RAS MEDICAL SCIENCE

Research Article: Civilization and the ABO blood groups

ISSN : 2766-5240

Issue Type: Volume 2 Issue 3

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Citation: Donna K Hobgood MD Civilization and the ABO blood groups

Received Date: 28th May 2022

Published Date: 11th June 2022

ABSTRACT

Background:
Were humans who formed the first civilizations genetically different from other humans? Or did environmental factors alone result in settled ways of life and thus civilization? Hunter-gatherer ways of life appeared to be the norm until c 10,000 years ago when agriculture began to shape human destiny and civilization followed.
As the first human gene discovered, ABO gene has been studied extensively as to health and personality correlates, and while no consensus has been reached, there are findings that warrant further research.
Given the prominent variations in ABO blood group frequencies based on geography, some archeological evidence and current population data on ABO blood group frequencies could be valuable to understand the historical and genetic context of civilization.

Methods:
To explore possible genetic differences from hunter-gatherers in sites where early agricultural based civilizations formed, current populations in those areas were surveyed as to their ABO phenotypes.

Results:
Earliest civilizations seemed to be found in areas of lower ABO O:ABO A ratio compared to the world ratio.

Conclusions:
When looking at human migration patterns, the conclusion can be drawn that while the Out of Africa migrations of c 50,000 ya appeared to consist of groups with High ABO O:ABO A ratio, civilizations that formed after c 10,000 ya marking the Agricultural Revolution were of lower ABO O: ABO A ratio than that of c 50,000 years ago and even of current world ratio.
It appears that a more genetically behaviorally diverse population supported the formation of earliest civilizations.

Background

Root of civilization is usually traced to c10,000 years ago when agriculture began in the Fertile Crescent. Prior to that, man was a hunter-gatherer. From that time, farming and civilization appears to have spread fairly diffusely over large geographic areas from China to Egypt to Central America and to Greece.
Was there a genetic similarity in the humans who formed these civilizations that differed from other groups of humans? Is developing a community life of settling and cultivating food a genetic trait?
Change in climate after the last Ice Age and depletion of game for hunting could be the major environmental factors in creating settled ways of life, but human personality traits such as preference for routines and staying in one area would seem to be related to developing farming. These traits have been found to have some genetic correlates. Such genes as those related to neurotransmitters seem related in behavior and personality. Personality traits such as the Cloninger traits of novelty seeking, reward dependence, persistence and harm avoidance seem likely to relate to preferences for routines and staying in place that would predispose to farming. The Cloninger traits have been found to have genetic correlates with many genes related to neurotransmitters, and these genes have different frequencies related to

geographic areas.

Another gene, one that was the first gene discovered and that has present day allele frequencies expressed in areas where civilization started that differ from worldwide allele frequencies and which could be relevant to early man and his living choices, is the ABO gene on chromosome 9q34. This gene produces antigens that are found on many cell types. Each individual can be typed as having O, A and/or B antigens. Since an individual has 2 copies of this gene, one from mother and one from father, an individual can be OO, OA,OB, AA, BB or AB.

The ABO gene evolution in humansis an extension of that of the primate ancestors. As far back as can be known the primate ancestral allele is ABO A going back some 8 million years in Africa, the continent from which all humans alive today can trace their genetic ancestors. In the primate lineage, it is thought that ABO O and ABO B evolvedas ABO A became extinct for a time. Then some 260,000 years ago ABO A reappeared thought from a recombination of ABO O and ABO B, this coincident with the appearance of our ancestral homo sapiens in Africa. (1) All humans alive today are thought to have derived from ancestral populations in Africa who migrated from Africa about 50,000 years ago near the time of a glacial maximum. Other homo sapiens throughout the world are known to have existed but are now extinct as no traces of their progeny are now known. Populations vary significantly in frequencies of these phenotypes, O, A, B or AB since A and B antigens are co-dominant and O recessive. Authorities tend to think that though the ancestral allele for ABO site was A, complex evolutionary forces have resulted in the current world frequencies of humans of O (40-45 %) A (35-40 %), B (4-11%) and AB(0-2 %).

