ejpmr, 2017,4(3), 326-330

SJIF Impact Factor 4.161

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

CASTE BASED EVALUATION ON PREVALENCE OF SEX CHROMATIN IN WEST BENGAL, INDIA

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Article Received on 03/01/2017 **Article Revised on 24/01/2017** **Article Accepted on 14/02/2017**

ABSTRACT

The present study was conducted to evaluate the prevalence of sex chromatin among Bengalee Hindu caste females. Buccal smear were collected from 432 female participants from different castes of Bengalee Hindu population belonging to different reproductive stages of their life *viz* premenarche, menarche, pregnancy, lactation and menopause. The result of the present study showed that the caste wise variation in the frequency of sex-chromatin was not statistically significant ($p>0.05$). Similarly, sex-chromatin prevalence has not revealed any association with caste at any reproductive stages of women. From this result, it is clear that in different castes at the same geographic region, the prevalence of sex chromatin have not shown any significant difference. Therefore, in case of Bengalee Hindu female population, there may not be any effect of caste identity on prevalence of sex chromatin.

KEYWORDS: Sex Chromatin, Caste, Bengalee Hindu Caste females.

INTRODUCTION

X chromosome inactivation in the context of female mammalian development performs an essential role in dosage compensation (Turner, 2007). According to Lyon hypothesis, only one X chromosome is active in each diploid mammalian cell, all additional X chromosomes are inactivated, become heterochromatic and may be visible as sex chromatin bodies in interphase (Lyon 1961). This sex chromatin bodies can be easily demonstrated as highly concentrated structure about 1µm in diameter in female cells derived from cells of several tissues, such as epidermis, endothelium, kidney, thymus cartilage (Emery and McMillan, 1954). The observation of sex chromatin has been widely applied not only for rapid sex determination in human but also used for anomalies of sexual vis-a-vis reproductive system development (Moore *et al.*1953; Polani *et al.*, 1954; Plunkett and Barr, 1956; Jacob *et al.*, 1961). Apart from sex determination and chromosomal aberrations, research studies have demonstrated quantitative determination of sex chromatin in cell nuclei among normal female individuals (Bataineh and Al-Azab, 2004; Yen *et al.*, 1981; Voitenko, 1980; Purandare and Chakravarti, 1978, 1980; Verma*et al.*, 2013; Mukherjee, 2013; Mukherjee *et al.*, 2014) in terms of differential incidences of the sex chromatin among different ages of women.

India's unique caste system has attracted the attention of human geneticists and anthropologists to examine the intricacies involved in biological and socio-cultural aspects (Arya *et al*. 2002). The term caste structure or caste system refers to a social institution in India in which endogamous descent groups, known as castes, are hierarchically ranked under hereditary endogamous system, sanctioned and supported by religion, which decides the individual's status in the social stratification and his profession. The study on DNA analysis revealed that in India, mainland populations admixed widely irrespective of ancestry, which was rapidly replaced by endogamy, particularly most upper-castes communities, endogamy started nearly 70 generation ago, or around the time of Hindu Gupta period around 1,500 years ago (Internet Access 1). Later, castes system became hereditary subdivision of an ethnic unit occupying a position of superior or inferior rank. Although elements of the caste system, such as untouchability, were outlawed over 50 years ago by the Indian constitution, caste remains an obvious feature of Indian society.

Indian caste population is composed of various endogamous groups and their mating pattern is defined by the restricted marriages between the clans of that particular endogamous group within the fold of a particular caste (Bhasin, 2006). Anthropologists confirm the genetic homogeneity of caste by studying classical

biological markers like blood groups, serum proteins, red cell enzymes etc. (Roychoudhury et al. 1985; Das et al.1986; Mastana and Paphia, 1994; Bhasin, 2009) or mitochondrial or Y chromosome markers (Basu et al. 2003; Wooding et al. 2003; Zerjal et al. 2007) in that specific group. This provides a real picture of biological relatedness of a particular group of people living in same ecological settings relative to the other groups. Morphological diversity among Indian populations is appreciable, since caste differs from each other phenotypically in varying degrees due to difference in their genetic makeup as well as differences in nutritional and socio-economic factors (Malhotra1978, Singh 1993). In the view of above, the present study has been conducted to compare the prevalence of sex chromatin among different caste groups of Bengalee Hindu population.

MATERIAL AND METHODS

A total number of 432 female participants from different castes of Bengalee Hindu population have been selected at random for the present study. Here Bengalee Hindu population have been taken as a Mendelian population which defines a group of interbreeding, sexually reproducing people those share a common set of genes. Total 432 normal female participants categorized into five different reproductive stages *viz* premenarche, menarche, pregnancy, lactation and menopause. Buccal smear sample have been collected from each 432 individuals from normal healthy females (Table 1). One hundred (100) cells from each individual have been studied and this has given a percentage of sex chromatin presence.

