

# Inheritance of Diabetes Mellitus, Hearing Impairment and Epilepsy in Relation to Endogamy

T. Subalakshmi\*, P.J. Jega Chandra Mohan\*\*

## Abstract

Consanguineous marriage is an intra-familial relationship between two people who share a common ancestor. This type of practice is occurring in most populations, with varying percentages among all marriages in South India. The present study was carried out to estimate the prevalence of consanguinity, degree of consanguinity and patterns of abnormalities among the population. We interviewed 2673 families to determine the effect of consanguinity on common hereditary disorders such as diabetes, hearing impairment and epilepsy in Sivagangai population, Tamil Nadu between November 2015 and March 2016. The degree of consanguinity between each female and her spouse and the degree of consanguinity between their parents were recorded. Of the selected families approached, the rate of consanguinity was 29.62% and coefficient of inbreeding in the current generation was significantly coinciding with the global rate of 29.2%. The degrees of consanguinity among the population were 2<sup>nd</sup> degree in 279 families, 3<sup>rd</sup> in 306 and 4<sup>th</sup> in 207. All marriages were occurred in first cousins and double first cousins. All reported diseases were more frequent in consanguineous marriages. In order to avoid such hereditary related health problems in India, it is imperative to create awareness regarding the adverse effects of endogamous marriages in regions with high prevalence.

**Keywords:** Endogamy; Degree of Consanguinity; Diabetes; Hearing Impairment and Epilepsy.

## Introduction

Consanguineous marriage is a relationship between two people who share a common ancestor. This type of marriage is one of the customary practice occurs in varying degree throughout the world. Consanguinity in Tamil Nadu is a deeply rooted cultural trend in all communities irrespective of religion. The Tamil culture is an assimilation of diverse conventions, customs, rituals, and ideas harmonizing in one central core of seal entity. They believe that consanguinity strengthens family ties and enforces family solidarity. The cousin marriages provide excellent opportunities for the transmission of cultural values and cultural continuity. Wife's parents prefer to have their daughter living near them and to enjoy the presence of their grandchildren. Moreover, wealthy land lords may prefer to keep their property within the family. The National and family health survey statistics reported that South India has the highest degree consanguinity of 20 -60%, when

**Author's Affiliation:** \*Research Scholar \*\*Assistant Professor, PG and Research Department of Zoology, Raja Doraisingam Government Arts College, Sivagangai, Sivagangai, Tamil Nadu 630561, India.

**Corresponding Author:** P.J. Jega Chandra Mohan, Assistant Professor, PG and Research Department of Zoology, Raja Doraisingam Government, Arts College, Sivagangai, Tamil Nadu 630561, India.

E-mail: [jechmo@yahoo.co.in](mailto:jechmo@yahoo.co.in)

Received on 23.03.2018, Accepted on 11.04.2018

compare to other regions of India [1]. The phenomenon of inbreeding or endogamy increases the level of autosomal genetic disorders known as inbreeding depression [2]. This type of inbreeding has been known to increase the chance of lethal identical genes disorders derived from a common ancestor. The transmission of hereditary disorders increases with degree of genetic relationship of their parents. The risk is higher in offspring whose parents are close relatives cousin than distant relatives, such as second cousins [3]. In view of the above, the current study

was carried out to determine the extent and nature of consanguinity among population, Sivagangai District and its effect on health disorders such as diabetes mellitus, hearing impairment and epilepsy.

### Method

The study was conducted in the population of Sivagangai District between November 2016 and December 2017. The total samples of 2673 families were approached for study. The degree of consanguinity between each female and her spouse and the degree of consanguinity between their parents were recorded. The hereditary health disorder such as diabetes, hearing impairment and epilepsy among the families in the study area in relation to endogamy were assessed. The family members were interviewed separately without having the possible interactions with other sample respondents. Average time limits of 5 to 8 minutes were taken for each sampling.

