Tuberculosis and Associated Risk Factors

Among Patients in Kassala Teaching Hospital Centre

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Dedication

To my beloved parents who have done their best to push me forward & to all those who have stood beside me throughout.

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Abbreviations

ACET	The Advisory Council for the Elimination of Tuberculosis
AIDS	Acquired immunodeficiency Syndrome
ARI	Annual Risk of Infection
BCG	Bacillus calmette-Guerin
CDC	Center of Disease Prevention and Control
DOTs	Direct Observed Therapy Short course
HIV	Human Immunodeficiency Virus
NTP	National Tuberculosis Programme
SPSS	Statistical Package for Social Scientist
TB	Tuberculosis
TBMUs	Tuberculosis Medical Units
WHO	World Health Organization

Acknowledgement

I praise and thank God the Almighty for providing me health and strength to undertake this work.

I would like to thank and to express my gratitude and appreciation to my supervisor, Professor. Aggrey Majok for his keen guidance and continuous encouragement.

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Abstract

Tuberculosis remains a world wide public heath problem despite the fact that the causative agent was discovered more than 100 years ago and highly effective drugs and vaccine are available, making tuberculosis a curable and preventable disease.

Hospital based cross sectional study was conducted in order to determine the risk factors associated with TB. The study focused on hospital admissions, which have been recorded on visits and diagnosed as TB positive. A convenient sample of 57 patients was used for this study. Information was collected, using a structured questionnaire on host related factors, socio-economic status, environmental factors, behavioral factors, contact and co infection with HIV.

Collected information (data) was computerised, and analysis was performed, using SPSS software programme.

Results showed that HIV, illiteracy, unemployment and household overcrowding were the most outstanding risk factors for tuberculosis

TB was more common among middle age group, males and among those living in substandard houses.

Marital status showed little variation between married and unmarried groups

Smoking did not seem to be a risk factor for TB among the study group as shown by a lower frequency of smokers among known TB cases.

Contact with those experienced chronic cough and drinking raw milk did not matter much as sources of exposure to TB infection.

Results about smoking, contact and consumption of raw milk seem to be attributable to small sample size.

Male sex, illiteracy and unemployment were more frequent among HIV patients indicating that these factors could be regarded as important in the epidemiology of HIV infection.

Sexually active group aged between 30 and 49, showed high frequency of HIV positive results and there was no unusual trend with respect to married and unmarried groups.

Low level of education and therefore lack of awareness about TB and HIV/ AIDS, coupled with unemployment and poor health are all important factors that need to be addressed in order to minimize exposure to these diseases.

الخلاصة

مازال مرض السل مشكلة صحية في مختلف أنحاء العالم بالرغم من أنه قد تم اكتشاف الجرثومة المسببة له قبل أكثر من 100 عام ورغم وجود عقاقير لقاحات فعالة جعلت منه مرض قابل للوقاية والعلاج.

أجريت الدراسة لتحديد العوامل المؤثرة على السل اعتمادا على المرضى القادمين للمستشفى والذين تم تشخيص حالاتهم كمرضى بالسل.

تم اختيار عينة من 57 مريض بغرض الدراسة. وقد تم جمع المعلومات عنهم عن طريق ملأ بيانات الاستبيان فيما يتعلق بالعوامل الاقتصادية والاجتماعية والبيئية والسلوكية وفحص عينات الدم لتشخيص مرض الأيدز.

وقد تم ملء استمارات الاستبيان واجراء الفحص لكل المرضى المستهدفين في هذه الدراسة. كما تم ادخال البيانات وتحليلها احصائيا باستخدام برنامج ال SPSS .

وقد أظهرت النتائج أن الايدز والأمية والعطالة وزيادة عدد أفراد الأسرة هي العوامل الأكثر تأثيرا على حدوث المرض. كما أن المرض أكثر شيوعا بين الفئات المتوسطة عمرياً والذكور وبين من هم في مساكن تفتقر للمواصفات الصحية.

