



## ANCESTRY IN LATIN AMERICA: BRAZIL STUDY

Name:

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### Abstract

In this systematic review, the researcher sought to investigate the ancestry of populations in Latin America using the case of Brazil. In particular, the review focused on analyzing several pieces of empirical evidence on the genetic history of Brazilians. The study established that the Brazilian population is one of the world's most heterogeneous populations, comprising of Europeans, Amerindians, and Africans. Multiple studies that have employed genetic markers and autosomal polymorphisms, particularly the electrophoresis protein markers and blood groups, indicate that regardless of their skin color, most of the Brazilians exhibit an overwhelming degree of European ancestry, significant scope of African ancestry, and a uniform degree of Amerindian ancestry. The implication of this empirical finding is that the genetic history of the Brazilian people is largely drawn from the European continent.

*Keywords:* ancestry, Brazil, Europeans, Amerindians, Africans, markers.

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### Introduction

Genetic association studies (GAS) are usually carried out to establish the specific genetic factors that underlie the vulnerability to complex diseases [1]. Coelho et al. [1] explain that the single nucleotide polymorphisms (SNPs) constitute the major genetic distinctions examined in GAS. Empirical evidence involving GAS and in particular SNP genotyping shows that the Northeastern Brazilian populations experience a significant influence of the European ancestry, followed by the African and Amerindian ancestries respectively [1-3]. Coelho et al.'s [1] study reveals that the dominance of European ancestry on the Northeastern Brazilian populations is 59.7% whereas Campanella et al.'s [2] research indicates that the predominance of the same ancestry in this population is 67.5%. Despite this disparity in the findings, the consensus of both studies is that the

European ancestry has had a considerable impact on the people living in the north east region of Brazil.

It is worth pointing out that other than Coelho et al. [1] and Campanella et al.'s [2] studies, several other pieces of empirical evidence have demonstrated that it is not only the population in the north-eastern region of Brazil, but nearly in all of Brazil, whose ancestry is dominated by that of Europeans and Africans [4-6]. Therefore, based on these studies, it can be inferred without any prejudice that the majority of the inhabitants in Northeastern Brazil, and Brazil in general, originated from the European continent or the African continent [4,5]. Nevertheless, this conclusion is not indicative of the assumption that the influence of the Amerindian and Asian ancestry in the Brazilian population is insignificant. It only implies that the ancestral origin of the vast majority of Brazilian inhabitants can be traced back to Europe and Africa respectively [6]. In other words, the genetic history of most Brazilians has its roots in both Europe and Africa, with the European ancestry showing much greater dominance than the African ancestry. The focus of this systematic review is to explore the ancestry in Latin America using the case study of Brazil.

## Methodology

### Search strategy and selection criteria

Typically, a systematic review focuses on identifying, appraising, and synthesizing various pieces of evidence that satisfy the eligibility criteria so as to effectively respond to a particular research question. The search strategy that was used in this systematic review followed the existing guidelines and, more importantly, the researcher formulated and adopted a search strategy that is highly detailed, reproducible, and documentable. The researcher conducted in-depth, objective, and reproducible search of a broad range of sources so as to identify as many relevant empirical pieces of evidence as possible. The search terms included "genomic," "ancestry," "Brazil," "Latin America," "admixture," "population," "markers," "genetic," "allelic," "frequencies," "lineages," "molecular," "skin color," and "screening." The inclusion criteria employed in the search and selection strategy involved pre-test and post-test data. The search was limited to those articles published from 2007 to date. The exclusion criteria limited the search to the full-text articles that were presented in the scientific databases in English. The PRISMA diagram below (Figure 1) shows the various steps of the search and selection process.

The quality control of the selected articles was carried out by two peer reviewers. They examined the accuracy of the quantitative and qualitative data as well as the research methodologies and the sample sizes using a customized Downs and Black checklist.