Could ABO blood group gene have an effect on culture via an effect on human personality? An effect of the ABO gene on personality and theoretically on culture and civilization formation may be from links with the dopamine: norepinephrine ratio and the downstream effects on anxiety level. If so, the evidence would suggest that ABO A has a higher norepinephrine: dopamine ratio and thus higher anxiety, fear and “fight or flight”. Some data on modern populations suggests that ABO A is higher in populations of liberal leanings vs conservative leanings. This genetic stratification of populations seems to reflect the higher anxiety, fear, and “fight or flight” in modern liberal progressive philosophy compared to conservative settled philosophy. So genetic underpinnings of human macro-behavior is being explored.

Methods

To explore possible genetic differences in sites where early civilizations formed, current populations in those areas were surveyed as to their ABO phenotypes.

Additionally, archeological data was surveyed as to ABO phenotypes/genotypes in those areas.

Results

Date describing ABO blood type frequencies in historical and pre-historical populations is known though quite limited. Some work has been done analyzing tissue samples from ancient human remains as well as blood tests from current indigenous populations with some conclusions reached as to the ABO blood groups’ evolutionary course in prehistoric and early historical populations. For example, hunter-gatherer populations such as the Vikings and Celtic populations appear to have been of ABO O types. Other hunter-gatherers such as central European Germanic tribes appeared to be of ABO A types, and Mongolian hunter gatherers appeared to be ABO B. Neanderthal specimens have been found to all be ABO O. Egyptian specimens from Egyptian pharaohs have also shown ABO O blood types.

In contrast to the hunter-gatherer tribes in northern Europe and Asia dating from c1000 BC above, agricultural tribes appeared to form settled cities including Sumer in Mesopotamia c 4000BC followed by the Indus Valley c3000BC, Egypt c3000BC, China c 2000BC, Greece c 2000BC, Rome c1000BC and Central and South America c1000 BC. Except for the Central and South American agriculturally based indigenous early civilizations, where no ABO A was present, these other sites of early civilizations are areas where modern inhabitants are of lower ABO O: ABO A ratio thantotal world frequencies. To follow this development which paralleled the beginnings of the Agricultural Revolution, the history of the evolution of population frequencies of the ABO alleles could be revealing of what genetically based human behavioral changes led to civilization. (Table 1)

Using both historical accounts and accounts of genetic analysis of prehistoric human remains, a complex picture emerges. Australian aboriginal individuals, a group whose ancestors are thought to be a group with little change from their genetic status on their migration from Africa some 50,000 years ago, have been studied as to ABO status. They are of predominantly ABO O and some ABO A and no ABO B. African homo sapiens are thought to have been of predominantly ABO A type from c260,000ya through c 100,000ya by which time selection of ABO O and de-selection of ABO A from malaria is posited by researchers to have occurred (2)

All the current locations where early civilizations formed demonstrate less ABO O and lower ABO O: ABO A ratiothan current world population frequencies. Although frequencies of ABO blood groups in large populations are thought to remain fairly stable over timespans of several thousand years, that window being applicable to studying civilization, there is admittedly reason to be cautious about generalizing from current local populations to these ancient populations. However world population ABO frequencies are probably fairly stable over this window of time of past c7000 years.

So if the populations that migrated from Africa some 50,000 years ago wereof high ABO O:ABO Aratio as a result of selection of ABO O by malaria, and if the early civilizations after the Agricultural Revolution of c10,000 years ago were situated in areas of present day lower ABO O:ABO A ratio than world population, how did this occur? And what does this mean in terms of human evolutionary history?