الحالة الاجتماعية اظهرت تباينا اقل بين المتزوجين وغير المتزوجين

وقد أظهرت الدراسة أيضا قلة حدوث المرض بين المدخنين كما أن الحالة الاختلاط بالمصابين بمرض السل وتناول الحليب غير المغلي لا تعتبر من العوامل المؤثرة علي حدوث المرض.

أكثر الفئات المصابة بالإيدز كانت من الذكور، كما أظهرت الأمية والعطالة ارتباطـاً وثيقاً بحدوثه مما يجعلها من العوامل الأهم في وبائية الايدز. وأظهرت الفئات النشطة جنسياً

أعلى معدلات لحدوث الإيدز بينما لم يظهر اختلاف في حدوث المرض تبعاً للحالة الاجتماعية.

تدني مستوي التعليم، بالتالي مستوي الوعي عن مرضي السل و الايدز، إضافة الي العطالة و تدهور الحالة الصحية من العوامل المهمة التي يجب أن توضع فى الاعتبار للتقليل من حدوث هذين المرضين.

Introduction

Tuberculosis is a specific infectious disease caused by Mycobacterium tuberculosis. The disease primarily affects lungs and cause pulmonary tuberculosis. It can also affect intestine, meninges, bones and joints, lymph nodes, skin and other tissues of the body (K. Park, 2005). Most infected persons do not experience clinical illness, but are usually asymptomatic and noninfectious. However, infection can persist for years, and infected persons can remain at risk of developing clinical TB, especially if the immune system becomes impaired (CDC, 1995).

Tuberculosis remains a worldwide public health problem despite the fact that the causative agent was discovered more than 100 years ago and highly effective drugs and vaccine are available, making tuberculosis a preventable and curable disease (K. Park, 2005). The global epidemiologic pattern of tuberculosis has changed as a result of AIDS epidemic and development and spread of multiple drug resistant tuberculosis strains(Cesurs, 2004).

Based on published reports in the medical literature and the Centre for Disease Control and Prevention (CDC) surveillance data, the Advisory Council for the Elimination of Tuberculosis (ACET) recommends that the following groups are of high risk and may introduce TB infection to susceptible communities:

1. Those in close contacts (i.e. sharing the same household or other enclosed environments) with persons known or suspected to have TB.

2. Persons who inject illicit drugs or other locally identified high-risk substance users (e.g. crack cocaine users).

3. Persons who have the following medical risk factors which are known to increase the risk of disease, if infection occurs:-

- HIV infection

- Diabetes mellitus

- Conditions requiring prolonged high-dose of corticosteroid therapy and other immunosuppressive therapy (including bone marrow and organ transplantation).

- Chronic renal failure.

- Some hematologic disorders (e.g., leukemia's and lymphomas).

- Other specific malignancies (e.g. carcinoma of the head or neck).

- weight of greater than or equal to 10% below ideal body weight.

- Silicosis.

- Gastrectomy.

- Jejunoileal bypass.

4. Residents and employees of high-risk congregate settings (e.g., correctional institutions, nursing homes, mental institutions, other long-term residential facilities and shelters for the homeless).

5. Health-care workers who serve high-risk clients and patients.

6. Foreign-born persons including children who are recent arrivals (within 5 years) from countries that have a high TB incidence or prevalence

7. Some medically underserved such as low-income populations.

8. High-risk racial or ethnic minority populations. (CDC, 1995).

Objectives

The Objective of Study

The main objective of this study is to identify the risk factors associated with occurrence of Tuberculosis among patients who visited Kassala Teaching Hospital TB Centre from April to July 2008.

Specifically, the study focuses on the following:

1. Determination of the distribution of tuberculosis among TB patients according to their age, sex and marital status.

2. Estimation of HIV prevalence among TB patients.

3. Characterization of specific role of the following factors in the occurrence of tuberculosis:

- Contact with infected persons
- Smoking
- Socioeconomic status
- Overcrowding
- Housing
- Consumption of raw milk

4. Distribution of HIV positive patients according to their age ,sex and marital status and the role of socioeconomic status in HIV occurrence.

