

# Frequency of ABO/Rh Blood Groups and Social Condition of Hypertensive Patients in Luanda

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## Abstract

**Introduction:** Hypertension is a well-known clinical challenge worldwide, especially in low and middle-income countries. Previous studies have shown a relationship between sociodemographic characteristics and ABO/RH blood groups distribution with the increase in cases of hypertension.

**Objective:** Herein, we evaluated the frequency of ABO/Rh blood groups and social condition of hypertensive patients in Luanda, the capital city of Angola.

**Methodology:** This was analytical, cross-sectional study with a quantitative and qualitative approach.

**Results:** Age means was  $50.6 \pm 10.4$  years old. Most of the patients were from blood group B (36.4%) or blood group O (33.3%), Rh+ (84.8%), female (72.7%), lived in rural (43.4%) or peri-urban areas (35.4%), and own employed (73.87%). Moreover, single patients (69.7%), with secondary education (59.6%), consumed alcoholic beverages (41.4%), excessively refined salt (57.6%), did not physical exercise (76.8%), and that not known family history of hypertension (81.9%), were also most frequent.

**Conclusion:** Our results showed a putative relationship between ABO/Rh and social status distribution among patients with hypertension in Angola. The putative relationship between blood groups and social conditions in Angolan hypertensive patients needs further study.

**Keywords:** ABO/Rh blood groups; Socio demographic characteristics; Hypertension; Luanda; Angola

## Introduction

Hypertension is considered an important public health problem responsible for 40% of deaths in the world. Currently, many studies have reported a high prevalence of cases of hypertension in low- and middle-income countries (LMICs), such as most African countries, contributing to higher mortality rates from cardiovascular diseases [1,2].

Arterial hypertension (AH) is a disease defined by the persistence of Systolic Blood Pressure (SBP)  $\geq 135$  mm/Hg and Diastolic Blood Pressure (DBP)  $\geq 85$  mm/Hg [3]. According to Santos ZMSA [4], Systolic Arterial Hypertension (SAH) is the main cause of cardiovascular and cerebrovascular disorders. Also, SAH is responsible for 40% of deaths from stroke, 25% from coronary artery disease, and in combination with diabetes mellitus, 50% of cases of end-stage renal failure [5].

Previous indicates that the incidence of ischemic heart disease may be higher in patients with blood group A than in people with other blood groups [6]. Recent studies showed that the ABO blood group and sociodemographic characteristics may be associated with the incidence or prognosis of various diseases [7,8].

A study carried out by our research team to assess the effect of social and clinical conditions on blood pressure variation in Angolans hospitalized with malaria found that of the 333 patients, 28% were normotensive, 50% had moderate hypertension and 20% had severe hypertension in first 48 hours of hospitalization. The average age of moderate or severe hypertension was  $27 \pm 9$  years, the male/female ratio was 153/180, from urban areas (76%), unemployed (72%) [9].

So far, there are no studies that explain why the high rates of hypertension observed in African countries, nor even why people of African origin are better known for having a higher risk of

hypertension and cardiovascular disease compared to patients from high-income countries [10]. Therefore, in this study, we evaluate the frequency of ABO/Rh blood groups and social condition of hypertensive patients in Luanda, the capital city of Angola, in order to assist the health authorities in the identification of characteristic potencies associated with the emergence of cases of hypertension in different communities in Angola.

## Methodology

### Study design

An analytical, cross-sectional study with a quantitative and qualitative approach was carried out with 99 patients with arterial hypertension admitted at Josina Machel hospital, located in Luanda, the capital city of Angola, between January to July 2020.

### Ethics statement

The study was reviewed and approved by the Human Research Ethics Committee of the Instituto Superior de Ciências da Saúde, Universidade Agostinho Neto (904/GD/ISCISA/UAN/ 2019) and authorized by the Pedagogical and Scientific Department of Josina Machel hospital (555/DPC/HJM/2019). All patients gave their informed consent before their inclusion in the study. All patients gave their informed consent before their inclusion in the study.

