The most frequent autosomal STRs involved in exclusion of paternity cases in a population from southeast, Mexico

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ABSTRACT

Introduction: Short tandem repeats (STR) are very widespread in the human genome; being a source of polymorphic markers, used for the determination of kindship. Few studies indicate the frequency of autosomal STR involved in the exclusion of paternity, as well as, those with a higher percentage of discordance. determine the distribution and frequency of the main autosomal STR markers involved in the exclusion of paternity cases in an admixed population from Southeast, Mexico (Peninsula de Yucatan).

Methods: 91 cases of excluded paternity, were included in the study: 61 trios and 30 motherless. All subjects belong to an admixed population with Mayan ethnicity from Southeast of Mexico. PowerPlex Fusion System (PPFS) was used for genotyping. The distribution and frequency of the autosomal STRs involved in each case of paternity exclusion were recorded based on 22 autosomal STR of PPFS.

Results: The number of STR which determined the exclusion in all cases ranged from 5 to 18 markers, being up to 14 STR for motherless cases. Paternity exclusions occurred most frequently with 13-STRs (22.22%) for trios and 9-STRs (37.5%) for motherless cases. The autosomal STR with the highest percentage of discordance is PENTA-E, for all cases 69.23%, 85.25% for trios. For motherless cases were D1S1656 and PENTA-E (36.67%, both).

Conclusions: The most frequent number of autosomal STR marker to confer a paternity exclusion was 13, the most informative STR marker for exclusions was PENTA-E.

1. Introduction

The human genome contains thousands upon thousands of STR markers, only a small core set of loci have been selected for use in forensic DNA and human identity testing [1]. According to the recommendation of FBI the CODIS Core Loci are twenty: CSF1PO, D3S1358, D5S818, D7S820, D8S1179, D13S317, D16S539, D18S51, D21S11, FGA, TH01, TPOX, vWA, D1S1656, D2S441, D2S1338, D10S1248, D12S391, D19S433, D22S1045 [2]. These loci are commonly used to paternity testing largely because of their ease of use in the form of commercial STR kits [3]. Commercial kits as PowerPlex Fusion include the main 20 autosomal STR markers and two pentanucleotide: PENTA D and PENTA E.

Few studies indicate the frequency of autosomal STR involved in the exclusion of paternity, as well as, those with a higher percentage of discordance. New genetic systems with a higher number of STRs are poorly studied in Mexican Mestizo populations, so, in this study, we describe the distribution and frequency of the main autosomal STR involved in the exclusion of paternity cases in an admixed population from Southeast of Mexico (Peninsula de Yucatan).

To determine the distribution and frequency of the main autosomal STR markers involved in the exclusion of paternity cases in an admixed population from Southeast of Mexico (Peninsula de Yucatan).

2. Methods

Information dataset was obtained from 334 paternity cases (exclusion and inclusion) performed over five years (2015–2019) by a private Mexican laboratory (www.dimygen.com). We selected (N = 91) cases of excluded paternity for the study: 61 trios and 30 motherless. All subjects belong to an admixed population with Mayan ethnicity from Southeast of Mexico. Inform consent was signed by each participant.

The DNA extraction was carried out with the Swab Solution System (Promega Corp.) from buccal swabs. PowerPlex® Fusion Kit (PPF) (Promega) was used for genotyping, PCR fragments were amplifying from Thermal Cycler ARKTIK® (Thermo Scientific). Amplified products
were the most common test (61 cases, 67.7%), followed by motherless
ternity exclusions, resulting in 27.25% testing exclusion rate. Trios
exclusion and the frequent of autosomal STR involved in the exclusion of
paternity. We reported the number of loci detecting the ex-
clusion alleles. The distribution and frequency of the autosomal STRs
were analyzed by capillary electrophoresis with the ABI Prism™ 310
(Applied Biosystem). The Genemapper software V.5 was used to allo-
cating the exclusion (mismatches) in all cases ranged from 5 to 18 for motherless cases. Paternity exclusions occurred most frequently with
13-STRs (22.95%) for trios and 9-STRs (36.67%) for motherless cases (Table 1).
The most frequent autosomal STR of discordance was PENTA-E, for all
cases 69.23% and for trio 85.25%. For motherless cases were
D1S1656 and PENTA-E (36.67%, both). (Table 2).

4. Discussion

We obtained 27.5% of paternity testing exclusion rate in this study, which is similar to the exclusion rate (29.58%) for Mexican population in 3005 paternity test cases [5] and consistent to the range of exclusion rate reported by the American Association of Blood Banks (AABB) from 4.5 to 33% [6].

In our dataset trio was the most common paternity test modality in this population. Opposite situation was reported by a previous study in Mexico where motherless cases are the most common tests (77.27%), followed by trios including the mother (20.7%). In the study, they re-
ported this options were preferred probably by the following reasons: i) it is cheaper that when mother is included (trio); ii) the father does not want that the mother realize about it; iii) mother's participation is not obligatory because the large majority of the tests are for personal (no legal) purposes [5]. One of the strongly reasons in our study probably who explain why trio cases where the most frequently is due to the cost is the same for trio or motherless; in order to increase the scientific power of the test. Therefore, if the mother is available or agree to participate it will not be an additional cost. For all cases from dataset did not discriminate by legal or personal modality.

The average of the number of STR which determined the exclusion of paternity test in motherless cases was 9.58, which is within the range reported by Garcia-Aceves et al. 2018 [5] in the Mexican population from 8.83 to 10.65 for father-daughter and father-son cases, respec-
tively. Our results do not discriminate father-daughter or father-son cases.

The most frequent number of autosomal STR marker to confer a paternity exclusion was 13 for all cases and trios and 9 for motherless. The most informative STR marker for exclusions was PENTA-E for all cases, both trios and motherless being within the range reported in the same Mexican previous study. In general, the estimated STR exclusion rate, as well as the average number of loci to paternity exclusion test; are in agreement with previous reports.

5. Conclusion

This is the first study who reports results of paternity exclusions test in a population from Southeast of Mexico. It stands out that trio was the most frequent (61%) paternity testing. The paternity exclusion rate was 27.5%. The most frequent number of autosomal STR marker to confer a paternity exclusion was 13. The most informative STR marker for ex-
cclusions was PENTA-E.

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References