Chapter One

Review of Literature

1.1 Definition:

Tuberculosis (TB) is a common and often deadly infectious disease caused by mycobacteria, mainly Mycobacterium tuberculosis (Kumar, *et al*, 2007). Mycobacterium Tuberculosis usually attacks the lungs (as pulmonary TB) but can also affect the central nervous system, the lymphatic system, the circulatory system, the genitourinary system, the gastrointestinal system, bones, joints, and even the skin. Other mycobacteria such as Mycobacterium bovis, Mycobacterium africanum, Mycobacterium canetti, and Mycobacterium microti also cause tuberculosis, but these species are less common (WHO,2006).

1.2 Diagnosis:

1.2.1 Clinical description

The most important symptoms in the selection of tuberculosis (TB) suspects in adults (aged older than 15 years) are:

─ Productive cough for more than 2 weeks, and/or

─ Haemoptysis and

─ Significant weight loss. (Michelle *et al*, 2005).

Patients with TB may also have other symptoms (which are more common, but less suggestive) such as:

- Chest pain
- Breathlessness
- Fever/night sweats
- Tiredness, and
- Loss of appetite.

Among refugees and internally displaced populations, it is unusual to have ready access to X-ray facilities. It is the priority of health services to detect the sources of infection by sputum microscopy, and cure them.

1.2.2 Clinical case definition

Tuberculosis suspect: Any person who presents with symptoms or signs suggestive of TB, in particular, cough of long duration (more than 3 weeks)

Case of tuberculosis: A patient in whom TB has been bacteriologically confirmed or diagnosed by a clinician.

Definite case of tuberculosis: A patient with positive culture for the M. tuberculosis complex. (In countries where culture is not routinely available, a patient with two sputum smears positive for acid-fast bacilli (AFB) is also considered a "definite" case.) (Michelle *et al*, 2005).

1.2.3 Laboratory criteria for diagnosis

Each TB suspect should have three sputum samples examined by light microscopy for AFB. The chances of finding TB organisms are greater with three sputum samples than with one or two samples. Secretions build up in the airways overnight, so that an early-morning sputum sample is more likely to contain the TB organisms than a sample taken later in the day. In practice, a suspect provides sputum samples in the following manner:

Day 1

Sample 1 – Person suspected of TB provides an "on-the-spot" sample under supervision on presentation to the health facility. He or she is given sputum container to take home for an early-morning sample the following day.

Day 2

Sample 2 – Person suspected of TB brings an early-morning sputum sample collected just after waking up.

Sample 3 – Person suspected of TB provides another "on-the-spot" sample.

Smears should be stained using the Ziehl–Neelsen method. Any TB suspect with two positive smears is a smear-positive TB patient, who must then be registered and started on anti-TB treatment. (Michelle *et al*, 2005).

If only one initial sputum smear is positive a suggestive X-ray showing active pulmonary TB interpreted by an experienced medical officer may lead to a diagnosis of smear-positive TB. AFB microscopy may be repeated and, if at least one smear is again positive with compatible X-ray, the patient should be considered a smear-positive TB patient. In the absence of X-ray, one sputum smear with positive culture for M. tuberculosis is also classified as sputum-positive TB.

If the initial three smears are negative, but pulmonary TB is still suspected because of persistent symptoms, the suspect should be treated for acute respiratory infection with broad-spectrum antibiotics (e.g. Amoxicillin or Co-trimoxazole, but not Rifampicin or any other anti-TB drug) for at least 1 week.

If there is no improvement, sputum samples must be re-examined 2 weeks after the first sputum examination. Between 65–80% of all pulmonary TB cases are expected to be confirmed by positive sputum smear examination. X-ray lesions compatible with active TB should encourage further sputum examination if the three sputum smear examinations were negative.X-ray itself is not a diagnostic tool for pulmonary TB.

In some circumstances, a compatible X-ray together with symptoms consistent with TB will lead to the diagnosis of pulmonary TB in smear-negative cases. Thus, if all three samples are again negative after the trial of antibiotics, either a compatible X-ray interpreted by an experienced physician or, in the absence of X-ray facilities, the experienced

physician’s judgment alone will decide whether a patient is categorized as having TB (classed as smear-negative TB).