### Patient's enrolment criteria and sample collection

Only patients with hypertensive disease and who are followed up in a cardiology consultation were included in the study. Hypertension was defined by the persistence of systolic blood pressure (sBP)  $\geq$  140 mm/Hg and diastolic blood pressure (dBP)  $\geq$  90 mm/Hg for more than three months. On the other hand, patients with diabetes or other cardiovascular problems were excluded. Variables such as age, gender, ABO/Rh blood group, history of risk factors such as alcohol consumption, physical exercise, excessive salt intake, and family history were obtained. An estimated 2 mL blood sample was collected for each patient using the venipuncture technique and the samples were placed in test tubes containing Ethylenediaminetetraacetic Acid (EDTA). The samples were placed in three wells and the posterior was associated with anti-A, Anti-B, and Anti-D reagents (Immucor, Portugal). The determination of the blood group was performed using the microplate technique according to the manufacturer's instructions, which is an agglutination test between the patient's serum and the anti-A, Anti-B, and Anti-D reagents of each well for phenotypic identification of blood groups (ABO and Rh).

### Statistical analysis

The data obtained in this study were analyzed using SPSS v20 (IBM SPSS Statistics, USA). Absolute and relative frequencies were determined in the descriptive analysis. Normally data distribution was expressed as mean and standard deviation (SD). Chi-square ( $X^2$ ) test was used to assess the relationship between categorical variables. All reported p-values are two-tailed and deemed significant when  $p < 0.05$ .

## Results

### ABO/Rh blood groups and sociodemographic characteristics

A total of 99 patients met all inclusion criteria and were included in the analyses. The sociodemographic characteristics of the patients with hypertension are summarized presented in table 1. When evaluating the overall mean age of patients, we found that it was 50.6 years (SD=10.4), mostly composed of patients from blood group B (36.4%,  $n=34/99$ ), followed by patients from group O (33.3%,  $n=33/99$ ). Rh(+) patients were the majority in the study, representing about 84.8%

( $n=84/99$ ) of patients with hypertension, the majority represented by individuals from group B (40.5%,  $n=34/84$ ) and O (36.9%,  $n=31/84$ ). Rh(-) patients represented only 15.2% ( $n=15/99$ ) and were mostly individuals from group A (46.7%,  $n=7/15$ ) and patients from group AB (26.7%,  $n=4/15$ ), except in those cases of the Rh group, in no other evaluation was found the group A and AB in greater proportions than the group B and O.

The age group with the highest number of hypertensive patients was individuals over 50 years of age (51.5%,  $n=51/99$ ), however, the mean age of this group did not exceed 59.2 years. The majority of the female, representing about 72.7% ( $n=72/99$ ), however, males diagnosed with hypertension had the lowest mean age (45.1 years, SD=2.6), when compared to the mean age of hypertensive in women (51.8 years, SD=10.5). Hypertensive patients were mostly those who lived in rural areas (43.4%,  $n=43/99$ ), followed by the patients from peri-urban areas (35.4%,  $n=35/99$ ). Patients who did not have an official job ( $n=73.87\%$ ,  $n=73/99$ ) and single (69.7%,  $n=69/99$ ), were also prevalent in this studied population. About 59.6% ( $n=59/99$ ) of hypertensive patients had completed secondary education, these patients had a mean age of 49.3 years (SD=8.9), moreover, illiterate patients represented 13.1% ( $n=13/99$ ) and had a mean age of 61.0 (SD=7.4), on the other hand, only 6.1% ( $n=6/99$ ) had the higher education level and had a mean age of 43.6 years (SD=9.7). A statistically significant relationship was observed in ABO blood groups, the Rh factor, and working conditions ( $p < 0.05$ ).

