

Supplementary Text S1: Affinities of the Ethio-Somali ancestry component

Our analysis of the Ethio-Somali ancestry component revealed at K=12 produced three results that support its non-African affinities. First, the lowest pairwise F_{ST} values estimated for the Ethio-Somali ancestral population from the ADMIXTURE analysis are with the Maghrebi and Arabian ancestral populations (0.074, 0.083) (the Maghrebi ancestry component derives from an early back-to-Africa migration into North Africa [1,2]). F_{ST} values are on average lower between the Ethio-Somali component and non-African populations (mean=0.097) than with sub-Saharan African populations (mean=0.126) (see figure immediately below).

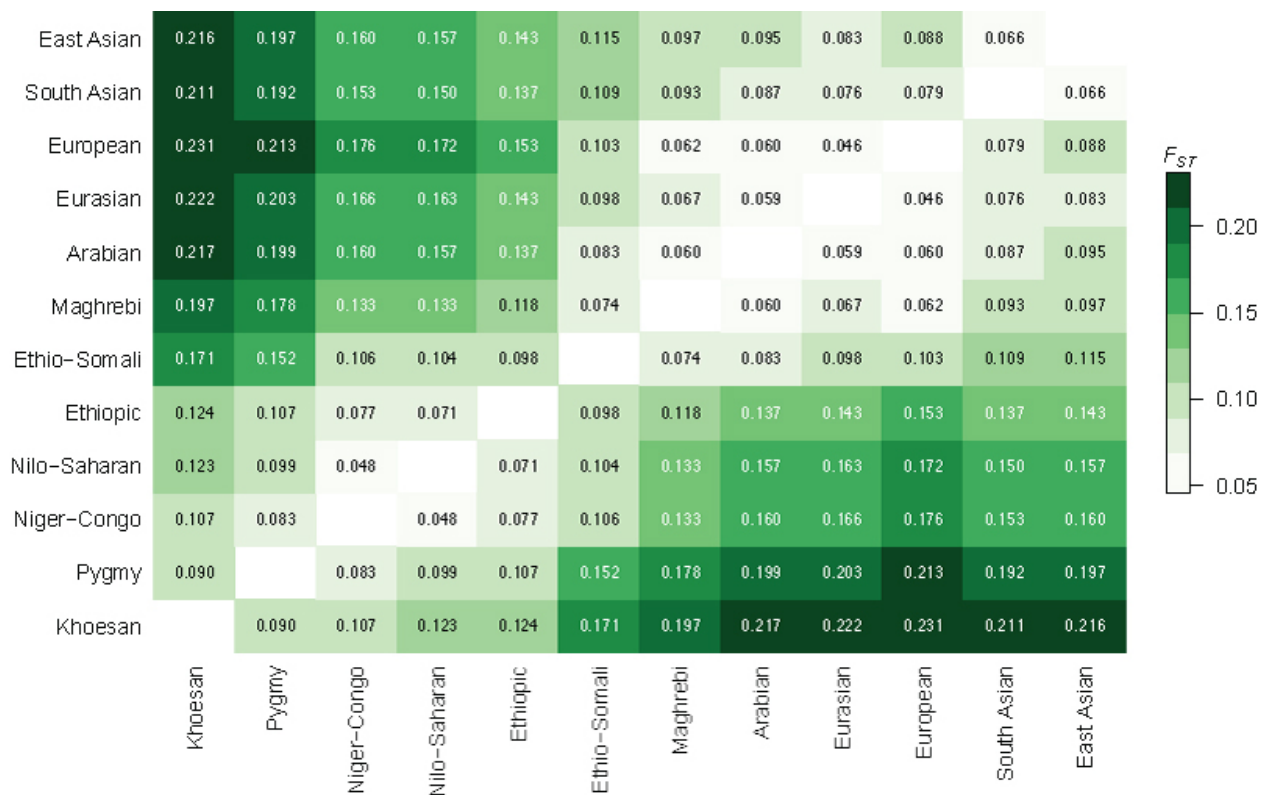


Figure S1-1 – Pairwise F_{ST} estimates show the non-African affinities of the Ethio-Somali.

