

بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

**Frequency of Human Immunodeficiency Virus,
Hepatitis B and C Virus among Ethiopian
Residents**

in Khartoum State

**تردد انتشار الإصابة بفيروسات عوز المناعة البشرية
وفيروسات التهاب الكبد الوبائي (ب) و(ج) وسط
الإثيوبيين المقيمين بالخرطوم**

A Thesis Submitted in Partial Fulfillment for the
Requirements of M.Sc. in Medical Laboratory Science
(Microbiology)

By

Khalid Hussain Abdalla Algoubai

B.Sc. Medical Laboratory Science, Omdurman Islamic University
(2010)

Supervisor:

Dr. Abdelbagi Elnagi Mohamed

August 2013

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال الله تعالى

إِنِ اللَّهُ وَمَلَائِكَتُهُ يُصَلُّونَ عَلَى النَّبِيِّ يَا
أَيُّهَا الَّذِينَ آمَنُوا صَلُّوا عَلَيْهِ وَسَلِّمُوا
تَسْلِيمًا

صدق الله العظيم

سورة الأحزاب الآية 56

Dedication

TO THE SOUL OF MY Father

To the soul of my NIECE ENAAM

TO MY BELOVED MOTHER SITNOOR

TO MY WONDERFULL

BROTHERS AND SISTERS.

Acknowledgments

First, thanks for The ALMIGHTY ALLAH who gave me the power for preparation and completion of this study. With a great deal of respect I would like to express my thanks to supervisor Dr. Abdebagi Elnagi Mohamed for his advice, enthusiasm, help and endless guide .My deep thanks are extended to Mr. Ibrahim Aljebail for his technical support in performing this study. I would like to thank Mr. Altijani Abdelhai, Ms. Sahr Abubakr, Ms. Entisar Abdelwhab, Mrs. Hanan Salim, Ms. Amani Ali, Mr. Elfadil Ahmed and all technologists of Althora Medical Centre and Academy Charity Teaching Hospital.

My thanks and appreciations to Dr. Mohamed Siddig for his help in scientific data analysis. Last, but not least, my thanks to all those who helped and supported me all throughout this study.

Abstract

The aim of this study was to determine the frequency and possible risk factors for Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and Hepatitis C Virus (HCV) infections among Ethiopian (including both Ethiopians and Eritreans) residents at Khartoum State, Sudan.

The samples were collected from the apparently healthy individuals attending Althora Medical Centre, Omdurman and The Academy Teaching Charity Hospital, Khartoum.

Hundred (n= 100) apparently healthy individuals of both sexes and of ages ranging from 15 to 35 years., were investigated for the specific anti-HIV antibodies, Hepatitis B surface Antigen (HBsAg), and anti-HCV antibodies during the period from July to October, 2012. Seventy of the examined subjects were Ethiopians and thirty were Sudanese (as control).

The third and fourth generation Enzyme-Linked Immunosorbent Assay (ELISA) was used as screening test and the Western blot technique (WBT) was used as confirmatory test for HIV infection, while third and fourth generation ELISA was used for HBsAg and HCV antibodies.

Out of the 70 Ethiopians examined, five were found positive (7.1%) for HIV infection by both ELISA and WBT, four (5.7%) were found and confirmed positive for HBV

infection, and no positive HCV infection was detected among all examined individuals.

All Sudanese individuals examined (n=30) were shown negative for all three viral infections.

The rate of HIV infection was higher (20%) among age group 21-25 years (all were females), compared to other groups 2.5% among age group 15 - 20 years) and high among the married 9.7% compared to the single individuals (5.1%). For HBV infection, the rate was 5% among both age groups 15 - 20, and 21 - 25, and 50% in age group 31 - 35 years. The rate was high among females (5.8%), and among the single (7.7%) individuals examined.

There was no significant difference ($p > 0.05$) observed in the frequency of all three viral infections among Ethiopians compared to Sudanese individuals, also no significant effect ($p > 0.05$) was observed for all the predisposing factors examined in this study (e.g. Sex, marital status, previous blood transfusion and surgical operations).

ملخص الأطروحة

هدفت هذه الدراسة بصورة أساسيه إلى تحديد مدى انتشار الإصابة بفيروس عوز المناعة البشرى والتهاب الكبد الفيروسي "ب" و "ج" وتحديد عوامل الخطر المحتملة المهددة للإصابة بهم وسط الأثيوبيين المقيمين بولاية الخرطوم - السودان.