### Risk factors associated with arterial hypertension

The putative risk factors related to hypertension are summarized in table 2. Most of the patients did not consume alcoholic beverages before being diagnosed with hypertension (58.6%,  $n=58$ ) and these patients had a higher mean age (53.6 years, SD=10.3). Most of the patients (57.6%,  $n=57/99$ ) reported that before diagnosis they consumed excessively refined salt (above 53% in all blood groups) and did not perform a physical exercise (76.8%,  $n=76/99$ ), especially individuals with a mean age above 50.7 years (SD above 10.6), regardless of the blood group (above 60.7%). The hypertension history in direct relatives such as father, mother, brother, sister, grandparents, and uncles, was not known by most of the patients (81.9%,  $n=81/99$ ), however, of the 18.2% ( $n=18/99$ ) who knew of the existence of the disease in the family, they were mostly patients in group B (30.6%,  $n=11/36$ ) and group O (18.2%,  $n=6/33$ ). In the statistical evaluation, it was found that the frequency of blood groups and the family history of hypertension were statistically related ( $p < 0.05$ ), on the other hand, the other risk factors such as alcohol consumption, excessive consumption of refined salt, and the practice of physical activity were not related to the frequency of blood groups in hypertension ( $p > 0.05$ ).

## Discussion

Our data showed a general mean age was 50.6 years (SD=10.4) among patients with hypertension in Luanda, the capital city of Angola (Table 1). These findings differ from those obtained by Garcia GM, et al. [11] in which he performed the characterization of hypertensive emergency diagnosed at the Hospital do Prenda Angola, where the authors found that the mean age was  $38.62 \pm 5.49$  years. This difference may be related to Garcia's study as he studied a clinical condition that is a hypertensive emergency. In this case, a pathological condition was studied which is AH already diagnosed and followed up in consultations and it is known that with aging, the blood pressure tends to increase.

This was the first study developed by our research group, where another blood group overcomes blood group O (Table 1). In a

**Table 1:** Sociodemographic characteristics and ABO/Rh blood groups distribution among patients with hypertension in Luanda, Angola.

Sociodemographic characteristic	N (%)	Mean age	Blood groups				p-value
			A (%)	AB (%)	B (%)	O (%)	
<b>Overall</b>	99 (100)	50.6 ± 10.4	17(17.2)	13(13.1)	36(36.4)	33(33.3)	
<b>Rh factor</b>							
<b>Negative</b>	15 (15.2)	50.5 ± 9.4	7 (46.7)	4(26.7)	2 (13.3)	2(13.3)	0.001*
<b>Positive</b>	84 (84.8)	50.7 ± 10.7	10 (11.9)	9 (10.7)	34 (40.5)	31 (36.9)	
<b>Age group (years)</b>							
≤ 40y	20 (20.2)	36.8 ± 2.6	5 (25.0)	3 (15.0)	6 (30.0)	6 (30.0)	0.849
41-50y	28 (28.3)	45.1 ± 2.6	4 (14.3)	5 (17.9)	11(39.2)	8 (28.6)	
≥ 50y	51 (51.5)	59.2 ± 6.3	8 (15.7)	5 (9.7)	19(37.3)	19 (37.3)	
<b>Gender</b>							
<b>Female</b>	72 (72.7)	51.8 ± 10.5	13(18.1)	8 (11.1)	28 (38.9)	23(31.9)	0.669
<b>Male</b>	27 (27.3)	47.6 ± 9.9	4 (14.8)	5(18.5)	8 (29.6)	10 (37.1)	
<b>Residence</b>							
<b>Urban</b>	21 (21.2)	51.2 ± 8.1	3 (14.3)	3 (14.3)	7 (33.3)	8 (38.1)	0.954
<b>Peri-urban</b>	35 (35.4)	49.5 ± 10.4	7 (20.0)	3 (8.6)	14 (40.0)	11 (31.4)	
<b>Rural</b>	43 (43.4)	51.4 ± 11.6	7 (16.3)	7 (16.3)	14 (32.6)	15 (34.8)	
<b>Occupation</b>							
<b>Own account</b>	73 (73.7)	50.2 ± 9.7	11 (15.1)	12 (16.4)	30 (41.1)	20 (27.4)	0.043**
<b>Employed</b>	26 (26.3)	51.8 ± 12.3	6 (23.1)	1 (3.8)	6 (23.1)	13 (50.0)	
<b>Marital status</b>							
<b>Single</b>	69 (69.7)	51.2 ± 10.6	14 (20.3)	10 (14.5)	23 (33.3)	22 (31.9)	0.507
<b>Married</b>	30 (30.3)	49.5 ± 10.1	3 (10.0)	3 (10.0)	13 (43.3)	11 (36.7)	
<b>Education</b>							
<b>Illiterate</b>	13 (13.1)	61.0 ± 7.4	3 (23.1)	3 (23.1)	4 (30.7)	3 (23.1)	0.253
<b>Primary</b>	21 (21.2)	50.3 ± 12.4	5 (23.8)	1 (4.8)	4 (19.1)	11 (52.3)	
<b>Secondary</b>	59 (59.6)	49.3 ± 8.9	8 (13.6)	9 (15.3)	24 (40.7)	18 (30.4)	
<b>Higher</b>	6 (6.1)	43.6 ± 9.7	1(16.7)	0 (0.0)	4 (66.6)	1 (17.7)	

