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Emergence of sociocultural norms restricting intermarriage in large social strata (endogamy) coincides with foreign invasions of India

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In an excellent article in PNAS by Basu et al. (1), the authors have undertaken an impressive genomic reconstruction of the history of extant populations of India. However, some limitations still remain in the sampling: the lack of genetic analysis of the patrilineal/ matrilineal exogamous *gotras*, and the use of certain parametric values in the analysis of data presented.

Basu et al. (1) suggest that the historical period of formulation and adoption of sociocultural norms restricting intermarriage in large social strata (endogamy) coincides with the ancient regime of the Guptas. Upon using alternative, historically more appropriate, generation time parameters, another explanation that is more plausible emerges which cannot be ruled out, that endogamy originated around the time of foreign invasions of India.

The arbitrary generation time parameter of 22.5 y used in the study is unsupported by evidence and is historically unsubstantiated. The near universality of marriage at a very early age in the study populations' history posits that generation times were more likely in the range of 13–18 y, until a generation or two ago (2) (scienceblogs.com/gregladen/2011/03/01/how-long-is-a-generation/, accessed February 16, 2016). If a generation time parameter of 22.5 y is used and one selected value of 70 generations before present alone is used, the time period in history does indeed appear to fall during the Gupta period. The Guptas reign was restricted to the northern plains, whereas different kingdoms unrelated to the Guptas ruled the vast regions of the south and southwest. Thus, the Guptas

could not have enforced endogamy in the south. The authors themselves admit that the abrupt start of endogamy in the east of India appears to have started during the reign of the Buddhist Pala dynasty, after the Gupta period. Thus, the onset of endogamy in the east of India as well cannot be explained as a consequence of an edict from the Hindu Gupta dynasty enforcing Vedic Brahmanism of Hinduism.

Upon using alternative, historically more appropriate, generation time parameters (Table 1), another explanation that is more plausible emerges, that is, endogamy originated around the time of foreign invasions of India (Fig. 1). The population of India was estimated to be about 100-140 million 2,300 y ago and remained at about 100 million as late as 400 y ago. During this entire period of 1,900 y, India remained the largest economy in the world, followed by China. There are no recorded calamities in the history of India that could have kept the population stagnant and prevented it from growing despite a continuously booming economy (2, 3). Such invasions involved complete destruction of populations and their centers of learning, scholarly work, and culture (universities, schools, and temples), such as the ancient Nalanda University and Somnath temple, to give a couple of examples. A hugely disrupted Indian society might have thus been a very fertile receptive ground for the induction of a new social order. The newly established social order could have been influenced by the invading foreign cultures, because there are known genetic markers for such endogamous grouping within Islamic societies (4, 5).

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¹ Basu A, Sarkar-Roy N, Majumder PP (2016) Genomic reconstruction of the history of extant populations of India reveals five distinct ancestral components and a complex structure. *Proc Natl Acad Sci USA* 113(6):1594–1599.

| Population | Ancestral North Indian | Ancestral Austro-Asiatic | Ancestral South Indian | Ancestral Tibeto-Burman |
|---------------------|------------------------|--------------------------|------------------------|-------------------------|
| Gujarati Brahmin | NA | 69.3833 | 69.3265 | * |
| 13 | | 902 | 901 | |
| 15 | | 1,041 | 1,040 | |
| 18 | | 1,249 | 1,248 | |
| West Bengal Brahmin | NA | 69.5409 | 68.3778 | 63.3518 |
| 13 | | 904 | 889 | 824 |
| 15 | | 1,043 | 1,026 | 950 |
| 18 | | 1,252 | 1,231 | 1,140 |
| Maratha | NA | 48.7989 | 48.92 | * |
| 13 | | 634 | 636 | |
| 15 | | 732 | 734 | |
| 13 | | 878 | 881 | |
| | NIA | | | * |
| lyer | NA | 69.1751 | 71.699 | |
| 13 | | 899 | 932 | |
| 15 | | 1,038 | 1,075 | |
| 18 | | 1,245 | 1,291 | |
| Pallan | NA | 74.3893 | 76.1979 | * |
| 13 | | 967 | 991 | |
| 15 | | 1,116 | 1,143 | |
| 18 | | 1,339 | 1,372 | |
| Kadar | 47.5509 | 60.7911 | NA | * |
| 13 | 618 | 790 | | |
| 15 | 713 | 912 | | |
| 18 | 856 | 1,094 | | |
| Irula | 39.4951 | 49.8475 | NA | * |
| 13 | 513 | 648 | | |
| 15 | 592 | 748 | | |
| 18 | 711 | 897 | | |
| Gond | 77.6637 | 91.9575 | 70.509 | 58.1287 |
| 13 | | | 917 | |
| | 1,010 | 1,195 | | 756 |
| 15 | 1,165 | 1,379 | 1,058 | 872 |
| 18 | 1,398 | 1,655 | 1,269 | 1,046 |
| Но | 54.0405 | NA | 67.8753 | 52.9333 |
| 13 | 703 | | 882 | 688 |
| 15 | 811 | | 1,018 | 794 |
| 18 | 973 | | 1,222 | 953 |
| Santal | 54.8661 | NA | 71.5929 | 61.5647 |
| 13 | 713 | | 931 | 800 |
| 15 | 823 | | 1,074 | 923 |
| 18 | 988 | | 1,289 | 1,108 |
| Korwa | 46.5407 | NA | 55.7532 | 46.6478 |
| 13 | 605 | | 725 | 606 |
| 15 | 698 | | 836 | 700 |
| 18 | 838 | | 1,004 | 840 |
| Manipuri Brahmin | 69.7002 | 67.6769 | 70.4008 | NA |
| 13 | 906 | 880 | 915 | |
| 15 | 1,046 | 1,015 | 1,056 | |
| 18 | 1,255 | 1,218 | 1,267 | |
| Tharu | 62.7826 | 65.2317 | 72.9749 | NA |
| 13 | 816 | 848 | 949 | |
| 15 | 942 | 978 | 1,095 | |
| 18 | | | | |
| | 1,130 | 1,174 | 1,314 | NIA |
| Tripuri | 65.1124 | 69.6447 | 70.5565 | NA |
| 13 | 846 | 905 | 917 | |
| 15 | 977 | 1,045 | 1,058 | |
| 18 | 1,172 | 1,254 | 1,270 | |

| Table 1. | Estimates of time (in generations before present and in years) of contribution of each of the ancestral |
|----------|---|
| compone | nts to the populations considered |

The numbers 13, 15, and 18 are historically more appropriate generation times; the units of corresponding values in cells below generations before present are years. NA, not applicable. *The contribution of the ancestral component is too low for reliable estimation of time depth.

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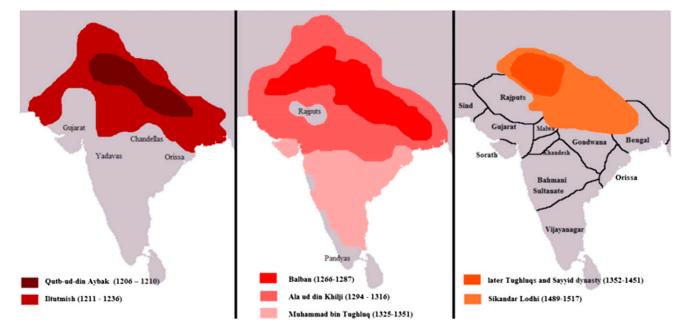


Fig. 1. Map of Islamic dynasties of India with their extent over relevant time periods. Image courtesy of Javier Fernandez-Vina (Florida International University, Miami, FL).

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