شملت الدراسة 100 شخص (70أثيوبي و 30 سوداني) من المترددين على مركز الثورة الطبي أمدرمان ومستشفى الأكاديمية التعليمي الخيري الخرطوم، خلال الفترة من يوليو حتى أكتوبر 2102

شملت الدراسة مجموعة من الجنسين تتراوح أعمارهم بين 15 - 35 سنة. أوضحت الدراسة أن الإصابة بفيروس الإيدز ايجابية وسط الإثيوبيين في (7.14%) منهم. والإصابة بالمستضد السطحي لفيروس الكبد "ب" ايجابية في (5.7%) منهم. كما أوضحت عدم وجود إصابة بفيروس الإيدز أو فيروس الكبد الوبائي "ب" وسط السودانين الذين شملتهم الدراسة وذلك باستخدام تقنية الجيل الثالث والجيل الرابع من مقايسة الامتصاص المناعي المرتبط بالإنزيم وتقنية الوبسترن بلوت . أما نتيجة الإصابة بفيروس الكبد "ج" فقد كانت سالبة (0.0%) في كل العينات التي تم أخذها من المترددين باستخدام تقنية الجيل الثالث من مقايسة الامتصاص المناعي المرتبط بالأنزيم.

أوضحت الدراسة أن معدل الإصابة بفيروس مرض الإيدز أعلى في الفئة العمرية من 21 - 25 سنة ووسط النساء (20%) ووسط المتزوجين (9.7%). أما نسبة الإصابة بفيروس التهاب الكبد الفيروسي "ب" فقد كانت (5%) في الفئة العمرية من 15 - 20 سنة و الفئة العمرية من 21 - 25 سنة و(50%). في الفئة العمرية من 31 - 35 سنة. وكان معدل الإصابة أعلى وسط النساء (5.8%) ووسط غير المتزوجين. (7.7%).

بين معدل ($p > 0.05$) لم تظهر الدراسة أي فروق ذات دلالة إحصائية الإصابة بالأمراض الفيروسية وسط الأثيوبيين مقارنة بالسودانيين. وكذلك للعوامل ($p > 0.05$) لم تظهر الدراسة أي تأثيرات ذات دلالة إحصائية الأخرى (مثال النوع، الحالة الاجتماعية، التاريخ السابق لنقل الدم و العمليات الجراحية) للإصابة بهذه الفيروسات.

Table of contents

Page No.	Subjects	Item
الآية		
I	Dedication	
II	Acknowledgments	
III	Abstract, English	
V	Abstract , Arabic	
VI	Table of contents	
XI	List of tables	
XII	List of figures	
XIII	List of abbreviations	
Chapter One: Introduction		
1	Background	1.1
2	Rationale	1.2
2	Objectives	1.3
2	General Objective	13.1
3	Specific Objectives	1.3.2
Chapter Two: Literature Review		
4	Human Immunodeficiency Virus (HIV)	2.1
4	Origin	2.2
4	Discovery	2.3
5	Structure	2.4
6	Tropism	2.5
7	Replication	2.6
8	Genetic variability	2.7
9	Signs and Symptoms	2.8
9	Acute HIV infection	2.8.1
10	Latency stage	2.8.2
10	Acquired Immunodeficiency	2.8.3

	Syndrome(AIDS)	
11	Epidemiology	2.9
11	Transmission	2.10
11	Sexual transmission	2.10.1
12	Blood or blood products transmission	2.10.2
12	Mother to child transmission	2.10.3
13	Laboratory diagnosis	2.11
13	Enzyme - Linked Immunosorbent Assay (ELISA)	2.11.1
13	Simple rapid HIV - antibody assays	2.11.2
13	Western blot	2.11.3
14	Immunofluorescence assay (IFA)	2.11.4
14	Polymerase Chain Reaction (PCR)	2.11.5
14	P24 antigen test	2.11.6
14	Treatment	2.12
16	Prognosis	2.13
16	HIV in Sudan	2.14
17	Hepatitis B virus (HBV)	2.15.
17	History	2.15.1
17	Classification	2.15.2
17	Structure	2.15.3
18	Genome	2.15.4
19	Replication	2.15.5
19	Serotypes and genotypes	2.15.6
20	Epidemiology and transmission	2.15.7
21	Symptoms and signs	2.15.8
21	Clinical course	2.15.9
22	Complications	2.15.10
22	Laboratory diagnosis	2.15.11
23	HBV in Sudan	2.15.12
24	Prevention	2.15.13
25	Treatment	2.15.14
26	Prognosis	2.15.15

26	Reactivation	2.15.16
27	Hepatitis C Virus(HCV)	2.16
27	History	2.16.1
27	Classification and structure	2.16.2
27	Genome structure and organization	2.16.3
28	Replication and growth cycle of the virus	2.16.4
28	Cell entry and fusion	2.16.4.1
28	Replication inside the cell	2.16.4.2
29	Epidemiology	2.16.5
30	Pathogenesis	2.16.6
31	Clinical signs and symptoms	2.16.7
32	Clinical course	2.16.7.1
32	Complications	2.16.7.2
32	Laboratory diagnosis	2.16.8
33	Serological tests	2.16.8.1
33	Molecular tests	2.16.8.2
33	Genotype tests	2.16.8.3
33	Biochemical liver function tests	2.16.8.4
34	Liver biopsy	2.16.8.5
34	Prevention and control	2.16.9
34	Treatment	2.16.9.1
34	Vaccination	2.16.9.2
34	Stability	2.16.9.3
34	HCV in Sudan	2.16.10
Chapter Three: Materials and Methods		
36	Study design	3.1
36	Study area	3.2
36	Study population	3.3
36	Inclusion criteria	3.4
36	Exclusion criteria	3.5
36	Sample size	3.6
36	Data collection and presentation	3.7