Informed consent was obtained from all participants in the present study that had been approved by Institutional Bio Ethics Committee for Human & Animal Research Studies, University of Calcutta, Kolkata. A structured schedule was administered to collect socio-demographic information and life style related issues etc of females of different reproductive stages.

Table No.1: Selection Criteria for the Participants of Five Different Reproductive Stages

Group	Status	Age range and Mean ± SD	Criteria for selection
A (n = 85)	Pre menarcheal (Non-ovulation)	(7 - 13 years) 9.58±1.27	Under the influence of minimal sex steroids and menstruation has not been experienced for the last one year
B (n = 87)	Menarcheal (Ovulation)	(18 - 29 years) 22.34±2.81	Under the influence of sex steroids and experienced menstruation for the last one year uninterruptedly
C (n = 85)	Pregnant (Non-ovulation)	(18 - 37 years) 25.56±4.61	Under the influence of high level natural sex steroids and considered 3 trimester
D (n = 82)	Lactation	(18 - 37 years) 27.43±4.10	Under the influence of sex steroids and prolactin hormone. breast feeding for the last six months
E (n = 93)	Menopausal (Non-ovulation)	(45 – 67 years) 56.05±4.82	Under the physiological withdrawal of sex steroids and not experiencing menstruation for the last one year

RESULTS

Caste distribution of total 432 females of present study (Table 2) showed the highest frequency of females is found in the Brahmin (37.73%) followed by Kayastha (32.87%), Baishya (12.04%), Kumbhakar (3.47%) caste group. Remaining 13.88% has been shared by 2 castes groups Namasudra and Baidya showing almost similar distribution. In case of premenarchial females, Kayastha caste demonstrated highest frequency (36.47%) followed by Brahmin (29.49%) and Baishya (17.65%). Among menstrual females, Brahmin and Kayastha showed highest frequency (35.63% and 34.48% respectively). Pregnant females of this study exhibited highest frequency in Kayastha caste (35.29%) and Brahmin caste (31.76%). In case of lactating mothers and menopausal females, Brahmin caste demonstrated highest frequency i.e. 36.59% and 53.76% respectively.

Table No.2: Details of Caste Wise Distribution of Bengalee Hindu Caste Females of the Present Study

Caste	Categories for the Female Participants					Total
	Pre Menarche	Menstrual	Pregnant	Lactation	Menopause	
Namasudra	6	5	6	8	5	30
	7.06	5.75	7.06	9.76	5.38	6.94
Kumbhakar	3	4	4	2	2	15
	3.53	4.60	4.71	2.44	2.15	3.47
Kayastha	31	30	30	24	27	142

	36.47	34.48	35.29	29.27	29.03	32.87
Brahmin	25	31	27	30	50	163
	29.41	35.63	31.76	36.59	53.76	37.73
Baishya	15	9	11	13	4	52
	17.65	10.34	12.94	15.85	4.30	12.04
Baidya	5	8	7	5	5	30
	5.88	9.20	8.24	6.10	5.38	6.94
Total	85	87	85	82	93	432
	100.00	100.00	100.00	100.00	100.00	100.00

The table 3 represented the sex chromatin prevalence according to caste group of Bengalee Hindu Caste Females. The one way and two way ANOVA was performed to know the association of prevalence of sex-chromatin among different castes of Bengalee Hindu population in each reproductive stages and also interaction between caste and reproductive stages on prevalence of sex chromatin.

The frequency of Sex-chromatin prevalence ranges from 12.80 to 15.67 in premanerchal stage, 45.25 to 50.50 in menstrual stage, 48.71 to 53.33 in pregnant stage, 57.92 to 60.53 in lactation stage and 28.75 to 30.59 in menopausal stage. In the Baishya caste prevalence of sex-chromatin found minimum values in pre-manechal, lactation and menopause stages, in menstrual and lactation stages Baidya caste showed minimum frequency. Maximum prevalence of sex-chromatin found in Kumbhara caste for pre-manechal and menstrual stages. Namasundra caste showed high frequency in pregnant stage, in lactation stage Brahmin stage found high prevalence and in menopause stage Baidya caste found to be high prevalence. However, the caste wise variation in the frequency of sex-chromatin prevalence which observed in the present study was not statistically significant ($p>0.05$) from one way ANOVA analysis none of reproductive stages showed significant variation among caste wise (Table 3 & Fig 1). Further, two way ANOVA analysis performed to know the interaction between castes and reproductive stages in prevalence of sex-chromatin frequencies, which also found non-significant ($F = 0.845$; $p=0.659$) (Table 3). It clearly showed that sex-chromatin frequency does not have any association with caste at any reproductive stages of women.

