



Forensic genetic analysis of the population of Gujarat with PowerPlex 21 multiplex system

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ABSTRACT

The present investigation assessed the allele frequencies and forensic parameters for the loci included in PowerPlex 21 multiplex system (Promega, USA) in 101 unrelated individuals residing in the state of Gujarat, India. The study likewise introduces the first global report on polymorphism on Penta D and Penta E autosomal STR loci from the population of Gujarat, India. The obtained outcomes in the study revealed that the considered STR multiplex system is highly polymorphic and suitable for forensic genetic analysis.

1. Introduction

Gujarat is the name derived from the Sanskrit word Gurjaradesa, implying "The Land of the Gurjaras". Gujarat is ranked as fifth biggest West Indian state by region and the ninth biggest state by population. As per 2011 census absolute population of Gujarat is 60,439,692 of which male and female are 31,491,260 and 28,948,432 respectively [1]. The study compiled an autosomal STR DNA database of Gujarat and evaluated autosomal STR diversity with regards to population genetics and forensic efficiency parameters.

2. Material and methods

Blood samples of studied population were collected from 101 unrelated healthy male individuals following the Code of Ethics of the World Medical Association (i.e. Declaration of Helsinki). All individuals provided written informed consent. No minor was involved in the study. This study was approved by the ethical committee of the Raksha Shakti University, Gujarat, India (RSU/IRD/RSUIEC/5-2019/72/2019).

In this particular investigation, samples were directly amplified without DNA extraction using PowerPlex 21™ (20 autosomal STR loci: D3S1358, D1S1656, D6S1043, D13S317, PENTA-E, D16S539, D18S51, D2S1338, CSF1PO, PENTA-D, TH01, vWA, D21S11, D7S820, D5S818, TPOX, D8S1179, D12S391, D19S433, FGA and amelogenin marker) multiplex STR systems according to manufacturer's recommendations with exception that the 8 µL volume was used during analysis as per the previous described protocol [2,3]. Samples were typed on ABI 3500 XL

Genetic Analyser (Thermo Fisher Scientific, Foster city, CA, USA-Thermo) with WEN ILS 500 Size Standard (Promega, USA) following the recommendations of the manufacturer using GeneMapper® ID-X Software Version 1.4 (Thermo) for analysis.

Allele's frequencies on considered 20 loci was estimated using the GenAlEx version 6 [3]. The assurance of p values of exact test for the Hardy–Weinberg equilibrium was analysed with Arlequin 3 software [4]. PowerStats v1.2 software [5] was utilized for figuring of Genetic parameters of forensic interest viz. Power of Discrimination (PD), Matching Probability (PM), Polymorphic Information Content (PIC), Power of Exclusion (PE), and Typical Paternity Index (TPI).

3. Result and discussion

Different bio-statistical estimations of forensic interest were determined for the loci examined in the present investigation appeared in Figs. 1 and 2. A total 201 alleles were observed in the studied population. No deviations from the Hardy–Weinberg equilibrium was observed even after applying bonferroni correction [6] ($0.05/20 = 0.0025$). The combined probability of match (CPM) and combined paternity Index (CPI) was 7.87×10^{-25} and 8.12×10^8 , respectively. The locus Penta E was found to be the most polymorphic among all the studied loci with the value of 0.911 in the studied population. In this specific examination combined probability of exclusion and combined power of discrimination was 0.999999999 and 1, respectively. The distribution of the allele frequency in the studied population sample was in accordance with published data about general Indian

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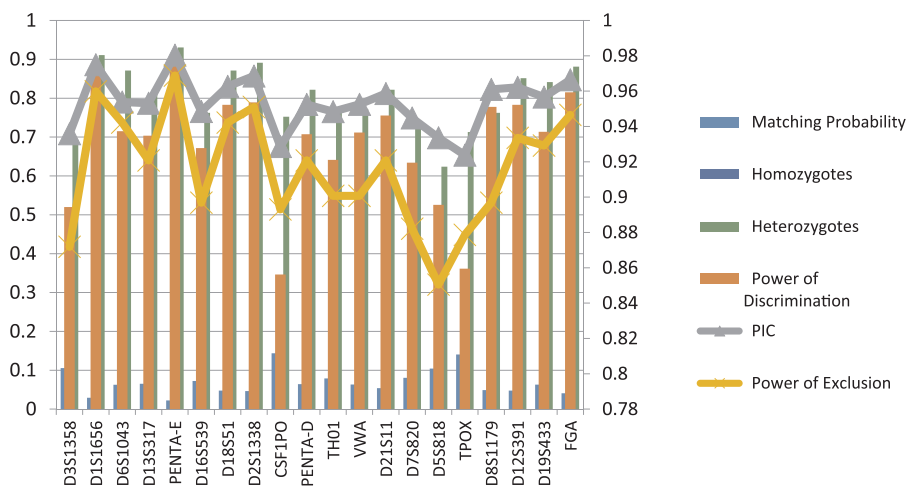


Fig. 1. Forensic evaluation of 20 autosomal STR markers in population of Gujarat.

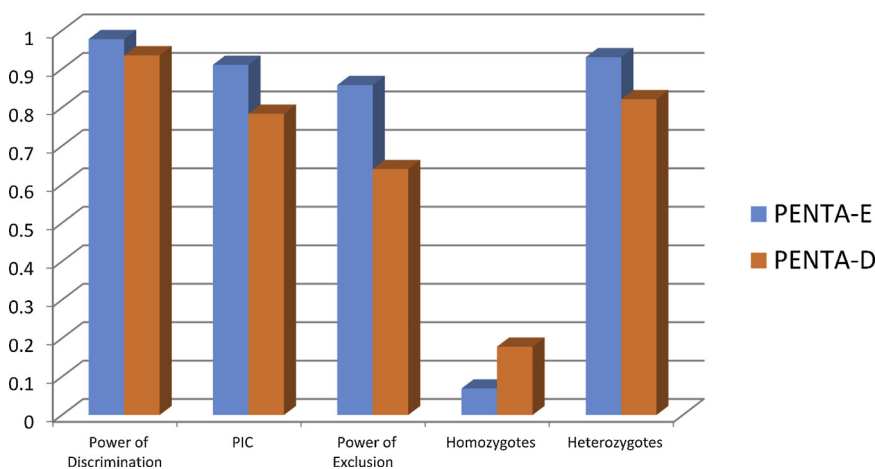


Fig. 2. Forensic evaluation of Penta E and Penta D markers in population of Gujarat.

population.

4. Conclusion

The study provides allele frequency data set which is useful for forensic individual identification in paternity examinations and population hereditary investigations of population of Gujarat state of India.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest in the conduct of the study.

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