37	Ethical consideration	3.8
37	Laboratory tests	3.9
37	ELISA for detection of HCV antibodies	3.9.1
37	Principle	3.9.1.1
38	Procedure	3.9.1.2
38	Quality control and calculation of results	3.9.1.3
39	Interpretation of results	3.9.1.4
39	ELISA for detection of Hepatitis B surface antigen (HBsAg)	3.9.2
39	Principle	3.9.2.1
39	Procedure	3.9.2.2
40	Quality control and calculation of results	3.9.2.3
40	Interpretation of results	3.9.2.4
40	Supplemental ELISA for HBsAg	3.9.3
40	Principle	3.9.3.1
41	Procedure	3.9.3.2
41	Calculation of the cut-off	3.9.3.3
41	Interpretation of results	3.9.3.4
41	ELISA for detection of anti-HIV Antibodies	3.9.4
41	Principle	3.9.4.1
42	Procedure	3.9.4.2
42	Calculation of the cut-off	3.9.4.3
43	Interpretation of results	3.9.4.4
44	Supplemental ELISA for detection of HIV-1 and HIV-2 antigens and antibodies	3.9.5
44	Principle	3.9.5.1
45	Procedure	3.9.5.2
45	Calculation of the cut-off	3.9.5.3
46	Interpretation of results	3.9.5.4

46	Western blot confirmation test for HIV	3.9.6
46	Principle	3.9.6.1
47	Procedure	3.9.6.2
47	Interpretation of results	3.9.6.3
Chapter four: Results		
48	Detection of important serological markers to hepatitis B, hepatitis C, and human immunodeficiency virus among Ethiopian residents (70) and Sudanese (30) using different serological techniques.	4.1
48	Detection of important serological markers to hepatitis B, hepatitis C, and human immunodeficiency virus among Ethiopian residents examined by various techniques of ELISA and Western Blot	4.2
48	The effect of age on infection with HIV and HBV among Ethiopian residents	4.3
49	The effect of gender and marital status on HIV infection among Ethiopian residents	4.4
49	The effect of gender and marital status on HBV infection among Ethiopian residents	4.5
Chapter five: Discussion		
53	Discussion	5
54	Conclusion	5.1
54	Recommendations	5.2
55	References	
Appendix		

63	Questionnaire	
64	Photos of ELISA and Western blot results	

List of tables

Page No.	Legend	Table No.
51	Detection of anti-HIV antibodies, hepatitis B surface antigen and anti-HCV antibodies using different serological techniques	4.1
51	Detection of anti-HIV antibodies, hepatitis B surface antigen and anti-HCV antibodies among Ethiopians in comparison to Sudanese	4.2
52	The effect of the age groups of the Ethiopian residents on HIV infection.	4.3

List of figures

Page No.	Legend	Figure No.
6	Structure of HIV	2.1
18 18/BV	HBV particle and surface antigen.	2.2
28	Structure of HCV	2.3
53	The effect of gender and marital status on HIV infection among Ethiopian residents.	4.1
53	The effect of gender and marital status on HBV infection among Ethiopian residents.	4.2

List of Abbreviations

AIDS	Acquires Immunodeficiency Syndrome
ALT	Alanine Aminotransferase
CDC	Center for Disease Control and Prevention
CNS	Central Nervous System
CRFS	Circulating Recombinant Forms
CSTD	Condoms Sexually Transmitted Diseases
DHHS	Department of Health and Human Services
ELISA	Enzyme - Linked Immunosorbent Assay
HAART	Highly Active Anti-Retroviral Therapy
HCW	Health Care Workers
HIV	Human Immunodeficiency Virus
HRP	Horse radish Peroxidase
HTLV	Human T cell Leukaemia Virus
ICTV	International Committee on Taxonomy of Viruses
IFA	Immunofluorescence Assay
LAV	Lymphadenopathy- Associated Virus
LTR	Long Terminal Repeat

NARTLs	Nucleoside Analogue Reverse Transcriptase Inhibitors
NIAID	National Institute of Allergy and Infectious Diseases
	NIH National Institute of Health
NNRTI	Non- Nucleoside Reverse Transcriptase Inhibitor
PCP	<i>Pneumocystis carinii</i> Pneumonia
SIV	Simian Immunodeficiency Virus
SNAP	Sudan National AIDS Programme
STD	Sexually-Transmitted Diseases
SDS-PAGE	Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis
	TMB Tetramethyl benzidine