Additional cases of TB may be found among close contacts of known smear-positive cases, either family members or persons sleeping in the same shelter. Symptomatic contacts should be screened using the procedures described above. (Michelle *et al*, 2005).

1.2.4 Tuberculin Test

The most common type of tests to screen for tuberculosis is the Mantoux PPD tuberculin skin test, which is generally considered the most reliable test as screening tool that are designed to help identify individuals who may have been infected by the tuberculosis bacteria. A diagnosis of tuberculosis is never made based on the results of a TB skin test, but requires further testing including a sputum culture and a chest x ray.

TB skin test is usually given at a clinic, hospital, or doctor's office. Sometimes the test is given at schools or workplaces. Many cities provide free TB skin test and follow-up care. The Mantoux PPD tuberculin skin test involves injecting a very small amount of a substance called PPD tuberculin just under the top layer of the skin (intracutaneously). Tuberculin is a mixture of antigens obtained from the culture of M. tuberculosis. Antigens are foreign particles or proteins that stimulate the immune system to produce antibodies. Two different tuberculin preparations are available, Old Tuberculin (OT) and Purified Protein Derivative (PPD). The test is usually given on the inside of the

forearm about halfway between the wrist and the elbow, where a small bubble will form as the tuberculin is injected. The skin test takes just a minute to administer and feels more like a pinprick than a shot.

After 48-72 hours, the test site will be examined by a trained person for evidence of swelling. People who have been exposed to tuberculosis will develop an immune response, causing a slight redness or swelling at the injection site. Reactions may not peak until after 72 hours in elderly individuals or those who are being tested for the first time. (Altha, 1999).

1.3 TB in HIV-positive patients

HIV-positive patients are more susceptible to TB infection, and HIV in a TB patient is a potent cause of progression of TB infection to disease. The principles of TB control are the same even when there are many HIV/TB patients. In HIV-infected patients, pulmonary TB is still the commonest form of TB. The clinical presentation of TB depends on the degree of immunosuppression.

Early in HIV infection, when immunity is good, the signs of TB are similar to those in an individual without HIV infection. As HIV infection progresses and immunity declines, the risk of TB dissemination increases. TB meningitis, miliary TB and widespread TB lymphadenopathy occur.

It is important to look systematically for signs or symptoms of TB in HIV-positive patients and to start treatment without delay based on

clinical, bacteriological and, in some circumstances, radiological evidence. (Michelle *et al*, 2005).

1.5 Diagnostic criteria for classification of TB:

1.5.1 Pulmonary Tuberculosis (PTB)

Pulmonary TB refers to disease involving the lung parenchyma. Tuberculous intrathoracic lymphadenopathy (mediastinal and/or hilar) or tuberculous pleural effusion, without radiographic abnormalities in the lungs, therefore constitutes a case of extra pulmonary TB. A patient with both pulmonary and extra pulmonary TB should be classified as a case of pulmonary TB.

• Smear-positive pulmonary TB

Either:

A patient with at least two sputum specimens positive for AFB by microscopy;

Or:

A patient with at least one sputum specimen positive for AFB by microscopy and radiographic abnormalities consistent with pulmonary TB; (Michelle *et al*, 2005).

Or:

A patient with at least one sputum specimen positive for AFB by microscopy, which is culture-positive for M. tuberculosis.

• Smear-negative pulmonary TB

A case of PTB that does not meet the above definition for smear-positive TB. This group includes cases without smear result. This commonly occurs in children but is comparatively uncommon in adults.

Diagnostic criteria for PTB (which is also used to exclude sputum negative.

PTB) is based on the following criteria:

– At least three sputum specimens negative for AFB, and

– No clinical response to a one-week course of broad-spectrum antibiotics, and

– Radiographic abnormalities consistent with active PTB, and

– Decision by a clinician to treat with a full course of TB chemotherapy.

A patient whose initial sputum smears were negative and whose subsequent sputum culture result is positive is also considered to have smear-negative pulmonary TB. (Michelle *et al*, 2005).