Discussion

To attempt to answer this question, one can review the migrations of northernmost hunter-gatherer tribes during the time of the formation of early civilizations from c5000 BC following the Agricultural Revolution of c10,000 BC. While ABO O groups like the Celts and the Vikings were earliest hunter-gatherer inhabitants of northern Europe and the Baltic area, ABO A groups including the Franks, Goths, Visigoths and many others were living in northern Europe as well. ABO B hunter-gatherer groups centered on Mongolia and migrated widely during the time that agricultural based civilizations were forming. These high concentrations of ABO A and ABO B types would have escaped the de-selection of ABO A and ABO B by malaria by their presence in areas to the north where malaria was less prevalent. The ABO A Germanic hunter-gatherer groups have been extensively historically documented as moving into the probably high ABO O:ABO A ratio agricultural based settlements

in Sumer, Egypt, Greece and Roman Empire and in Henan China and other sites of the earliest cities. Mongolian ABO B hunter-gatherer groups followed similar migration and conquest routes like the Germanic ABO A groups though ABO B groups trended more eastward. There is no record that these ABO A and ABO B hunter-gatherers expanded through the Bering Strait to the Central and South American early civilizations which are of almost all ABO O populations. This would have eventuated in a diverse population in the agricultural based civilization forming sites in Sumer, Henan, China, Indus Valley, Egypt, Greece and Roman as to ABO blood groups. (2,3)

In summary, malaria is thought by researchers to have caused the shift in Pre-50,000ya Africa from high ABO A:ABO O ratio to high ABO O:ABO A ratio by 50,000ya. After migration, areas with less malaria risk kept a large population of ABO A and of ABO B which dispersed ABO A and ABO B back into other post migration populations of high ABO O. The result would appear to be populations with diverse ABO frequencies. Those with a ratio near unity of ABO O and of ABO A can be surmised to have supported the events of the Agricultural Revolution and resulting formation of cities.

Support for the probability of this historical process can be also seen to lie in the personality correlates of the ABO blood group alleles. This data can be used to infer that a behaviorally diverse population would be able to adopt farming and sedentary ways of life that led to cities and civilizations whereas a more genetically homogeneous population would have been less likely to succeed. Civilization would require specialization which would be supported by variation in human propencities. Because of the research demonstrating personality and behavioral correlates in the ABO blood group alleles, behaviorally diverse populations would be posited to have been associated with if not caused by diversity in ABO blood group frequency distribution.

ABO A is associated with genetically higher activity dopamine beta hydroxylase (DBH) and thus a higher norepinephrine:dopamine ratio. Persistence trait has been found to be higher in the ABO A blood groups. Personality trait studies support a higher anxiety in ABO A as well.(4-25)

Since personality traits show correlations with catecholamine genes, if catecholamine genes are correlated with ABO blood groups, then there would be tendencies of the catecholamine activities' effects on personality noted with the ABO blood groups, and there is some research demonstrating these correlations. ABO group A appears to show tendencies to correlations with increased DBH, increased COMT and increased MAOA with result of low dopamine and higher norepinephrine. ABO B appears to have decreased DBH, decreased COMT and increased MAOA with resultant higher dopamine and moderate norepinephrine. ABO O has research showing trends toward high DBH, high COMT, and low MAOA. In comparing ABO O with ABO A, a study done in Japan has shown increased DBH in ABO A. Japan and Korea have long traditions of popular interest in and use of ABO blood group typing to understand an individual's personality. According to Japanese ABO blood group personality theory, there is consensus in the personality of each ABO blood group: ABO A is described in such terms as quiet, concerned about the feelings of others, and peaceful. ABO B is described as being individualistic, unconventional, and unaware of others' feelings. ABO O is called a leader, outgoing and strong. ABO AB is noted to be one who tries to fit in but who feels aloof. Interest in ABO blood group correlations with personality may have taken hold of the popular fancy in Japan and Korea because the types are somewhat more equally prevalent there, i.e., there is more opportunity for noticing enough of each type to begin to form empiric conclusions.