Table 3: Sex Chromatin Prevalence according to the Caste groups of Normal Bengalee Hindu population

Caste	Pre Menarche		Menstrual		Pregnant		Lactation		Menopause		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Namasudra	15.00	3.10	45.40	6.50	53.33	3.20	59.88	3.98	29.40	1.67	42.10	17.56
Kumbhakar	15.67	4.51	50.50	7.94	51.00	2.16	59.50	3.54	30.50	0.71	42.20	16.53
Kayastha	14.32	3.68	45.50	5.16	50.07	5.02	59.46	4.50	30.59	3.05	39.18	16.50
Brahmin	14.52	3.47	47.00	4.23	52.19	3.04	60.53	4.16	30.02	3.54	40.16	16.02
Baishya	12.80	2.78	48.56	4.39	49.36	5.26	57.92	4.57	28.75	4.99	39.23	18.91
Baidya	13.80	2.17	45.25	8.22	48.71	4.35	58.40	3.05	31.00	3.08	40.63	15.48
Total	**14.18**	**3.37**	**46.55**	**5.34**	**50.81**	**4.34**	**59.59**	**4.23**	**30.16**	**3.30**	**39.97**	**16.56**
F	**0.754**		**1.116**		**1.771**		**0.782**		**0.366**		**0.250**	
p	**0.586**		**0.359**		**0.128**		**0.565**		**0.871**		**0.940**	
F (Caste *Reproductive Stages)=0.845; p=0.659												

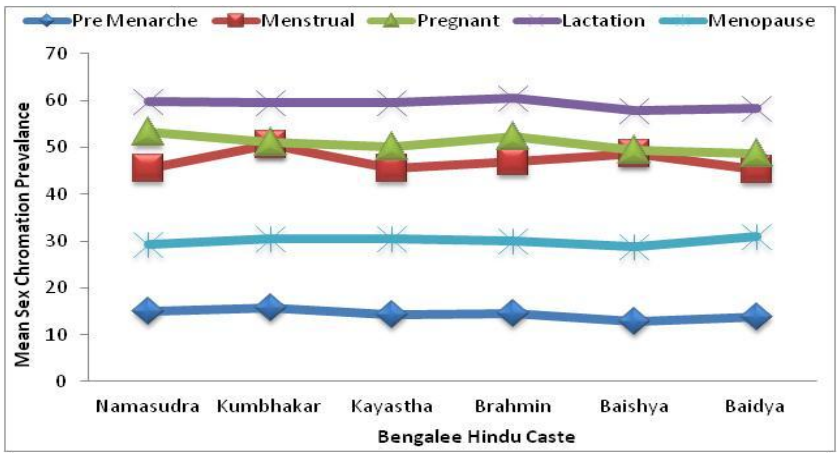

Fig. 1: Graphical Representation of Sex Chromatin Prevalence according to the Caste groups of Normal Bengalee Hindu Population

DISCUSSION

The result of the present study has not demonstrated any association between prevalence of sex chromatin and different caste groups. From this result, it is clear that in different castes at the same geographic region, the prevalence of sex chromatin have not shown any significant difference. Therefore, in case of Bengalee Hindu female population, there may not be any effect of caste identity on prevalence of sex chromatin.

In India, there is high cultural diversity between different endogamous groups. Ethnicity, which is a socio-cultural homogeneity within the group, along with geography are most robust measurements of population homogeneity (Gupta, 2011). The outcome of decades long research efforts of Indian biological anthropologists confirmed that the caste along with geography are the precious factors for studying genetic structure of Indian population (Bhasin and Walter 2001). Therefore, India has a great potential for the study of quantitative genetic variation within and between caste populations. Genetic diversity is comparatively high within a given caste group, while the intercaste genetic differentiation is small (Char et al. 1989). This diversity is largely attributable to the effects of evolutionary forces, particularly genetic admixture, through successive historic migrations (Balakrishan 1987; Sharma and Talukder 1987). Thus, India has a great potential for the study of quantitative genetic variation within and between populations and it offers a unique opportunity to examine the genetic determinants of physical characteristics of caste groups and to understand the genetic diversity among caste populations.

Recently, a study by researchers from National Institute of Bio-Medical Genomics (NIBMG) in West Bengal has worked at genes of various communities to find out the time frame of caste becoming dominant norm for ethnic communities in West Bengal. By looking at the block lengths of ancestral genes, the team could pinpoint the era when mixing of castes ended. In the case of West Bengal Brahmins, marriages with the northeastern communities continued until the arrival of the 8th century Pala dynasty which cut off these regions.

The date of admixture 2000-4000 years ago is an upper bound on the beginning of the caste system (Reich et al. 2009). Even after about 1900 years ago, there was no significant interbreeding pointing to cultural changes that brought in a strong form of endogamy. The findings of this study revealed the fact that every population in India evolved from randomly mixed populations suggested that social classifications like the caste system are not likely to have existed in the same way before the mixture (Internet Access 3). Thus, the present-day structure of the caste system came into being only relatively recently in Indian history. But once established, the caste system became genetically effective as mixture across groups became very rare (Internet Access 2).

Keeping the view of above, the present study was first attempt to understand the population variation in prevalence of sex chromatin among Bengalee Hindu caste females and found no impact of caste identity on prevalence of sex chromatin.

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