Development of DNA markers for the identification of individuals in the Sri Lankan human population and its applications in forensic casework

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ABSTRACT

DNA typing for the identification of criminals is seen as one of the greatest technical advancements in criminal investigations. In DNA typing, the DNA itself is analysed, which means that a person's genetic makeup can be determined directly, rather than indirectly through gene products as was required by earlier methods such as blood group analysis. DNA typing is capable of identifying individuals and determining relationships between individuals with a high degree of sensitivity, accuracy and efficiency. The overall objective of this study was to facilitate the use of DNA typing for the identification of individuals in the human population of Sri Lanka, with the intention of applying it to forensic casework in Sri Lanka.

RFLP analysis was done with the use of the multilocus DNA probe 33.15. DNA typing was done for 35 individuals of the Sri Lankan population, and for three tests of paternity. The mean band sharing frequency (0.224) for the individuals typed was found to be in general agreement with other studies, and the probability of DNA fingerprint identity (7.5×10^{-14}) was also calculated. A larger, more representative sample of the population would yield a more accurate numbers for the parameters that were calculated. Although this study began with the use of RFLP-based minisatellite DNA analysis, it was decided to use the PCR-based Short Tandem Repeat (STR) methods because STR analysis has now become the method of choice in forensic DNA typing.

Blood samples were obtained from 418 volunteer blood donors, and a population database was constructed for 9 STR loci, namely, CSF1PO, TPOX, TH01, D16S539, D7S820, D13S317, F13A01, FESFPS and vWA. The allele frequencies (< 0.467), the heterozygosities (0.819-0.678) and the Polymorphism Information Content (0.81-0.67) of the nine STR showed that the Sri Lankan population possessed a relatively high genetic diversity, and that these STR loci could be used efficiently for identification of individuals and for the determination of paternity. Further, it was shown that the probability that two unrelated Sri Lankans would have the same DNA profile at all nine STR loci is between 1 in 430 million and 1 in 43 billion. Compared with a physical population of around 19 million, it may be said that a Sri Lankan's DNA profile at these nine STR loci is to all practical purposes, unique. Tests for allelic and genotypic independence showed several deviations from Hardy-Weinberg Equilibrium (HWE) and Linkage Equilibrium(LE). F_{ST} or θ values, which can be used to designate the effects of population subdivision, were calculated for the nine loci.

STR typing was performed in16 Court cases; one of multiple murder, three cases involving the identification of suicide bombers and 14 cases of disputed paternity. The results of these STR analyses have been accepted in both Criminal and Civil Courts.