Diversity in political philosophy may correlate with the genetic or personality underpinnings of ABO blood groups. ABO A support of progressive liberalism appears to be the ABO A personality correlation with such traits and genes that are consonant with empathy for others while the ABO O support for conservative philosophy is likely related to apersonality correlation with conscientiousness. (26)

ABO blood groups have distinctive population frequency distributions that show diversity in stratification of health risks and behavioral traits. Further, this Mendelian trait can be a useful tool to study how additive effects with many other Mendelian traits produce stratification of populations as to risks of disease and of personality traits. Via linkage disequilibrium at the ABO/DBH loci at chromosome 9q34, ABO blood group A can be seen to be associated with high activity dopamine beta hydroxylase (DBH). ABO blood group A may also be associated with high activity catechol-O-methyl transferase (COMT). Hapmap population frequencies for these related gene alleles are congruent with this association of behavior and health And ABO O association with MAOA low activity is seen from analysis of hapmap population frequencies and associated health risks. Also angiotension converting enzyme (ACE) has shown association with ABO blood groups with ABO A showing low levels ACE, ABO O showing moderate levels of ACE and ABO B showing high levels of ACE, the mechanism thought to be related to differential degradation of ACE enzyme from various ABO antigens that the ACE enzyme expresses. Based on population frequencies of the ACE alleles and population frequencies of the ABO alleles, it appears that individuals with high activity ACE alleles may have ABO alleles that lower activity of ACE so additive effects in this case may counterbalance against extreme ACE enzyme levels. But the end result is that instead of being fairly uniform as to health and personality effects of dopamine levels and activities, populations are stratified as to levels of and activities of dopamine and all the stratification effects on health and behavior produced.

Although personality is thought to be 50% heritable, consensus has not been reached about the specific genes involved. Interest in genes affecting personality and behavior continues because of the linkage of personality traits with both physical and mental illness. One hundred and twenty years of study of the ABO blood types and the genes causing them has led to more precise assignment of genotype-phenotype linkage. Dopamine system has been linked to the introversion-extraversion spectrum with high dopamine linked to introversion. Dopamine beta hydroxlase determines the ratio of dopamine to norepinephrine. Dopamine beta hydroxylase gene, DBH, is in linkage disequilibrium with ABO gene thus offering insight into the ABO findings related to personality traits. ABO blood groups have been studied with some but not all studies finding type AB associated with introversion. One explanation for the inconsistent replication of findings could be that genotypes would show more differences than phenotypes. ABO A allele, ABO B allele or the synergism of both alleles could be the driver of introversion trait in ABO AB.

A question could be raised as to whether simply a lower ABO O frequency was the factor that supported the formation of agriculturally based civilization. But the counter argument is that ABO O agriculturally based civilizations similar in complexity to Sumer, Henan China and other early civilization formed in Central and South America c 4000 ya. So a more

fitting conclusion is that a lower ABO O:ABO A ratio and thus a more diverse population seemed to support the early formation of civilizations in the Old World. A diverse population based on genetic personality traits then appeared to form the first civilizations. This group of humans thus had a population of diversity as to genetic ABO-related personality traits such as anxiety vs serenity and creativity vs conscientiousness. The balance resulting from their work synergy appears to have created a sustainable stationary way of life for many thousands of years.

Table 1

Early sites of first civilizations	Modern sites	ABO O%	ABO A%	ABO B%	ABO AB%
Early Out of Africa c50,000ya	Australian Aborigenes	61	39		
Sumer c 7000ya	Iraq	29	28	35	8
Indus c 6000ya	India	28	26	32	14
Henan China c 5000ya	Henan China	29	27	32	12
Egypt c 4000ya	Egypt	33	36	24	7
Greece c 4000ya	Greece	40	42	14	4
Roman c 2500ya	Italy	46	41	11	2
World population after 10000ya	World population modern	47	41	9	3

Note: numbers in table are a consensus of the available frequencies

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