### Result

In consanguineous marriage, it was customary to exclude marital unions beyond second cousins. Second cousins inherit 1/32 of their genes from a common ancestor, which means that their offspring inherits identical genes at 1/64 (1.56%) of all loci. In numerical terms, this was conventionally expressed as coefficient of inbreeding, which for second-cousin progeny was 0.0156. A total of 792 consanguineous (29.62%) and 1881 non consanguineous (70.38%) marriage were recorded in the present study. Among the total populations, 180 individuals had diabetes (72 non-consanguineous and 108 consanguineous), 171 had hearing impairment (36 non-consanguineous and 135 consanguineous) and 315 epilepsy (126 non-consanguineous and 189 consanguineous). Out of 792 consanguineous population, 522 (65.9%) were affected with any one of the respective recessive hereditary disorder (Figure 1). While among 1881 non-consanguineous population, only 234 (12.44%) were affected with the same disorders (Figure 2). Percentages of affected individuals with various degrees of consanguinity were 35.22% in 2<sup>nd</sup> degree,

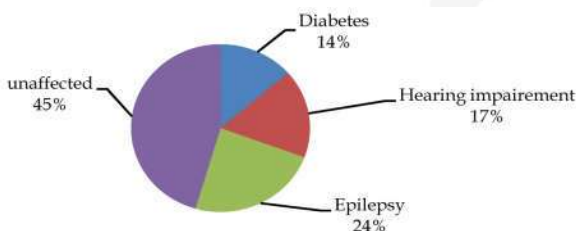


Fig. 1: Percentage of affected and unaffected individuals among the consanguineous population

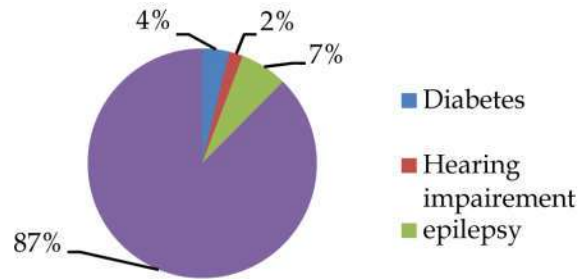


Fig. 2: Percentage of affected and unaffected individuals among the non consanguineous population

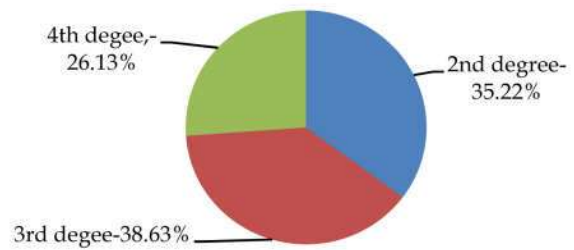


Fig. 3: Percentage of affected individuals with various degrees of consanguinity

38.63% in 3<sup>rd</sup> degree and 26.13% in 4<sup>th</sup> degree (shown in Figure 3).

### Discussion

Consanguinity is an interbreeding between close people with a common grandparent or people who share another recent ancestor. This type of marriage practice is common among emigrant communities from Pakistan, Turkey, North Africa and Lebanon, North America, Australia and India [4,5]. The previous studies on consanguinity showed that the prevalence of this cultural aspect in South India was ranged from 20 to 60% (Rasathi), which is in accordance to the findings of present study (29.62%). According to Bhaskar, the pattern and prevalence of consanguinity in Mangalore, India was more among Muslims than Hindus and Christians [6]. The same reports were recorded in Belgaum [7]. These studies supported and substantiated the findings of present study that consanguinity is one of the commonest phenomenon amongst all communities of world. The degrees of inbreeding revealed that the endogamy in Sivagangai is an irreplaceable socio cultural aspect of ancient to current generation. The occurrence of consanguinity is more predominant among socioeconomically disadvantaged groups in rural populations. The pattern of cognate marriages in the study area is a cultural based aspect irrespective of religion and considered as the Hot Spot of Uncle-

Niece Consanguinity. Consanguinity has been attributed to low socio-economic status and knowledge about the consequences of consanguinity, can be held directly proportional to Education status of an individual. This trend is prevalent all over the world, especially in Middle Eastern and African Muslim countries.

The present study comprehensively examined the occurrence of blood related marriages and their association with adverse hereditary disorder among Sivagangai populations. The rate of congenital malformation was lower among neonates from non-consanguineous marriages and higher from consanguineous marriages [10]. It is believed that high rates of inbreeding over multiple generations lead to elimination of deleterious recessive genes from the gene pool [11]. Among the total population studied, 180 diabetes, 171 hearing impairment and 315 epilepsy. The rates of hereditary abnormalities were higher in consanguine (Figure 1 & 2). Among the total affected population (666), 432 were consanguineous. It is well known that inbreeding leads to an increase in homozygosity by expression of some of the lethal recessive genes and results in an increase in genetic anomalies that cause congenital malformations, polygenic or multifactorial diseases, spontaneous abortions, stillbirths, infant death and sterility [8,9]. The genes responsible for hearing loss are GJB3, GJB6, TECTA and POU3F4, for Diabetes mellitus are HLA, INS, CTS, CTSSA, PPARY, ABCC8, KCNJ11 and CALPN10, and for Epilepsy are MDR3, MRP1. Any point mutation in the genes can cause recessiveness and lead to lethal anomalies among individuals. The same multifactorial impairment may be transmitted with change generation after generation through endogamy.