The Ethio-Somali ancestry component has the lowest pairwise F_{ST} values with the Maghrebi and Arabian ancestral populations (0.074, 0.083). F_{ST} values are on average lower between the Ethio-Somali component and non-African populations (mean=0.097) than with sub-Saharan African populations (mean=0.126).

Second, we conducted three formal tests for admixture and found that eight of the HOA populations had statistically significant signals of admixture with non-African populations for all three tests (Tables S2, S3, S4). For these eight populations, we estimated the proportion of non-African ancestry using both the admixture bounds extension of the f_3 test and f_4 ratio estimation [3]. We also summed the non-African ancestry components from the ADMIXTURE analysis with and without the Ethio-Somali component. The f_3 bounds and f_4 ratio estimates agree that all admixed HOA populations have around 50% non-African ancestry (see table immediately below). The ADMIXTURE estimates of non-African ancestry that do not include the Ethio-Somali values are substantially lower, averaging around 20%. Only if we include the Ethio-Somali component as non-African ancestry do the ADMIXTURE values become consistent with the f_3 bounds and f_4 ratio estimates.

Estimates of non-African ancestry in admixed Horn of Africa populations.

Population	f_3 bounds	f_4 ratio range	ADMIXTURE (-Ethio-Somali)	ADMIXTURE (+Ethio-Somali)
Afar	0.47 – 0.66	0.49 – 0.55	0.26	0.69
Amhara	0.48 – 0.61	0.52 – 0.71	0.30	0.65
Ari Cultivator	0.42 – 0.79	0.24 – 0.50	0.03	0.20
Oromo	0.58 – 0.76	0.42 – 0.65	0.24	0.55
Ethiopian Somali	0.38 – 0.60	0.43 – 0.65	0.11	0.64
Somali	0.39 – 0.59	0.43 – 0.65	0.09	0.66
Tygray	0.50 – 0.62	0.54 – 0.57	0.32	0.68
Wolayta	0.52 – 0.74	0.39 – 0.60	0.17	0.44

Third, the first dimension of the IBS MDS analysis appears to represent the proportion of non-African ancestry (Main Text Figure 1). If so, there should be a positive relationship between non-African ancestry proportions estimated from the ADMIXTURE analysis (K=12) and the MDS first dimension values. We fit linear models testing this relationship for all ancestry components that contribute at least 5% ancestry to two or more HOA populations (see table immediately below). As predicted, there is a positive relationship between the first MDS dimension and Arabian or Eurasian ancestry (and a negative relationship between the first MDS dimension and Nilo-Saharan or Ethiopic ancestry). The relationship between Ethio-Somali ancestry and the first MDS dimension is both statistically significant and positive ($p = 1.3 \times 10^{-6}$, $R^2 = 0.14$).

Relationship between ADMIXTURE ancestry and first MDS dimension¹.

	Direction	R²	p
Nilo-Saharan	negative	0.67	$< 2.2 \times 10^{-16}$
Ethiopic	negative	0.10	2.0×10^{-6}
Ethio-Somali	positive	0.14	1.3×10^{-6}
Arabian	positive	0.52	1.3×10^{-15}
Eurasian	positive	0.02	n.s.

¹ For those ancestry components present at 5% or greater in two or more Horn of Africa populations.

Taken in combination, these three lines of evidence offer strong support to the hypothesis that the Ethio-Somali ancestry component has a non-African origin, and results are consistent with earlier findings of substantial non-African ancestry in HOA populations [4–6].

Supplemental Text References

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6. Pagani L, Kivisild T, Tarekegn A, Ekong R, Plaster C, et al. (2012) Ethiopian Genetic Diversity Reveals Linguistic Stratification and Complex Influences on the Ethiopian Gene Pool. *Am J Hum Genet* 91: 83–96. doi:10.1016/j.ajhg.2012.05.015.