\*Result was significant in the chi-square test ( $p < 0.0001$ ).

\*\*Result was significant in the chi-square test ( $p < 0.05$ ).

previous study aimed to check the sickle cell trait in people undergoing hemoglobin electrophoresis, our group found that blood group O was about 41% of the total population and all participants in this blood group were under 41 years old [12]. These data differ from the data obtained by Coelho EAF, et al. [13] where about 38% of individuals were blood group A, 12% from blood group B, 4% from blood group AB, and 46% from blood group O.

Our results showed that Rh(-) patients represented only 15.2% and were mostly individuals from blood groups A (46.7%) and AB (26.7%,  $n = 4/15$ ), which is similar to Pena CM [14]. A study that verified the frequency of ABO/Rh among blood transfusion recipients at the hospital Montes Claros, observed 90% of Rh-positive and 10% was Rh-negative. However, in the study developed by Sacomboio ENM, et al. [12] in Angola, the percentage of Rh- participants was 16.9% (10/59).

In the present study, the majority of the patients was female (72.7%), which is similar to the data published by Silva SSB, et al. [5] in hypertensive patients from two Basic Health Units in the western region of São Paulo city, where they found 62.1%, however, our data did not agree with the data obtained by Lopes E, et al. [15] where the predominant gender was male (58.8%).

Most of the patients were from rural areas (43.4%). These data do not corroborate the data presented at the African Union Conference

of Health Ministers [16] on the impact of non-communicable diseases and neglected tropical diseases on the development of Africa, where hypertension levels have been reported to be structurally higher in urban environments than in rural environments, mainly because of the contextual and behavioral factors associated with urban environments, these include changes in diet and sedentary lifestyles that together create a complex system conducive to the development of hypertension.

The frequency of self-employed patients was higher ( $n = 73.87%$ ) (Table 1) compared to the result obtained by Pessuto J, et al. [17] when evaluating the risk factors in individuals with AH were observed that the lowest levels of hypertension occur in the most privileged social groups.

We did not find evidence of any associations between blood groups on marital status ( $p < 0.05$ ). Simão M, et al. [18] found that most of the patients with hypertension were single (54.1%), on the other hand, a study conducted in Brazil by Silva EC, et al. [19] to assess the prevalence of SAH and associated factors in men and women from Amazonia Legal, observed that 72.1% of the patients were married.

About 59.6% of the patients had completed secondary education, 13.1% were illiterate, and only 6.1% had a higher education level. These data corroborate with Malta DC, et al. [20] on the prevalence

**Table 2:** Previous risk factors and ABO/Rh blood groups distribution among patients with hypertension in Luanda, Angola.

Sociodemographic characteristic	N (%)	Mean age	Blood groups				p-value
			A (%)	AB (%)	B (%)	O (%)	
<b>Overall</b>	99 (100)	50.6 ± 10.4	17 (17.2)	13 (13.1)	36 (36.4)	33 (33.3)	
<b>Alcohol</b>							
No	58 (58.6)	53.6 ± 10.3	11 (64.7)	7 (53.4)	20 (55.6)	20 (60.6)	0.902
Yes	41 (41.4)	46.6 ± 9.5	6 (35.2)	6 (46.2)	16 (44.4)	13 (39.4)	
<b>Excessive Salt</b>							
No	42 (42.4)	50.6 ± 9.9	7 (41.2)	6 (46.2)	15 (41.7)	14 (42.4)	0.993
Yes	57 (57.6)	50.7 ± 10.9	10 (58.8)	7 (53.8)	21 (58.3)	19 (57.6)	
<b>Exercise</b>							
No	76 (76.8)	51.8 ± 10.6	14 (82.4)	11 (84.6)	28 (77.8)	23 (69.7)	0.639
Yes	23 (23.2)	46.6 ± 9.3	3 (16.6)	2 (15.4)	8 (22.2)	10 (30.3)	
<b>Family History</b>							
No	81 (81.8)	50.0 ± 10.8	16 (94.1)	13 (100.0)	25 (69.4)	27 (81.8)	0.040**
Yes	18 (18.2)	53.8 ± 8.2	1 (5.9)	0 (0.0)	11 (30.6)	6 (18.2)	

