

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال الله تعالى

اللَّهُ نُورُ السَّمَاوَاتِ وَالْأَرْضِ مِثْلُ نُورِهِ
كَمِشْكَاةٍ فِيهَا مِصْبَاحٌ الْمِصْبَاحُ فِي زُجَاجَةٍ
الزُّجَاجَةُ كَأَنَّهَا كَوْكَبٌ دُرِّيٌّ يُوقَدُ مِنْ شَجَرَةٍ
مُبَارَكَةٍ زَيْتُونَةٍ لَا شَرْقِيَّةٍ وَلَا غَرْبِيَّةٍ يَكَادُ
زَيْتُهَا يُضِيءُ وَلَوْ لَمْ تَمْسَسْهُ نَارُ نُورٍ عَلَيَّ
نُورٍ يَهْدِي اللَّهُ لِنُورِهِ مَن يَشَاءُ وَيَضْرِبُ اللَّهُ
الْأَمْثَالَ لِلنَّاسِ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ

سورة النور الآية 35

صدق الله العظيم

Dedication

To my kind parents

To my fiancé Nesreen

To my sisters and brothers

And my fiancé's family

ACKNOWLEDGEMENTS

First of all, thanks for Allah who gave me the power for preparation and completion of this study.

I would like to express the deepest appreciation to my supervisor **Professor Babeker Ahmed Babeker** for his advice, enthusiasm, help and endless guide

Also I would like to thank staff of Sudan University of Science and Technology, to help me to find equipments in the lab to complete my practical.

And also thank you **Nesreen Ali** for helping me to finish my research.

Finally thanks for my friends and my colleagues.

Abstract

This is a prospective and analytical study, aimed to determine the frequency of ABO Rh (C,c,D,E,e) and Kell antigen and phenotypes, among Albderia Sudanese tribe. Also aimed at establish ABO, Rh (C,c,D,E,e) and Kell blood group baseline data for this Sudan anise tribe to determine the interaction between this tribe and other Sudanese tribes which will be useful in blood transfusion.

The study was conducted in marwee locality during three months (January to march 2010), following informed consent, a total of hundred venous blood samples were collected 2.5 ml into Blain containers from unrelated individual. All samples were tested for ABO Rh (C,c,D,E,e) and Kell antigens using the slide agglutination techniques. The result obtained showed that, The O group was most common frequently occurred (51%), followed by group B (32%), group A was found (16%) and the least common was group AB (3%).

The Rh (D) antigen was most common frequently occurred (97%), followed by e antigen (91%), followed by c antigen (79%), antigen C was found (66%), and the least common was antigen E (18%).

K2 was (100%) and K1 was (4%).

There was marked similarities between the Sudanese tribes that lived in the same geographical area like Alshigeia tribes , this could be due to intermarriage, while the difference that seen in some tribes could be most probably due to the wandering nature of these

tribes. This study showed high frequency of B antigen in these tribes in comparison with other Sudanese, group A is slightly low.

مستخلص الأطروحة

هذه دراسة وصفية تحليلية مستقبلية أجريت في قبيلة البديرية السودانية هدفت لتحديد نسب تردد الأليل (الانتيجين)، والانماط الظاهرية لكل من العامل الريصي استغرقت الدراسة ثلاث شهور بمنطقة ABO,KELL مروي . هدفت الدراسة لتكوين قاعده معلومات لهذه القبيلة لتحديد مدا التداخل بينها وبين القبائل الأخرى، بعد مقارنتها استخدمت الدراسة الزمر الوظيفه لهذه الانظمه كعلامات للهويه لتحديد الاصل المشترك المحتمل . لتسهيل عمليات نقل الدم .

أخذت الموافقة من الأشخاص الذين سحب منهم الدم وقد تم إحاطتهم بأهداف البحث، تم تجميع عينات من (100) شخص من قبيلة البديرية بحيث لا توجد بينهم صلة قرابة ، تم تجميع كل عينه في وعاء سعته 2.5 مل. تم فحص جميع العينات لمعرفة الزمر الوظيفية والعامل الريصي باستخدام طريقه الشريحة، من ثم تحديد نسب التشابه بين هذه القبيلة والقبائل السودانيه .