1.5.2 Extra pulmonary tuberculosis (EPTB)

EPTB refers to TB of organs other than the lungs, e.g. pleura, lymph nodes, abdomen, genitourinary tract, skin, joints, bones and meninges. Diagnosis should be based on one culture-positive specimen, or on histological or strong clinical evidence consistent with active EPTB, followed by a decision by a clinician to treat with a full course of TB chemotherapy.

The case definition of an EPTB case with several sites affected depends on the site representing the most severe form of disease.

Some cases will be easy to diagnose with peripheral lymphadenitis, swelling of cervical or axillary lymph nodes, chronic evolution and/or production of caseous discharge. Other cases, such as severe, life-threatening forms (e.g. miliary TB, TB meningitis), TB of bone joints, TB peritonitis, TB laryngitis, will be suspected but should be referred to a hospital for assessment. (Michelle *et al*, 2005).

1.6 Mode of transmission:

Exposure to tubercle bacilli in airborne droplet nuclei produced by people with pulmonary or laryngeal TB during expiratory efforts such as coughing and sneezing. Extra pulmonary tuberculosis (other than laryngeal) is usually non-infectious.

Bovine tuberculosis results from exposure to tuberculous cattle, usually by ingestion of unpasteurized milk or dairy products, and sometimes by airborne spread to farmers and animal handlers.

1.7 Progression to active disease:

Progression to active disease can take weeks or years; latent infections may persist throughout life. The risk of TB occurrence is relatively high during the first year following TB infection, and then progressively decreases by half within the next 4–5 years.

Only 10% of infected people with normal immune systems will develop clinically evident. TB at some point in life; Of this 10%, 5% will have an early progression of the disease (primary tuberculosis) and the remaining 5% will have a late progression of the disease (post-primary tuberculosis) after a period of initial containment.

1.8 Period of communicability:

The period of communicability persist as long as viable tuberculosis bacilli are being discharged in the sputum. Effective treatment usually eliminates communicability within 2 weeks.

1.9 PREVENTION AND CONTROL MEASURES

1.9.1 Case management

Good case management includes directly-observed therapy (DOT) during the intensive phase for all new sputum-smear positive cases, the continuation phase of Rifampicin-containing regimens and the whole of the re-treatment regimens. (Michelle *et al*, 2005).

There are three main types of treatment regimens. These treatment regimens are based according to patient categories I, II and III as described below.

The chemotherapeutic regimens are based on standardized combinations of 5 essential drugs: Rifampicin (R), Isoniazid (H), Pyrazinamide (P), Ethambutol (E) and Streptomycin (S).

Each of the standardized chemotherapeutic regimens consists of two phases:

− **Initial (intensive) phase**: 2–3 months, with 3–5 drugs given daily under direct observation.

− **Continuation phase**: 4–6 months, with 2–3 drugs given 3 times weekly under direct observation or, in some cases (e.g. during repatriation of displaced populations), 2 drugs for 6 months given daily, unsupervised, but in fixed-dose combinations.

Staff should observe all doses of Rifampicin-containing regimen and actual swallowing of medication should be checked.

Hospitalized patients should be kept in a separate ward for the first 2 weeks of treatment.

A patient who has at any time received anti-TB treatment for more than 1 month may be described as previously treated and this group of patients comprises: (Michelle *et al*, 2005).

– **Return after interruption**: common among recent refugees or IDPs.

– **Failure**: a patient who, while on treatment, remained, or became again, smear positive, 5 months or later after starting treatment; also, a patient who was smear negative before starting treatment and who became smear-positive after the second month of treatment.

– **Relapse**: a patient who has been declared cured of TB in the past by a physician after a full course of chemotherapy and who has become sputum smear-positive again.

– **Chronic**: a patient who remained, or became again, smear-positive at the end of

a fully supervised, standardized re-treatment regimen (very small number of previously treated cases).

1.9.2 HIV-positive patients

Anti-TB drug treatment is the same for HIV-positive and HIV-negative patients, with one exception being thiacetazone which should not be given to HIV-positive TB patients as there is increased risk of severe toxicity and sometimes fatal skin reactions.