\*\*The result was significant in the chi-square test ( $p < 0.05$ ).

and AH associated factors in Brazilian adults, where they found that the pathology was higher in individuals with lower education degrees (38.0%). In another study, Gomez YEB [21] reported that there was a direct association between AH and education degree showing that people with a lower education level had a higher prevalence of AH and only 15.1% among those that have 12 or more years of schooling.

In this study, we found that 41.4% consumed alcoholic beverages (Table 2). Data similar to those were obtained by Simão M, et al. [19] among students in the city of Lubango-Angola where it was found that the consumption of alcoholic beverages was 40.6%. Most of the patients with hypertension (57.6%) reported that before diagnosis they consumed excessively refined salt (above 53% in all blood groups). This finding overcame the data obtained by Celestini A [22] which 24.9% of patients from Pelotas - RS revealed that they do not add salt to food. However, about 42.3% of the patients stated that they consumed salt, data slightly lower than the results of Coca AL, et al. [23] where food consumption and its influence on the control of AH in adults and elderly of both sexes in a basic health unit in Dourados were addressed. It was reported that the salt intake in males was 60% and in females 66.7%.

Most patients with hypertension reported that before diagnosis they did not perform a physical exercise (76.8%). This data differs from Carvalho ACC, et al. [3], on the population's perception of SAH and its risk factors, where the vast majority (85.71%) practices some physical activity for five days a week for at least 30 minutes. Most patients (81.9%) do not know of the existence of the disease in the family (Table 2). These results differ from those obtained by Almeida A [24], on the prevalence of SAH in a family health strategy in Minas Gerais, where they found that 32% of hypertensive patients had a family history of the disease.

Our study has potential limitations. The sample size is one of the limitations of our study. Also, our study was carried out in only one health unit, which does not represent all patients in Luanda or other regions of Angola. The degree of the disease has not been determined, which limited other analyzes of the study. Due to resource limitations,

we did not perform other laboratory tests to assess the condition of the studied patients, which would allow more clinical information. Therefore, more studies are needed to further describe the social characteristics and blood groups in patients with hypertension in Angola. These studies can provide details of the characteristics and possible risk factors associated with the development of the disease that can be used by public health policymakers to help reduce the increase in individuals with hypertension in Angola.

## Conclusion

Our findings showed a relationship between ABO/Rh and social status distribution among patients with hypertension in Angola. However, this relationship needs further investigation in a larger population and different regions of Angola.

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## References

1. Guwatudde D, Nankya-Mutyoba J, Kalyesubula R, Laurence C, Adebamowo C, et al. (2015) The burden of hypertension in sub-Saharan Africa: A four-country cross sectional study. *BMC Public Health* 15: 1211.
2. Cappuccio FP, Miller MA (2016) Cardiovascular disease and hypertension in sub-Saharan Africa: Burden, risk and interventions. *Intern Emerg Med* 11: 299-305.
3. Carvalho ACC, Filho RM, Bastos VP (2011) Manual of clinical orientation: arterial and systemic hypertension.
4. Santos ZMSA (2011) Hypertension - A Public Health Problem. *Brazilian J Health Promot* 24: 285-286.

