were also confirmed while filling the questionnaire. In short, the analytical validity of family history was increased by filtering much of the noise. Finally, the signature of the family head was taken at the end of the questionnaire confirming the authenticity of the information. The privacy of information was very strictly maintained for avoiding legal and social implications.

We were able to obtain the family history for type-2 diabetes from 76 families while 7 families refused to respond positively. Out of 76 families, the family history of 4 families were not complete enough to construct a pedigree and hence omitted from data analysis.

Finally, the family history of 72 families was used for constructing pedigrees and further analysis. Data were analyzed for (1) general population risk on the basis of suggested guidelines for risk stratification based on family history,[15] (2) pattern of inheritance, (3) susceptibility among either sex, (4) difference in the age of onset among parents and offspring and (5) incidence of type-2 diabetes among females by using Chi-square and t-tests.

Results and Discussion

In the population being analyzed, there were 140 males and 71 females with type-2 diabetes among 1136 individuals of 72 families [Table 1]. The families were classified according to Scheuner et al. guidelines [Table 2a]. This classification shows that people at high and moderate familial risk for type-2 diabetes were very common in the Brahmin population of this town.

As far as the age of onset of type-2 diabetes is concerned, we were able to obtain the age of onset of 54 affected existing females and 90 affected existing males. In females, the spectrum of age of onset is quite narrow and it falls in the age range of 31-60 years. On the other hand, the spectrum of the age of onset is
quite broad in males and falls within the age range of
21-80 years [Table 2b]. In females, most of the cases
of onset of type-2 diabetes fall in the age range of
41-60 years. This age in females is a period around
menopause. Higher percentage of onset of type-2
diabetes within this period among females cannot rule
out the possibility of hormonal changes to be one of the
factors in the process of diabetogenesis.

Data analysis for the pattern of inheritance [Table 2c]
shows equal risk of inheriting diabetes for male and female
offspring when both parents are diabetic. However, sons
are more affected when either of the parents is diabetic.
From the same table, it is to be noted that diabetic sons
were more likely to have a diabetic father – suggesting a
male sex specific paternal inheritance. The t-test shows
the mean parental age of onset of type-2 diabetes is
58.61 ± 2.94 and that in offspring 46.75 ± 2.54 in this
population. Thus, there is a decrease in the age of onset
when there was a parental history of type-2 diabetes. It
indicates that the presence of diabetes in the family results
in predisposition to diabetes in subsequent generations
with clustering of different sets of genes, which could be
responsible for type-2 diabetes in different families.

This study is limited and needs incorporation of
information regarding other common chronic conditions
within responders’ pedigrees. Our next task is to collect
the family histories for type-2 diabetes from different
communities including other common chronic conditions
and make a comparative study for understanding
relations and severity. In India, genetics professionals
are almost nil at district and rural levels. This is a very
unfortunate situation, because is where the bulk of
Indian population resides. Primary care physicians fail to
recognize the importance of the family history for disease
risk prediction and prevention. Majority of the physicians
lack the knowledge of genetics if this situation were to
be corrected, prevention and control of disease would
be easier than it is today.

**Conclusion**

This study shows that in the Brahmin community high
and moderate risk families are more with a tendency of
familial clustering of genes in successive generations.
Male sex specific susceptibility is very prominent and in
female diabetics age of onset coincides with the period
around menopause in most of the cases.

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