

*Dedication*

*This study is dedicated to my parents, teachers, wives,  
children, colleagues and students.*

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## الخلاصة

هذه دراسة وصفية ، تحليلية أجريت فى المجتمع السودانى هدفت لتحديد نسب تردد الأليل ، المجموعات الجينية والتركيبية الوراثية للعامل الريصى فى عشرة قبائل سودانية كبيرة . لقد استغرقت الدراسة ثلاث سنوات . هدفت الدراسة لتكوين قاعدة معلومات لهذه العشر قبائل لتحديد مدى التداخل بينها. استخدمتالدراسة الزمر الوظيفية للعامل الريصى كعلامات للهوية لتحديد الاصل المشترك المحتمل . أخذت الموافقة من الأشخاص الذين سحب منهم الدم وقد تم أحاطتهم بأهداف البحث. تم تجميع ألف عينة بواقع مائة عينة من كل قبيلة بحيث لا توجد بينهم صلة قرابة . تم تجميع كل عينة فى وعاء سعة 2.5 مل يحتوى على مادة مانعة لتجلط الدم. تم فحص جميع العينات لمعرفة الزمر الوظيفية للعامل الريصى باستخدام طريقة حديثة تسمى جل (مانعة النفاذية) وعشرة عينات من كل قبيلة بطريقة الشريحة ومن ثم تم تحديد الزمر الوظيفية ، المجموعات الجينية والتركيبية الوراثية لكل عينة . لقد تم تحديد نسب التشابه بين القبائل السودانية المختلفة بواسطة قانون جاكرد للتشابه وقد استعمل نفس هذا القانون لتحديد الاصل المحتمل لهذه القبائل . المعلومات الظاهرية التى تحصلت هى الأليل، المجموعات الجينية والتركيبية الوراثية التى اعتمدت على أن وجود الانتجين يعنى وجود الجين الذى يعبر عنه حسب قانون مندل للتوريث.

تبين ان الزمر الوظيفية c,e و D هى الاكثر تردداً وقد كانت نسبها ( 93.8% ) , (98.4%) و (90.7%) على التوالي وكانت المجموعة الجينية (41.85% (cDe(R<sup>o</sup> هى الاكثر تردداً ونجد أن (29.3% (r cde متوسطة التردد . بينما نجد ان (0.60% (R<sup>2</sup> cDE(0.95% (CdE(r<sup>y</sup>), كانت الاقل تردداً . وجد هناك ستة عشرة تركيبة وراثية وكانت التركيبية الوراثية cDe/cde(R<sup>o</sup>r) (44.2%)هى الاكثر تردداً. بينما نجد ان التركيبة الوراثية cDe/Cde(R<sup>o</sup>r<sup>f</sup>) (21.8%) كانت متوسطة التردد. نجد ان التركيبة الوراثية (0.3% (Cde/Cde(r<sup>f</sup>r<sup>f</sup>) و (0.1% (CdE/CdE(r<sup>y</sup>r<sup>y</sup>) كانت الاقل تردداً .

هناك تشابه واضح بين القبائل السودانية الاساسية وقد يعزى ذلك الى وجود سلف مشترك منذ القدم . هنالك بعض التغييرات التى يمكن ملاحظتها فى القبائل السودانية المترحلة مثل المسيرية ويرجع اختلافها عن مثيلاتها فى نفس المجموعة بحركتها من مكان لآخر . هنالك تداخل واضح بين التصنيف اللغوى والتصنيف المبنى على الجينات للقبائل السودانية.

يوجد تشابه مقدر بين القبائل السودانية المختلفة. التشابه اللغوى بين القبائل السودانية المختلفة والذى أدى الى نشوء التصنيف اللغوى الذى يتداخل تداخلاً كبيراً مع العلامات الجينية.

قبائل المحس والدناقلة التى تنتمى حسب التصنيف اللغوى الى القبائل النيلية الصحراوية تختلف جينياً مع بعض القبائل فى هذه المجموعة وتتشابه تشابهاً كبيراً مع القبائل العربية الافريقية ذلك يدعم أتمائها لهذه المجموعة

منطقياً . قبيلة الدينكا جزء أصيل من القبائل السودانية القديمة ومنها نشأت بقية القبائل النيلية الصحراوية. لقد حافظت قبيلة الحلاوين على خصائصها الجينية مع تغيير بسيط.