5. Silva SSBE, Oliveira SFSB, Pierin AMG (2016) The control of hypertension in men and women: a comparative analysis. *Rev Esc Enferm USP* 50: 50-58.
6. Brazilian Society of Cardiology (2016) Brazilian Society of Hypertension; Brazilian Society of Nephrology. Brazilian Guidelines on Arterial Hypertension. *Rev Bras Hipertens* 13: 260-312.
7. Dean L (2005) Blood Groups and Red Cell Antigens: National Center for Biotechnology Information (US).
8. Borges R, Velloso J, Ippolito JD, Lopes J, Neto R, et al. (2014) Blood group association with diseases. *J Academic Works-Campus Niterói, North America* 1: 1-5.
9. Sacomboio ENM, Bande JA, Zua SSD (2020) Effect of Social and Clinical Conditions on Blood Pressure Variation in Angolans Hospitalized with Malaria. *Acta Med Int* 7: 121-129.
10. Koopman JJE, Bodegom DV, Jukema JW, Westendorp RGJ (2012) Risk of cardiovascular disease in a traditional African population with a high infectious load: a population-based study. *PLoS One* 7: e46855.
11. García GM, Tiny V, Lopes CGAM, Gomes JV (2014) Characterization of patients under 46 years hospitalized with hypertensive emergency at Hospital do Prenda. *Portuguese J Cardi* 33: 19-25.
12. Sacomboio ENM, Sebastião DT, Sacomboio FJCF (2020) Sickle Cell Trait and Blood Groups (ABO and Rh) in Angolans Submitted to Hemoglobin Electrophoresis. *Hematol Oncol Curr Res* 2: 1004.
13. Coelho EAF, Silva-Diniz R, Reis JKP, Gomes KB (2010) Frequency of groups of the ABO and Rh systems in the population of Belo Horizonte, MG. *Braz Jour of Clin Anal* 42: 245-247.
14. Pena CM (2011) Frequency of blood groups of the ABO and Rh system in blood transfusion recipients in a hospital in Montes Claros.
15. Lopes E, Alarcão V, Simões R, Fernandes M, Gómez V, et al. (2016) Hypertension Control at the Primary Health Care: A Comparison Among Portuguese Natives and Portuguese Speaking African Countries Immigrants. *Act Méd Port* 29: 193-204.
16. African Union (CAMH6) (2013) The Impact of Non-Communicable Diseases (NCDs) and Neglected Tropical Diseases (NTD) on Development in Africa. Sixth Session of African Union Conference of Ministers Of Health Addis Ababa, Ethiopia 22-26 APRIL 2013, Addis Ababa, Ethiopia.
17. Pessuto J, Carvalho EC (1998) Risk factors in patients with arterial hypertension. *Rev Lat Am Enfermagem* 6: 33-39.
18. Simão M, Hayashida M, Santos CBD, Cesarino EJ, Nogueir MS, et al. (2008) Hypertension among undergraduate students from Lubango, Angola. *Rev Lat Am Enfermagem* 16: 18-59.
19. Silva EC, Martins MSSS, Guimarães LV, Segri NJ, Lopes MAL, et al. (2016) Hypertension prevalence and associated factors in men and women living in cities of the Legal Amazon. *Rev Bras Epidemiol* 19: 38-51.
20. Malta DC, Bernal RTI, Andrade SSCA, Silva MMA, Velasquez-Melendez G, et al. (2017) Prevalence of and factors associated with self-reported high blood pressure in Brazilian adults. *Rev Saude Publica* 51: 11s.
21. Gomez YEB (2015) Relationship between education level and control of Systemic Arterial Hypertension at BHU Morada de Bethânia. Rio de Janeiro State University/Sustainable University of Sus. Viana-Espírito Santo, Brazil.
22. Celestini A (2007) Association between blood pressure levels and food consumption of a Dash-type diet in adult individuals from Porto Alegre. Dissertation-Faculty of Medicine, Federal University of Rio Grande do Sul, Porto Alegre.
23. Coca AL, Gripp DB, Schinestzki ECS, Gianlupi K, Liberali R, et al. (2012) Food consumption and its influence on the control of hypertension in hypertensive adults and elderly people of both sexes in a basic health unit in Dourados - MS. *Revista Brasileira De Ciências Do Envelhecimento Humano*.
24. Almeida A (2015) Prevalence of systemic arterial hypertension in a family health strategy in a municipality in northern Minas Gerais. *Elect mag and health* 1: 6-12.