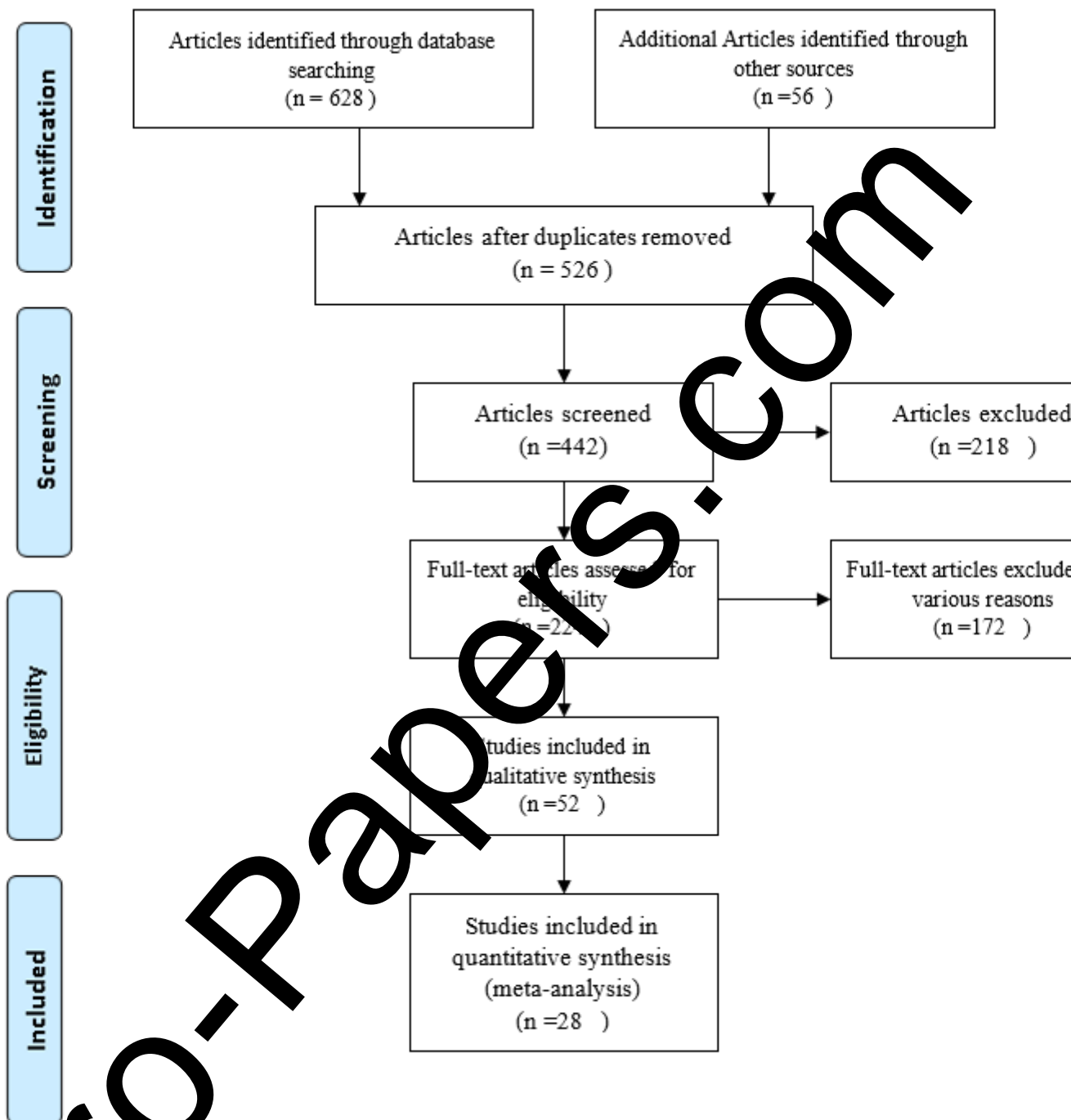


Figure 1: PRISMA flow diagram

## Results

### Analysis of Skin Color in the Brazilian Populations

Multiple genetic studies on normal and pathological distinctions in the human pigmentation have been carried out by many scholars in the recent past [3,7,8]. Some of these pieces of empirical evidence have shown that it is possible to use genotype data to predict the human phenotypes with varying degrees of precision, highlighting the significance of these types of research for forensic practices [3]. Moreover, other studies have suggested that some of the skin pigmentation variations also confer resistance or vulnerability to skin cancer because the presence of different skin tones is mostly attributed to adaptation to diverse environments. It is critical to note that there is a general

consensus among human geneticists and anthropologists that from a biological point of view, there are no human races in the world [9-11]. The physical characteristics of a person, in particular, skin pigmentation, shape of nose and lips, hair texture, and hair color are consistently used to group people [10]. Thus, these traits play an extremely important role in human social relationships [9]. Nonetheless, these oligogenic attributes are considered to have developed due to adaptation mechanisms to the geographically dependent environmental factors, for example, solar heat and radiation. Therefore, the use of these traits as “race” markers is erroneous [10, 11]. Regardless of this biological meaning, the human skin color remains an important marker that is used to trace ancestry of populations across the world, including Brazil.

Brazil has a relatively large level of genetic admixture [3, 6, 12, 13]. In fact, Brazilians are considered one of the world’s most heterogeneous populations, whose ancestry comprises of Europeans, Amerindians, and Africans [3]. In a study that sought to establish the color and the genomic ancestry of the Brazilian population, Pimenta et al. [11] observed that based on the estimates of molecular markers, color is a poor predictor of genomic ancestry of the Brazilian population. The researchers explicate that microsatellites exhibit a high degree of polymorphism because of the variation in the number of the successive units between the alleles. According to Pimenta et al. [11], this phenomenon is mainly believed to be a result of recurrent slippage during the replication process. Due to the high mutation rate of the microsatellites and the step-by-step mutation process results in frequent homoplasmy in the population studies. Traditionally, if one is to take into consideration the potential of size constraints in the growth of microsatellites, various populations would tend to depict typical allelic distribution for the markers. Nonetheless, microsatellites have been found to be useful in studying the evolution of human beings as well as their genetic structure.

