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Short communication

Micro and macro geographical analysis of Y-chromosome lineages in South Iberia

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ABSTRACT

In this study, we intend to identify the evolutionary footprints of the South Iberian population focusing on the Berber and Arab influence, which has received little attention in the literature. Analysis of the Y-chromosome variation represents a convenient way to assess the genetic contribution of North African populations to the present-day South Iberian genetic pool and could help to reconstruct other demographic events that could have influenced on that region. A total of 26 Y-SNPs and 17 Y-STRs were genotyped in 144 samples from 26 different districts of South Iberia in order to assess the male genetic composition and the level of substructure of male lineages in this area. To obtain a more comprehensive picture of the genetic structure of the South Iberian region as a whole, our data were compared with published data on neighboring populations. Our analyses allow us to confirm the specific impact of the Arab and Berber expansion and dominion of the Peninsula. Nevertheless, our results suggest that this influence is not bigger in Andalusia than in other Iberian populations.

1. Introduction

Archaeological and historical data shows that the Mediterranean Sea has been a natural barrier that has obstructed but not avoided human migrations between southern Europe and northern Africa. In fact, there have been many major cultural exchanges around this sea and, therefore, population admixture could be expected.

It has been previously reported that contemporary Spanish and North-western African patrilineages have different origins, with the 15-km-wide Strait of Gibraltar acting as a major barrier to gene flow. Indeed, detected bidirectional gene flow across the Strait accounts only for 4–7% when Y-chromosome is considered [1].

Still, as a result of this geographical proximity, Andalusia (the southernmost region of Iberia) is linked to North-western Africa by historical events, including cultural exchanges and population movements. Only the prehistoric period was characterized by the independence between both regions in terms of human population dynamics.

When history starts, both regions entered a shared Phoenician influence coming from the Middle East until the whole Peninsula became under the control of the Roman Empire, dividing Hispania into different provinces [1–3].

The next profound cultural and political impact into these two areas was the Islamic expansion. It came into NW Africa during the 7th century C.E. and arrived to Iberia during the beginning of 8th century C.E., lasting more than 7 centuries. The Arabs conquered Northern Africa spreading their language, culture and religion throughout the Berbers. However their genetic influence on North Africa and the Iberian Peninsula has just started to be studied recently [4,5], and the precise number of NW African peoples that may have contributed to the Peninsula population is not accurately known [6].

The Muslim Kingdoms in the south continually fought the Catholic Kingdoms in the North (Galicia, Asturias, Castile, Navarra, Aragon and Catalonia) [7], which leaded to the reconquest of the Peninsula by the Catholic Kingdoms and the ceasing of the Islamic rule in 1492. Probably only Y chromosomes of those Arab and Berber descendants who were converted to Christianity may have

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contributed to the genetic pool of modern Spaniards and Portuguese. In that period, driven by the historical episodes of social and religious intolerance those who had chosen to convert and stay, moved to northern regions such as Galicia and Leon, where they were less persecuted. In fact, a study published by Adams et al. in 2008 [8] detected that Galicia and Leon (Northwest Iberia) were the regions of Iberia showing more North African genetic influence, being Granada (the last southern region to be conquered in 1492) the least influenced.

Subsequent and more recent studies [9–11] underscore the importance of the Moorish conquest of Iberia as major cause of the higher genetic diversity in southern Europe, relegating into second place other alternative hypotheses such the existence of glacial refugia in southern Europe [12] or the gene flow from the Middle East [13,14]. Furthermore, Botigué et al. in 2013 [9] proved that the genetic influence of Maghreb in Europe follows a southwest to southeast gradient, emphasising the crucial role of Andalusia as a historical gateway to Europe for North African migrants.

Previous studies in North Africa and the Iberian Peninsula focused in gene genealogy or population comparisons to Middle East and European populations [15,16]. In the present study, our aim is to define the main patrilineal lineages in Andalusia, focusing on Arab and Berber influence and comparing them to those found in many other populations from Europe and North Africa.

We have typed 26 Y-SNPs and 17 Y-STRs in 144 males from Andalusia (South of Spain). The combined use of SNPs, whose mutations almost never show recurrence in evolutionary history, together with a well-established structure for Y-chromosome phylogenetic tree [17], will allow us to reconstruct phylogenies in a more reliable way and to test the possible existence of substructure in the Iberian populations because of the longer North African presence in the studied region. In addition, the highly polymorphic character of STRs and their high degree of geographical differentiation, provide the necessary phylogeographic resolution for population genetic studies.

2. Material and methods

2.1. DNA samples

In this study we have sampled unrelated males from 26 distinct municipalities belonging to the eight different provinces of Andalusia. All individuals have Spanish surnames and have lived in the municipality for three generations. We have also used data of 32 populations available in the literature: five from Iberia, ten from Northern African, six from Southern European in the Mediterranean area and other eleven European populations (Fig. 1 and Supplementary Table S1).

Fig. 1. Map of Mediterranean Area.
The 8 Andalusian populations included in the Microgeographical scale analysis: a) Huelva, b) Seville, c) Córdoba, d) Jaén, e) Cádiz, f) Málaga, g) Granada, h) Almería). The 32 populations included in the Macrogeographical scale analysis: 1)Galicia, 2) Basques, 3) Portuguese, 4) Catalan-speaking Spanish, 5) Castilian-speaking Spanish, 6) Morocco, 7) Bedouins, 8) Libya, 9) Berbers, 10) Algeria Berbers, 11) Algeria Arabs, 12)Egypt, 13) Tunisia, 14) North Africans, 15) Lebanon, 16) South Italy-Napoli & Sicily-, 17) North Italy, 18) Greece, 19) Sardinians, 20) Turkish Cypriots, 21) Cretans, 22) Bosnian Croats, 23) Bosnian Serbs, 24)Serbs, 25) Western Russians, 26) Croats, 27) Austria, 28) Germany, 29) Poland, 30) France, 31) Albania, 32) Ireland.