ABO وأظهرت نتائج الدراسة أن نسبه تردد الزمر الوظيفية التابعة لنظام بنسبه (32%)، ثم B تتردد بنسبه (51%) تليها O أن الزمرة الوظيفية ل (16%) وقد كانت الزمرة A (1.0) بنسبه (16%)

هي الاكثر ترددا بنسبه (D وفي نظام الريصص كانت الزمرة الوظيفية بنسبه (79%) ثم c بنسبه (91%) ثم الزمره e (97%) تليها الزمره هي الاقل ترددا بنسبه E بنسبه (66%) وقد كانت الزمره C الزمره (18%).

هي الأكثر ترددا وكانت K2 تبين أن الزمرة الوظيفية KELL وفي نظام هي الأقل بنسبه (K1 نسبتها (100%) وقد كانت الزمرة الوظيفية 10%).

والعامل الريصي ABO نجد ان هنالك تشابه في الزمر الوظيفيه لنظام بين القبائل السودانيه التي تعيش في منطقه جغرافيه KELL ونظام واحده مثلا قبيله الشايقه. وذلك قد يكون بسبب التزاوج بين تلك القبائل , وان الاختلاف الذي وجد في بعض القبائل قد يكون بسبب الترحال وعدم التقييد بمنطقه جغرافيه محدوده.

مقارنه مع بقيه B اظهرت الدراسه زياده ذات مغزى في فصيله الدم A القبائل السودانيه , وانخفاضا مماثلاً في الفصيله

Abbreviation

AHTR: Acute hemolytic transfusion reaction

AIHA: Autoimmune hemolytic anemia.

BFU: blast forming units

B.G: Blood group.

CFU: colony-forming units

DNA: Deoxyribonucleic acid

Ge: Gerbich-negatives

HTR: hemolytic transfusion reaction

HDN: Hemolytic disease of the newborn

IgG: immunoglobulin G

IgM : immunoglobulin M

ID: Immunodiffusion.

ISBT: International Society of Blood Transfusion

LISS: low ionic strength solutions

MRNA: Messenger ribonucleic acid

MLS: McLeod phenotype and McLeod syndrome

RBCs: Red Blood Cells

Rh: Rhesus

SCID: severe combined immunodeficiency

SCA: sickle cell anemia

UDP: uridine diphosphate

WHO: World Health Organization.

VWF: von Willebrand factor

List of contents

Subject		Page
الآية		I
Dedication		II
Acknowledgement		III
Abstract		IV
ملخص الأطروحة		V
Abbreviation		7
List of tables		XI
List of figures		XII
CHAPTER ONE		
Introduction and literature review		
1.1	General introduction	1
1.2	ABO blood group system	4
1.2.1	General introduction to ABO system	4
1.2.2	The History of the ABO system	4
1.2.3	ABO antigen and The role of H	5

	gene in the expression of ABO genes	
1.2.3.1	A, B ,and O -transferases	8
1.2.3.2	Subgroups of A	9
1.2.3.3	Subgroups of B	11
1.2.3.4	Cis-AB phenotype	11
1.2.3.5	Association with von Willebrand factor	12
1.2.3.6	Bombay phenotype	12
1.2.3.7	Distribution and evolutionary history	13
1.2.4	ABO blood group system antibodies	15
1.2.5	Clinical significant of ABO blood group	16
1.2.5.1	Transfusion reactions	16
1.2.5.2	Complication of transfusion	17
1.2.5.3	Hemolytic disease of the newborn (ABO)	18
1.2.5.3 .1	Moderating factors	18
1.3	Rhesus blood group	19
1.3 .1	General introduction of Rhesus blood group	19
1.3.1	History of discoveries	19
1.3.2	Nomenclature and genetic theories	21
1.3.2.1	The Wiener Theory	22
1.3.2.2	The Fisher-Race Theory	22
1.3.2.3	Conversion of Wiener to Fisher-Race	23
1.3.2.4	Rosenfield Nomenclature	24
1.3.2.5	Tippett's two-locus model	24
1.3.3	Antigens of the Rh blood group	25
1.3.3.1	D Antigens	25
1.3.3.1 .1	WEAK D ore Du	26
1.3.3.1 .1.1	Direct inheritance	26
1.3.3.1 .1.2	Position effect	27