### **Abstract:**

This community-based, prospective and analytical study that aimed to determine the frequencies of Rhesus blood group alleles, haplotypes and genotypes among ten major Sudanese tribes. The study also aimed at establishing Rhesus blood group baseline data for these major Sudanese populations. The study used Rh blood group alleles as markers of ethnic identity to determine a probable common ancestry.

This study was conducted in different parts of Sudan during the period of three years. Following informed consent, a total of one thousand venous blood samples were collected from unrelated individuals of the ten selected study populations (one hundred specimens from each tribe were collected into 2.5 mls EDTA containers). The red blood cells were tested for common Rhesus antigens by the Particle gel immune diffusion and ten specimens were tested by the slide agglutination techniques. The gene/allele and haplotypes frequencies and most probable genotypes were determined. Similarities between different Sudanese populations were calculated using Jaccard's coefficient of similarities. The same coefficient was employed to determine possible origins of these populations.

The phenotypic data obtained was referred to as alleles, haplotypes, genotypes this is based on reasonable assumptions that every Rh blood group antigen represents a gene that is always expressed and has a Mendelian dominant mode of inheritance.

The  $\bar{e}$ ,  $\bar{c}$  and the D genes were the commonest alleles detected with frequencies of 98.4%, 93.8% and 90.7% respectively. The C and the E genes were the least frequent with 58.4% and 21.0% frequencies respectively.

The cDe ( $R^0$ ) (41.85%) haplotype is commonest among study population whereas the cde (r) (29.3%) with intermediate frequency. The cDE ( $R^2$ ) (5.95%) and CdE ( $r^y$ ) (0.60%) are least common haplotypes.

There are 16 genotypes, the cDe/cde ( $R^0r$ ) is the most common frequent (44.2%), whereas the cDe/Cde ( $R^0r'$ ) (21.8%) with intermediate frequency, the Cde/Cde ( $r^l r^l$ ) (0.3%) and CdE/CdE ( $r^y r^y$ ) (0.1%) are the least common genotypes.

In conclusion; marked similarities between major tribes could probably point to a common ancestry in very ancient days. Some changes could be seen in Nomadic Sudanese tribes like the Misseria tribe could be explained by their wandering nature. There is great overlap between the linguistic classification of the major Sudanese tribes and this genetics-based categorization. Considerable similarities exist between different Sudanese populations. Linguistic similarities between different Sudanese populations that led to the development of the linguistic classification closely overlap with some genetic markers. The Danagla and the Mahas seem to be genetically different from the Nilo-Saharans and closely resemble the Afro-Asians making their inclusion in this group more logical. The Denka are probably part of the original ancient Sudanese populations from which the others Nilo-Saharan originated. The Halaween population probably maintained their original genetic constitution with minimal genetic change.

## List of abbreviations

Ab: Antibody.

AE1: Anion exchanger.

Ag: Antigen.

AIHA: Autoimmune hemolytic anemia.

Appro: Approximately.

cDNA: Complementary Deoxyribonucleic acid.

CHO: Carbohydrates.

CML: Chronic myeloid leukemia.

DNA: Deoxyribonucleic acid

Fy Ag: Duffy associated glycoprotein.

GPB: Glycoprotein-B.

H-chain: Heavy chain.

HDN: Hemolytic Disease of The Newborn.

ID: Immunodiffusion.

IgA: Immunoglobulin A.

IgD: Immunoglobulin D.

IgE: Immunoglobulin E.

IgG: Immunoglobulin G.

IgM: Immunoglobulin M.

ISBT: International Society of Blood Transfusion.

L-Chain: Light chain.

Le: Lewis.

Lu: Lutheran.

LW: Landsteiner and Wiener.

mRNA: Messenger ribonucleic acid.

PCR: Polymerase Chain Reaction.

RBC: Red blood corpuscle.

Rh Ag: Rhesus associated

Rh: Rhesus blood group system.

RNA: Ribonucleic acid.

SGP: Sialoglycoprotein.

UK: United Kingdom.

VH: Variable heavy.

VL: Variable light.

WHO: World Health Organization.



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