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COVID-19: Why has Africa been "Spared"?

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

After more than one year of the COVID-19 pandemic, the disaster predicted in Africa by experts has not occurred. The present review aimed to discuss factors which may have played an important role in this low incidence. The analysis of data provided by the WHO database and the ECDC (European Center for Disease Prevention and Control) was made. Using explicit reasoning and existing data, the most significant factors were listed and discussed. We found that Africa had the lowest percentage of COVID-19 cases per population (0.33%) and various factors such as rapid reactions, effective preventive measures, demographics, the impact of previous epidemics, genetic and immunity factors may have played an important role in this low incidence of the pandemic in Africa. It appears that Africa is globally less affected. Most of the factors discussed may have played an important role, but the genetic hypothesis and the potential undercount of cases, less studied to date, should be investigated.

Keywords: COVID-19; Africa; low incidence.

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1. INTRODUCTION

1.1 The Situation in All Continents

More than 3,02 million people have died from COVD-19 worldwide (0.04% of the world population) since the start of the pandemic and nearly 147 million have been infected (1.81% of the world population) (Table 1). As of April 26, 2021, the Americas is viewed as the epicenter of the epidemic alone with 42.5% of the total number of cases and 48.2% of the total number of deaths, followed by Europe (33.9% of total cases and 33.9% of total deaths) and Asia (20.2% of total cases and 13.9% of total deaths). Oceania and Africa are the less affected and together account for less than 4% of the total number of cases and less than 4% of the total number of deaths. However, in the African continent South Africa is the geographical area with the highest number of cases (35.3%) and nearly 65% of cases are spread over 5 countries namely South Africa, Morocco (11.4%), Tunisia (6,4%), Ethiopia (5.4%) and Egypt (4.8%). Consequently, the remainder of the cases distributed in the other 49 countries is relatively low compared to the countries previously mentioned as well as some countries in other continents. This, therefore, confirms the predictions that have been proposed by Gilbert et al. [1]. In a study conducted at the beginning of the pandemic to assess the preparedness and vulnerability of African countries to their risk of importing COVID-19, Gilbert et al. [1] found that the countries with the highest risk of importing COVID-19 were Egypt, Algeria, and South Africa while Ethiopia was among the countries with moderate risk. Similar predictions have been proposed by Sun et al. [2]. Meanwhile, some studies that predicted the worst for the whole of Africa by highlighting all the known shortcomings seem to have gone wrong [3]. Africa remained globally under threat and other factors seem to have influenced the progression of the spread of the virus but so far, no study has definitively ruled on the “African enigma” of this pandemic.

2. FACTORS THAT MAY HAVE INFLUENCED THE SPREAD OF COVID-19 IN AFRICA

The factors that may explain the low incidence of COVID-19 in Africa have been identified and discussed. These include the rapid reaction of African states and effective preventive measures, demography, climate, previous formative epidemics, enhanced immunity, the high prevalence of malaria and the taking of anti-malarial drugs, the undercounting of cases or viruses that could strike more.

2.1 A Rapid Reaction and Effective Preventive Measures

Immediately after the first cases appeared in Europe and the Americas, WHO called on Africa to prepare for the worst [6]. Very early on, most of these countries implemented preventive measures such as travel restrictions, curfews, school closures, compulsory masks, restrictions on gatherings, closures of drinking establishments and meeting places, social distancing [7-9]. Some countries implemented these measures as soon as the first cases were detected, while others did so without delay [10]. Furthermore, in addition to these measures and despite the relative lack of quality medical infrastructure in some countries, systematic testing has been instituted in order to detect, isolate and treat patients and thus limit the spread of the virus. These early responses likely resulted in limiting the importation of COVID-19 cases and arguably reduced its transmission. In general, early preventive measures have the advantage of limiting the spread of the germ incriminated in the disease while giving governments time to prepare the appropriate strategy and to mobilize the material and resources necessary to implement it. These measures have been all the more effective as most countries have already faced major health crises such as Lassa fever and Ebola virus fever. However, while it is certain that this early response played an important role in the low incidence of COVID-19 in Africa, many people were nonetheless infected but mortality and spread remained low. These and other factors explain the difference in situation between Africa and other continents.