1.3.3.1	Partial D (D variants; categories of D)	27
.1.3		
1.3.3.2	C and c antigens	28
1.3.3.3	E and e antigens	28
1.3.3.4	Uncommon Rh phenotypes	29
1.3.4	Rh antibodies	31
1.3.4.1	D antibodies	31
1.3.4.2	C,c antibodies	32
1.3.4.3	E,e antibodies	32
1.3.5	Clinical significance of Rh antibodies	33
1.3.5.1	Transfusion reactions	34
1.3.5.2	Hemolytic disease of the newborn	34
1.4	Kell blood group system	35
1.4.1	General introduction to kell blood group system	35
1.4.1	Nomenclature	36
1.4.2	Kell antigens	38
1.4.2.1	K and k (KEL1 and KEL2)	40
1.4.2.2	Kpa, Kpb, and Kpc (KEL3, KEL4, andKEL21)	40
1.4.2.3	Jsa and Jsb (KEL6 and KEL7)	42
1.4.2.3	Jsa and Jsb (KEL6 and KEL7)	42
1.4.2.4	Other Kell system antigens	43
1.4.2.5	depressed kell phenotypes	43
1.4.2.6	McLeod phenotype and McLeod syndrome (MLS)	43
1.4.2.7	K_{mod} phenotype	45
1.4.2.8	Gerbich-negatives	45
1.4.2.9	Null phenotype	46
1.4.3	kell antibodies	46
1.4.4	Clinical significance of Kell antibodies	49
1.4.4.1	Transfusion reactions	49
1.4.4.2	Hemolytic disease of the newborn	49
	Rationale And Objectives	
1.5	Rationale	51
1.6.1	General Objective	51
1.6.2	Specific Objectives	51

CHAPTER TWO		
Material and method		
2.1	Study population	52
2.2	Sample size	52
2.3	Collection of specimen	52
2.4	Inclusion criteria	52
2.5	Exclusion criteria	52
2.6	Equipment	52
2.7	Reagent	53
2.8	Method	53
2.8.1	Method of ABO, RH and Kell blood grouping	53
2.8.1.1	Principle of the test	53
2.8.1.2	Test procedure	53
2.8.1.3	Interpretation of result	53
2.8	D^u Method	54
2.8.2.1	Material requirement	54
2.8.2.2	Step of method	54
2.8.2.3	Interpretation of result	54
2.8.3	Controls	54
2.9	Data analysis	55
CHAPTER THREE		
Results		
3.1	Results	56
CHAPTER FOUR		
Discussion		
4.1	Discussion	64
CHAPTER FIVE		
Conclusion and Recommendations		
5.1	Conclusion	66
5.2	Recommendation	67
References		68
Appendices		73

List of Tables

No page		Subject
1.1	blood group systems	3
1.2	ABO antigen	7
1.3	Racial & Ethnic Distribution of ABO	15
1.4	Fisher-Race Nomenclature	24
1.5	Rh antigen	30
1.6	Antibodies produced against Rh antigens	33
1.7	antigens of the Kell blood group system: nomenclature	37
1.8	Antigens of the Kell blood group	39
1.9	Antibodies produced against Kell antigens	49
3.1	Gender Frequency in study Population	57
3.2	ABO blood group genes Frequency in Albderia tribe	58
3.3	Rh blood group genes Frequency in Albderia tribe	59

3.4	K1 Ag percent in Albderia tribe	60
3.5	K2 Ag frequency in Albderia tribe	61
3.6	Kell Genotype frequency in Albderia tribe	62
3.7	Kell Phenotype frequency in Albderia tribe	63

List of figures

No	Figure	page
3.1	Gender Frequency in study Population	57
3.2	ABO blood group genes Frequency in Albderia tribe	58
3.3	Rh blood group genes Frequency in Albderia tribe	59
3.4	K1 Ag Frequency in Albderia tribe	60
3.5	K2 Ag frequency in Albderia tribe	61
3.6	Kell Genotype frequencies in Albderia tribe	62
3.7	Kell Phenotype frequencies in Albderia tribe	63