



Investigating the resolution of ancestry testing in geographic regions characterized by high population admixture

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ABSTRACT

Ancestry testing can provide valuable information in forensic applications, but its efficiency has not yet been properly evaluated when used in highly admixed populations. In this work we tested a commercial ancestry panel containing 165 autosomal SNPs in 30 Dubai residents. Most of the tested individuals displayed, as expected, an admixed profile, but in general the main inferred ancestry was of Southwest Asian extraction, testifying that these tests can provide useful complementary forensic information.

1. Introduction

We have been conducting several genomic studies across the Arabian Peninsula, confirming it is a melting pot of the three main ancestries, African, Eurasian and East Asian [1–4]. The admixture has been taking place since pre-historic times, and attained an astounding dimension at contemporary times in places such as the United Arab Emirates (UAE) where the non-native population amounts to ~80%. This phenomenon challenges the use of ancestry testing in forensic genetics, which could provide additional information on a suspect or strengthen eyewitness accounts. It is thus important to evaluate the level of resolution that these tests provide when applied in the context of migration nexus such as UAE. In this work, we performed the genotyping of the Applied Biosystems™ Precision ID Ancestry Panel (Applied Biosystems, Foster City, California, United States of America), containing 165 autosomal SNPs that can provide biogeographic ancestry information.

2. Methods

We performed the genotyping of the Applied Biosystems™ Precision ID Ancestry Panel (Thermo Fisher, Waltham, MA, USA) in 30 residents in Dubai, the UAE, born in different countries: 21 UAE, 2 Yemeni, 1 Saudi, 1 Omani, 1 Iranian, 1 Pakistani, 1 Ethiopian, 1 Sudanese and 1 Egyptian. Samples were quantified using Qubit dsDNA HS Assay Kit and normalized to 1 ng in 15 µl. SNP libraries were constructed using Ion

AmpliSeq Kit for Chef DL8 with Precision ID Ancestry Panel on the Ion Chef instrument and with 22 PCR cycles as per the manufacturer's recommendations. The chef prepared pooled libraries were then diluted to an equimolar concentration of 30 pM for template preparation. Template preparation, enrichment of beads containing template and chip loading of the templated beads on Ion 530 chip were performed using the Ion Chef instrument and the Ion S5 Precision ID Chef & Sequencing Kit as instructed in the manual. Sequencing was done on an Ion S5 NGS with the Torrent Suite Software v5.2.2 and with default settings using Hg 19 as the reference genome. Data analyses were performed using the HID SNP Genotyper Plugin.

3. Results and discussion

The inferred ancestry (Table 1) showed a very diverse profile of admixture. Only three Arabians showed a 100% Southwest Asian (SWA) profile, 16 of them showed a main SWA proportion (between 40% and 90%) admixed with one or two other ancestries, while the remaining six were highly admixed. Even so, all the Arabian individuals were mapped around SWA. The Egyptian profile resembled a low admixed Arabian (95% SWA), while the Iranian had European (60%) added by SWA (30%) components. The Pakistani had the highest South Asian profile (70%), mixed with three other ancestries. The two Africans were also admixed: the Ethiopian had 45% African and 55% SWA; while the Sudanese had 30% and 70%, respectively of those ancestries. The top most inferred population is highly dependent on the

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Table 1

Inferred admixture proportions and top most inferred population and geographical region of the 30 samples from UAE residents by genotyping the Applied Biosystems™ Precision ID Ancestry Panel (Panel (Thermo Fisher, Waltham, MA, USA)).

Sample ID	Nationality of origin	Inferred admixture proportions							Top most inferred population	Inferred Region	Likelihood
		Africa	Europe	Southwest Asia	South Asia	East Asia	Oceania	America			
UAE_1	UAE	0%	20%	80%	0%	0%	0%	0%	Jews, Yemenite	Asia	1.13E-44
UAE_2	UAE	20%	25%	45%	0%	0%	0%	10%	Negroid makrani	Asia	2.06E-56
UAE_3	UAE	0%	0%	100%	0%	0%	0%	0%	Palestinian	Asia	8.63E-47
UAE_4	UAE	5%	0%	45%	45%	0%	5%	0%	Mohanna	Asia	1.61E-50
UAE_5	UAE	0%	20%	35%	45%	0%	0%	0%	Keralite	Asia	1.20E-43
UAE_6	UAE	0%	10%	55%	35%	0%	0%	0%	Pashtun	Asia	8.95E-45
UAE_7	UAE	5%	0%	60%	35%	0%	0%	0%	Negroid makrani	Asia	7.33E-48
UAE_8	UAE	0%	0%	70%	10%	5%	15%	0%	Pashtun	Asia	2.52E-51
UAE_9	UAE	0%	20%	55%	25%	0%	0%	0%	Kuwaiti	Asia	5.50E-48
UAE_10	UAE	0%	25%	75%	0%	0%	0%	0%	Sardinian	Asia	3.45E-40
UAE_11	UAE	15%	0%	85%	0%	0%	0%	0%	Negroid Makrani	Asia	7.50E-47
UAE_12	UAE	20%	0%	80%	0%	0%	0%	0%	Negroid Makrani	Asia	2.32E-52
UAE_13	UAE	25%	5%	20%	50%	0%	0%	0%	Negroid Makrani	Asia	2.60E-48
UAE_14	UAE	0%	15%	65%	20%	0%	0%	0%	Adygei	Europe	6.19E-47
UAE_15	UAE	0%	15%	85%	0%	0%	0%	0%	Kuwaiti	Asia	3.21E-44
UAE_16	UAE	5%	30%	10%	55%	0%	0%	0%	Mohanna	Asia	3.36E-48
UAE_17	UAE	5%	15%	60%	20%	0%	0%	0%	Negroid Makrani	Asia	4.35E-46
UAE_18	UAE	0%	45%	40%	0%	0%	15%	0%	Palestinian	Asia	4.63E-48
UAE_19	UAE	30%	0%	45%	25%	0%	0%	0%	Negroid Makrani	Asia	8.49E-50
UAE_20	UAE	25%	30%	40%	5%	0%	0%	0%	Negroid Makrani	Asia	3.03E-45
UAE_21	UAE	0%	0%	100%	0%	0%	0%	0%	Kuwaiti	Asia	4.97E-37
UAE_28	Omani	5%	0%	90%	5%	0%	0%	0%	Palestinian	Asia	3.35E-45
UAE_27	Saudi	0%	15%	80%	5%	0%	0%	0%	Palestinian	Asia	1.54E-46
UAE_22	Yemen	0%	0%	100%	0%	0%	0%	0%	Kuwaiti	Asia	1.21E-41
UAE_23	Yemen	5%	0%	75%	0%	0%	0%	20%	Palestinian	Asia	1.25E-56
UAE_29	Iran	0%	60%	30%	5%	0%	5%	0%	Hungarian	Europe	3.70E-42
UAE_25	Pakistan	10%	0%	0%	70%	15%	5%	0%	Keralite	Asia	3.04E-52
UAE_26	Egypt	5%	0%	95%	0%	0%	0%	0%	Jews, Yemenite	Asia	2.10E-45
UAE_30	Ethiopia	45%	0%	55%	0%	0%	0%	0%	Somali	Africa	7.39E-52
UAE_24	Sudan	30%	0%	70%	0%	0%	0%	0%	Jews, Ethiopian	Africa	1.44E-47

populations included as reference in the software, and this type of information should be dealt with great caution.

4. Conclusions

This work shows that the application of ancestry tests can be used to provide investigative leads to solve crimes, but values should not be strictly interpreted given the highly admixed profile of some populations, such as the UAE.

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