2.2 Demography: A Young Population, Population Density per km2, Few or no Retirement Homes

Demographics (especially Age) is one of the factors that may explain the low incidence of COVID-19 in Africa. Indeed, it has been observed that COVID-19 and its most severe forms mostly affect the elderly [11]. However, in Africa, 60% of the population is under 25 years old and the median age is more than twice lower (19.7 years) than that of Europe (42.5 years) while that of the United States is 38.6 years old. In France for example, one of the most affected

countries in Europe, 92% of deaths from COVID-19 were in people over the age of 65. Besides the young population, density should be considered as well. Africa has an average of 45 inhabitants/km2 and is much less populated in most regions than the European Union (121 inhabitants/km2), East Asia (131 inhabitants/km2) or South Asia (380 inhabitants / km2). However, some cities like Johannesburg (South Africa, 3.515persons / km2), Cairo (Egypt, 5.246 inhabitants/km2), Abidjan (Ivory Coast, 11.155 persons / km2), Lagos (Nigeria, 13.909 persons/km2) or Dakar (Senegal, 12.617 persons/km2) displays record densities, but rural areas are very sparsely populated in all African countries. The high density in the aforementioned countries may partly explain the high incidence of COVID-19 because it could have considerably increased the spread of the virus via the promiscuity that it implies whereas, the very low density in other countries could have significantly limited contact and transmission of the virus. Moreover, unlike developed countries, African countries hardly have retirement home systems. These retirement homes drastically reduce the contact of older people with younger people and this reduces their exposure to ambient pathogens and causes less recurrent sensitization of their immune systems to ambient germs. This hypothesis would take on its full meaning to the extent that recurrent exposure to pathogens would have contributed to strengthening the immune system of African populations.

2.3 Immunity Reinforced by Recurrent Exposure to Various Pathogens, the Potential Role of BCG and the Regular intake of Antimalarials

Some physicians like Elisabeth Carniel, director general of the Center Pasteur du Cameroun and the Cameroonian epidemiologist Yap Boum, believe that regular exposure to various pathogens, whether parasitic, viral or bacterial could have reinforced the resistance of the African population [12]. However, none of the studies conducted on the question have neither confirmed nor disproved this hypothesis. In addition, Calmette and Guérin Biliary Vaccine (BCG) seems to have played an important role in the low incidence of the pandemic in Africa. A recent meta-analysis on the incidence of COVID-19 in countries with vaccination coverage and those that did not have demonstrated that there is a possible inverse correlation between BCG immunization and COVID-19 disease incidence and severity [13,14]. Similarly, malaria would also have potentially played a preponderant role in this low incidence because malaria and COVID-19 may have similar aspects. COVID-19 has a variable prevalence among countries which are lower than expected in malaria-endemic regions [15-17]. Malaria patients develop anti-GPI antibodies which could identify SARS-CoV-2 glycoproteins and consequently play a protective role against COVID-19 or inducing a milder disease pattern. Both hydroxychloroquine (HCQ) and chloroquine (CQ) may have preventive and curative effects against SARS-CoV-2 virus through different mechanisms, however, clinical trials are still investigating the use of these medications as a potential treatment and preventive measure [17].

2.4 The Genetic Hypothesis

In the beginning of the pandemic, Majority of SARS-CoV-2 studies have focused on the genomic and epidemiological characteristics of the virus while the role of host genetics in COVID-19 onset has been largely unexplored [18,19]. Unlike other people, Indigenous Africans are characterized by higher levels of within– and between– population genetic diversity compared to non-Africans [19,20] and this genetic variation has been shown to influence resistance to several infectious diseases such as AIDS (acquired immunodeficiency syndrome) and malaria [19]. For example, Leffler et al. [21] demonstrated that structural variation at the GYPA and GYPB genes are correlated with a 40% reduced risk for severe malaria. In addition, other studies have shown changes in certain loci (such as APOL1, LARGE and IL-21) that are suggested to be protective against African trypanosomiasis and Lassa fever [19-22]. Arguably, as reported by Musa et al. [19], it is not inconceivable that genetic variation present in sub-Saharan Africa could confer resistance to COVID-19 in contemporary populations. However, more genetic, and epidemiological studies, including case-control and fine mapping analysis, are needed to explore this hypothesis.