Even though the rural populations are highly affected with hereditary disorder generation after generation, the removal of such consequences from the Tamil culture is a very difficult task at present. Further in-depth studies at gene level are needed to determine the impact of consanguinity in relation to lethal anomalies in this population. In order to avoid hereditary such health problems in South India, it is imperative to create awareness among people about the high risk of homozygous recessive disorders due to blood related marriages. However, the present study may serve as primary platform for further gene imbalance studies among blood related marriages.

#### *Informed Consent*

Informed consent was obtained for this study.

#### **Compliance with Ethical Standard**

This article does not contain any studies with human participants or animals performed by any of the author.

#### *Financial Disclosure*

The author declared that this study has received no financial support.

#### *Competing Interests*

We have no financial interest to declare.

#### **Acknowledgement**

The author would like to thank Institution and the Head of the Department of Zoology, R.D. Government Arts College, Sivagangai for support and necessary approval of this work.

#### **References**

1. Rasathi, S., Shankar Shanmugam, R., Vengatesan. A Evaluate the Knowledge and Effects of Fetal Outcome on Consanguineous and Non Consanguineous Married Women. IOSR Journal of Nursing and Health Science. 2015 Sep. - Oct.;3(5):38-41
2. Fareed M., Afzal M., Estimating the inbreeding depression on cognitive behaviour. A population based study of child cohort. PLoS ONE. 2014;9(10): 89-98.
3. Kingston H M, ABC of Clinical Genetics, 3rd Edition (London: BMJ Books, 2002) Page 7, ISBN 0-7279-1627-0.
4. Hamamy H, Antonarakis S.E, Cavalli-Sforza L.L, Temtamy S, Romeo G, Ten Kate LP, Bennett RL, Shaw A, Megarbane A, van DC, Bathija H, Fokstuen S, Engel E, Zlotogora J, Dermitzakis E, Bottani A, Dahoun S, Morris MA, Arsenaault S, Aglan MS, Ajaz M, Alkalamchi A, Alnaqeb D, Alwasayah MK, Anwer N, Awwad R, Bonnefin M, Corry P, Gwanmesia L, Karbani GA, Mostafavi M, Pippucci T, Ranza-Boscardin E, Reversade B, Sharif SM, Teeuw ME, Bittles AH. Consanguineous marriages, pearls and perils: Geneva International Consanguinity Workshop report. 2011 Genet Med 13:841-47.
5. Schulpen T.W, Wieringen JC, Brummen PJ, Riel JM, Beemer FA, Westers P, Huber J. Infant mortality, ethnicity, and genetically determined disorders in The Netherlands. Eur J Public Health. 2006;16: 291-94.
6. Bhaskar B, Sucharitha, S, Avadhani R Prevalence and pattern of consanguineous marriages among

- different communities in Mangalore. Online Journal of Health and Allied Sciences. 2012;11:4.
7. Bhasin MK, Nag S. Incidence of consanguinity and its effects on fertility and morbidity in Indian region: A reappraisal. *J Hum Ecol.*; 1994;3:161-263.
  8. Kulkarni ML, Kurian M. Consanguinity and its effect on fetal growth and development, a South Indian study. *J Med Genet*; 2005;27(6):348-52.
  9. Mosayebi Z, Movahedian AH. Pattern of congenital malformations in consanguineous versus non-consanguineous marriages in Kashan, Islamic Republic of Iran. *East Mediterr Health J* 2007;13(4): 868-75.
  10. Alwan, A. A. & Modell, B. Community Control of Genetic and Congenital Disorders. EMRO Technical Publication Series 24 WHO Regional Office for the Eastern Mediterranean Region, Egypt. 1997.
  11. Roberts JAF, Pembrey ME. Cousin marriage in Roberts JAF, Pembrey ME (Eds): *An Introduction to Medical Genetics*. New York, Oxford University Press, 1978.p.295.
-