Dedication

To great father and mother who spend their life for the sake of me.

To my lovely and merciful sisters with my wishes.

To my dear brother, with my love.

To my dear darling with all love and wishes.

Acknowledgement

Many persons contributed to the success of this study and making it reality from inception to completion. I would like to express my deep gratitude and honest appreciation to every one of them :

Firstly I am most grateful to my supervisor Ustas \ Malik Hassan Ibrahim, Assistance professor of hematology , head department of hematology, Sudan University for science and technology, for his expertise, support, endless valuable advice and patience.

Also to all my teachers and friends in Sudan University.

My best regards and thanks to brother Jemis Shawish from Niwer tribe who helped us a lot and was the translator and best helper between me and Niwer.

Sincere thanks to the staff of Almonawara specialized hospital for their help and guide throughout the study work, and special thank for dear friend Khalid Alwaly. Also, I would like to appreciate to the people from whom the blood samples had been collected, for their co-operation and good behavior.

My acknowledgement extended to all authors listed as references of literature review.

Contents

Dedication	I
Acknowledgement	II
Contents	III
List of tables	V
List of figures	VII
Abstract	VIII
Chapter One	
Introduction and literature review	1
Red blood cell antigens 1 – 1	1
1The ABO blood group system – 1 – 1	1
Inheritance of the ABO groups 1- 1 – 1 -	2
Genetics of the ABO system 1-1-1-2	5
The Gene H: Its Role in Expression of A and B Genes : 1-1-1-3	6
Biochemistry of ABO system :1-1-1-4	9
Antibodies of the ABO system 1-1-1-5	01
Anti-A and anti-B 1-1-1-5-1	10
The Rh blood group system 2 – 1 – 1	13
Rh terminology 1 – 2 – 1 – 1	14
Nomenclatures and genetic theories 2 – 2 – 1 – 1	15
Genetics of the Rh system 1-1-2-2-1	15
The Fisher-Race Nomenclature : 1-1-2-2-2	17
The Wiener Nomenclature : 1-1-2-2-3	19
The Wiener theory of Rh inheritance : 1-1-2-2-4	21
The Rosenfield Nomenclature : 1-1-2-2-5	22
Rh Inheritance : 1-1-2-3	25
The Determination of Rh phenotypes and probable Genotypes :-1-1-2-4	27
Rh system Antigens :1-1-2-5	34
Weak D phenotype : 1-1-2-5-1	35
Partial D 1-1-2-5-2	35
Cc and Ee variant antigens : 1-1-2-5-3	36
Cis or compound antigens : 1-1-2-5-4	36
(The G antigen (Rh12 : 1-1-2-5-5	36
Other Rh antigens : 1-1-2-5-6	36
Rh system deletions : 1-1-2-5-7	37
Rhnull and Rhmod : 1-1-2-5-8	37
Dosage effect : 1-1-2-5-9	38
Rh antibodies :1-1-2-6	39

Frequencies and racial variations : 1-1-2-7	40
Objectives	43
General objective	43
Specific objectives	43
Chapter Two	
Materials and methods	44
Ethical consideration :2-1	44
Study population :2-2	44
Inclusion criteria1 2-1- 2	44
Exclusion criteria : 2-2-2	44
Sample size : 2-3	44
Data collection :2-4	44
Data processing :2-5	44
Data presentation :2-6	45
Study period :2-7	45
Methodologies :2-8	45
Collection of blood samples :3-8-1	45
Materials :3-8-1-1	45
Study population 2-8-1-2	45
Method : 2-8-2	45
Slide method : 2-8-2-1	46
Interpretation of the results : 2-8-2-1-1	46
Chapter Three	
Results	47
Chapter Four	
Discussion	52
Chapter Five	
Conclusion and recommendations	54
Conclusion : 5-1	54
Recommendations : 5-2	54
Chapter Six	
References	55

List of tables

Tables	*Title*	*Page Number*
Table 1 – 1	ABO system classification .	2
Table 1 – 2	Phenotypes and Genotypes in the ABO blood group system.	3
Table 1 – 3	Frequencies of ABO blood groups (England) .	6
Table 1 – 4	Number of A and B antigen sites on red cells of various A and B groups .	11
Table 1 – 5	Some properties of immune and naturally occurring anti-A and anti-B .	13
Table 1 – 6	The Rh system antigens nomenclature .	16
Table 1 – 7	The Rh system : Gene complexes and phenotype Frequencies .	17
Table 1 – 8	Comparison of Fisher-Race and Wiener nomenclatures .	21
Table 1 – 9	Comparison of nomenclatures of antigens of the Rh system.	23
Table 1 – 10	The 18 different reaction combinations in testing red cells with the five most common Rh antisera and their all possible genotypes .	29
Table (1 – 11)	*Estimations of probabilities in Rh genotyping and the percentage of error.*	31
Table (1 – 12) ,	Common Rh gene complexes in order of frequency for Whites .	32
Table (1 – 13)	Common Rh antigens in order of frequency among Whites .	32

Table (1 – 14)	The 36 possible Rh genotypes in order of frequency among Whites .	33
Table (1 – 1 5)	*Examples of dosage.*	38
Table (1 – 16)	Rh system nomenclatures and frequencies (Antigens) .	40
Table (1 – 17)	Rh system nomenclatures and frequencies (Complexes).	40
Table (3- 1)	Frequency of ABO antigens among Niwer ethnic group .	48
Table (3 – 2)	Frequency of Rh antigens among Niwer ethnic group	48

List of figures

Figure	Title	Page number
Figure(1 – 1)	A family study reveals the exact ABO genotypes of all family members .	4
Figure(1 – 2)	ABO inheritance.	5
Figure(1 – 3)	The genetic pathway leading to ABH gene expression on the red cells.	7
Figure(1 - 4)	Antigen molecule with H specificity.	8
Figure(1 - 5)	Antigen molecule with A specificity.	8
Figure (1 – 6)	The Fisher-Race theory of Rh Inheritance.	19
Figure (1 – 7)	The Wiener theory of Rh inheritance.	22
(Figure (1 – 8	Rh inheritance with Fisher-Race .nomenclature	25
(Figure (1 – 9	Rh inheritance with Wiener .nomenclature	26
(Figure (3-1	Frequency of ABO antigens among . Niwer ethnic group	**49**
(Figure (3-2	Frequency of D antigen among Niwer . ethnic group	**49**
(Figure (3-3	Frequency of C antigen among Niwer . ethnic group	**50**
(Figure (3-4	Frequency of c antigen among Niwer . ethnic group	**50**

(Figure (3-5	Frequency of E antigen among Niwer ethnic group .	**51**
(Figure (3-6	Frequency of e antigen among Niwer ethnic group .	**51**

Abstract

This is a descriptive analytical study carried out in Niwer ethnic group during April to August 2005 for determination of ABO blood grouping antigens and Rhesus blood grouping antigens.

One hundred samples were collected from one hundred unrelated, adult, healthy, volunteers from both sexes.

Before starting samples collection, volunteers were well notified about the objectives and need of study and they accept to donate the samples.

The blood samples were analyzed in the laboratory by using anti sera.

Thirty samples were analyzed by using gel technique, in addition to the anti sera, and the two methods were compared together.

The results were as follow :

Blood group A 28 % , B 11% , O 59 % , AB 2 %.

D 95 % , C 19 % , c 100 % , E 31 % , e 100 % .

Data was analyzed using the statistical programme SPSS with computer system.

When we compared the results delivered by the two methods, we found that there was no difference between the two methods.

Results were shown in tables and charts, and compared with some international results, and we found that there were significant differences in the frequency of the antigens studied.