In multiple studies that have used DNA markers to determine the ancestry of Brazilian populations it was found that regardless of their regional source, the Y chromosomes in the vast majority of the Brazilian males are of European origin [2,9,11,23]. At the same time, these individuals have an insignificant frequency of the Sub-Saharan African Y chromosomes [2]. Furthermore, the signs of Amerindian ancestry are completely absent. The inference that can be drawn from these studies where DNA markers have been used is that there is a strong directional mating that involves the European males and the African and Amerindian females [9]. It is worthwhile pointing out that since Brazil has as a country has a large territory and because several of its diverse population groups moved into different parts of the country, it has significant phylogeographical heterogeneity [9].

A critical evaluation of Pena et al.’s [4] empirical observation indicates that Brazil has a significant admixture that can be appreciated not only at the individual level, but at the group level as well. The researchers acknowledge that at the individual level, Brazilian populations show great ancestry variation for all the color categories across all the regions [4]. On the other hand, it emerges from the group level that the African ancestry of the Black individuals is far lower than that witnessed at the individual level. If one is to take into account the uniqueness of the history and social culture of the Brazilian populations, it becomes clear why there is a significant disparity in both the individual and group admixtures [4]. Africans typically have black skin that is associated with other dominant attributes of color, for example, black curly hair, thicker lips, and broad nose [4,21]. The Europeans have white skin that has a correlation with specific components such as thin nose and lips, light-colored hair, and light straight hair [4]. According to Pena et al. [4], these characteristics in both Europeans and Africans are all determined by a relatively small number of genes resulting from evolution under certain aspects of the geographical environment, specifically, the levels of ultra violet (UV) exposure. Therefore, if the social identification system is based mainly on the phenotype of individuals, this classification is only based on the presence of specific alleles that are relatively small in number but have an impact on an individual’s color, while not taking into account the rest of the genome. On the contrary, if one considers a population that is an outcome of an

extensive admixture of Africans and Europeans, for example, the Brazilian population, the link between color and ancestry should dissipate with time, an observation that has been confirmed by empirical evidence [4,9].

### **Genomic Ancestry of Brazilian Population**

It emerges from a review of the existing body of knowledge on color and genomic ancestry of Brazilian populations that the majority of the researchers have consistently employed the historical, anthropological, and sociological methodology to evaluate the origins of the Brazilians [9]. Contemporary studies that have used uniparental markers in both the black and white Brazilians show that the genomic structure of the majority of the Brazilians is mosaic, comprising of Nonrecombining Region of the Y Chromosome (NRY) and mtDNA of different phylogeographical origins [9]. Pena et al. [9] point out that the studies with the autosomal biparental markers indicate elevated degrees of genetic admixture between the European, African, and Amerindian mixtures. However, the researchers observe that it is also clear from these studies that there was a significant population effect of the “whitening” program that came about during the immigration of the Europeans to Latin America after 1872.

Subsequently, the relationship between genomic ancestry and skin color is imperfect [9, 21]. In other words, it is hard to accurately predict an individual’s skin color from their level of Amerindian, African, and European ancestry [9,21]. Therefore, regardless of their skin color, most of the Brazilians exhibit an overwhelming degree of European ancestry, significant African ancestry, and a uniform degree of Amerindian ancestry [9,21]. In a nutshell, the high ancestral distinction observed in Blacks and Whites suggests every Brazilian has a singular and fairly individual fraction of Amerindian, African, and European ancestry in their mosaic genomes [9,21]. Understanding the premise of variety in human physical appearance has been a subject of long-standing examination intrigue. Refining our knowledge on the hereditary qualities of physical appearance in human populaces is of impressive developmental, biomedical, and legal significance. Latin America gives a beneficial setting in which to analyze the effect of ancestry on physical appearance [3,8,24]. The locale has a one of a kind history identifying with the social and socio-governmental issues of ethnicity, race, and country. An impressive number of hereditary examinations have studied the admixture in Latin America [23,24,27]. Barely any studies have been conducted on the effect of hereditary lineage on physical appearance or the relationship of these to singular ideas of ethnicity and family line. Since the late fifteenth century, the number of inhabitants in what is currently called “Latin America” has experienced real statistic changes [18,22,24-28]. There have additionally been various discernible populace changes in the area, Latin America now being the most urbanized locale of the world [4,19].

### **Discussion**

The interjected family maps obtained are consistent with other ancestry studies and with evaluation of data on dispersion of fundamental ethnicity bunches inside every nation [5,7,23,27]. This information underlines the strong genetic bonds existing inside and between Latin American nations. Comprehensively, Local American heritage is most noteworthy in territories that were thickly populated in pre-Columbian times and in areas that got generally little non-local migration and which right now have moderately low populace densities [9,13,22]. Early Iberian migrants settled over the mainland, admixing broadly with Local Americans and Africans [21].

Observational confirmation including GAS and specifically SNP genotyping demonstrates that the Northeastern Brazilian populaces have European lineage, followed by the African and Amerindian ancestries individually. One study demonstrates that the frequency of European ancestry in Northeastern Brazilian populaces is 59.7% though another exploration shows that the transcendence of this parentage in this populace is 67.5%. In spite of this dissimilarity, the

European lineage has considerably affected the general population living in the north east district of Brazil.

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