Table 1. Global assessment of COVID-19 in each continent. [4,5]

	Africa	Americas	Asia	Europe	Oceania	Total
Cases	4 431 639	60 380 341	28 782 011	48 142 304 33.94%	68 956 0.04%	141 805 251
	3.16%	42.57%	20.29%			100%
Deaths	117 934	1 461 130	420 620	1 025 900	1 312	3 026 896
	3.89%	48.27%	13.90%	33.90%	0.04%	100%
%Cases/Population	0.33%	5.90%	0.62%	6.43%	0.16%	1.81%
%Deaths/Population	0.01%	0.14%	0.01%	0.14%	0.00%	0.04%
Cases /1 million of population	3305.72	59032.51	6201.61	64392.70	1615.73	18192.29
Deaths/1 million of population	87.97	1428.51	90.63	1372.19	30.74	388.32

2.5 A Favorable Climate

Hypotheses on the negative correlation between high temperatures and the progression of the spread of COVID-19 have been argued from the onset of the pandemic [14,23-25]. However, no study has definitively verified this hypothesis. Regardless of the surface, it has been reported that time and temperature intervals required to kill COVID-19 are 3 minutes at a temperature above 75°C (160°F); 5 minutes for temperatures above 65°C (149°F); 20 minutes for temperatures above 60°C (140 ° F) [26]. All of these temperatures are far above the usual temperatures in most countries; therefore, the temperature could not have had a direct effect on reducing the spread of the virus. Interestingly, a study conducted in Wuhan, China to assess the effect of meteorology on the deaths resulting from COVID-19 concluded that the temperature variation and humidity may be an important factor affecting the COVID-19 mortality [27]. Contrary to the above, the study conducted by Stanam et al. [28] revealed that there was no significant correlation between temperatures and cases confirmed positive, dead or recovered was observed. Therefore, the actual impact of climate remains mixed overall and more research is needed to better understand the potential implication of weather.

2.6 The Role of Previous Epidemics

For a continent that has recently experienced large-scale health crises such as Ebola or other permanent crises such as malaria, we can assume that despite the limited means and infrastructure, the African continent was sufficiently ready to deal with a pandemic of the scale of COVID-19. This view is shared by several experts including Michael Ryan, Director of emergency programs [12]. This knowledge of epidemics has undoubtedly played an important role in the detection and management of new cases as well as isolating patients, raising awareness, and strengthening hygiene.

2.7 Lack of Testing and the Hypothesis of Undercounting of Cases

If the spread of the virus on the African continent seems lower than in Europe or the United States, many specialists agree that the number of cases is probably underestimated [7,8]. This assumption is mainly based on the limited means of most African countries. A very recent study by Nguimkeu et al. [29] on this question concluded that differences in demographic and geographic characteristics help understand the relatively low progression of the pandemic in sub-Saharan Africa as well as the gap in the number of active cases between this region and the rest of the World. The hypothesis of undercounting of cases, although it is probable, does not fully explain this gap between the number of cases in Africa and the rest of the world because it is very likely that this is the same situation in all countries because the virus passes silently through many people, especially the youngest.

2.8 Potential Role of Pharmacopoeia in Low Incidence of COVID-19 in Africa and Low Mortality

One of the highlights of COVID-19 in Africa, there has been a rapid rise in the consumption of medical foods like ginger, garlic, and lemon for both preventive and curative purposes. For example, it is well known that lemon is rich in vitamin C and several studies reported the

immune-boosting properties of vitamin C and their potential in the management of COVID-19 [30]. Some phenolic compounds commonly found in garlic (*Allium sativum)* and ginger (*Zinziber officinale)* such as quercetin and kaempferol were shown as antiviral agents due to their ability to inhibit the enzymatic activity of SARS 3-chymotrypsin-like protease (3CLpro), a vital enzyme for the replication of SARS-CoV [31]. Another approach to manage COVID-19 in Cameroon was the consumption of aqueous extracts of *Cinchona succirubra* bark (locally called “quinquina”) and *Vernonia* leaves (locally called “ndole”). These extracts contained the active principle (quinine hydrochloride and cinchonine) [32] of a medicine which was used in the management of malaria and which is found in chloroquine, an efficient anti-COVID-19 medicine [33].

3. CONCLUSION

The overall COVID-19 situation indicates that Africa has been less affected than other continents. It is difficult to say with certainty which factor played the preponderant role in this situation. However, it can be assumed that most of the factors mentioned in this review each have, at their own level an important role and that taken together, has led to this low overall incidence. Of all the hypotheses discussed, those which seem to have played a major role in this gap are regular intake of antimalarials and traditional medicines, a globally young population, effective preventive measures, previous "formative" epidemics, and a certain immunity of the population.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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