Controlled clinical trial studies have shown that Isoniazid preventive treatment (IPT) reduces the risk of TB disease in HIV-positive individuals with latent TB infection (shown by a positive tuberculin skin

test).The use of IPT has shown to be more effective than other regimens for prevention of latent TB infection. (Michelle *et al*, 2005).

The decision to use IPT must be carefully evaluated, and requires first the exclusion of active TB in the patient.

To manage the problem of HIV/TB co infection effectively, TB and HIV programmes should coordinate activities through a TB/HIV coordinating body.

1.9.3 Prevention and control:

Detection and treatment of smear-positive (infectious) TB cases is the most effective preventive measure. To ensure the appropriate treatment and cure of TB patients, strict implementation of the **DOTS** strategy is important. **DOTS** is the internationally recommended strategy for TB control, and has the following components:

− Government commitment to ensuring sustained, comprehensive TB control activities.

− Case detection by sputum smear microscopy among symptomatic patients self reporting to health services.

− Standardized short-course chemotherapy using regimens of 6–8 months, with direct observation of treatment at least during the intensive phase (or for as long as Rifampicin is administered) for at least all confirmed smear-positive cases (see Case management). (Michelle *et al*, 2005).

− A regular, uninterrupted supply of all essential anti-TB drugs.

− A standardized recording and reporting system that allows assessment of follow up and treatment results for each patient and of the TB control programme's overall performance. (Michelle *et al*, 2005).

1.9.4 Complementary Control Strategies:

− Health education is important to improve awareness and reduce stigma.

− Maintaining good ventilation and reducing overcrowding in health clinics, and ensuring hospitalized patients are kept in separate wards for the first 2 weeks of treatment.

− Use of Isoniazid prophylaxis may not be recommended in refugee situations, except for children being breastfed by smear-positive mothers. If the child is well, BCG vaccination should be postponed and Isoniazid given to the child for 6 months. In the event of a sudden disruption to the programme, Isoniazid may be stopped and BCG given before the child leaves the refugee camp (preferably after a one week interval).

1.9.5 Immunization

BCG has been shown to be effective in preventing severe forms of TB such as TB meningitis and miliary TB in children. As overcrowding and malnutrition are common among many refugee and displaced populations, the risk of TB transmission to children is increased. BCG is strongly recommended for all newborn children and

any children aged up to 5 years who have not already received it. The vaccination of newborns should be incorporated into routine immunization programmes for all children. Re-vaccination is not recommended. (Michelle *et al*, 2005).

1.9.6 Health education

The key elements of community education include the following:

─ Avoiding stigmatization of TB patients.

─ Curability of TB disease.

─ Early (self) referral of TB suspects.

─ Importance of adherence to treatment.

─ Contact tracing.

The most important messages to consider may be recommended as:

• TB in an adult should be suspected when the person has a productive cough lasting more than 2 weeks, and/or blood in the sputum, with significant weight loss.

• Cover the mouth whenever coughing or sneezing to prevent the spread of lung diseases.

• Anyone may contract TB.

• TB is curable.

• Early treatment is important for best results and to prevent spread, especially to family members.

• Children are especially at risk if not treated and may develop severe, even fatal, disease.

• Good treatment is the best prevention.

• All patients must take the full course of treatment.

• Treatment makes patients non-infectious in 2 weeks, but cure takes 6–8 months.

• Treatment must be completed even though the patient may feel better sooner.

• Failure to complete the treatment may result in a recurrence that may be impossible to treat and may spread serious disease to others, especially children.

• All patients should be treated sympathetically and with respect.

• Controlling TB is a community responsibility. (Michelle *et al*, 2005).

I.2.Global Situation

About a century after Koch's discovery of the TB bacilli the tuberculosis epidemic which had appeared to be under control was again recognized as a major global health threat. The decline in the epidemic in this century had been largely through the improved living standards and, eventually, the availability and use of effective antibiotics. While tuberculosis gradually disappeared from the health agenda in the Western World it remained a big killer throughout the century. (Kochi, 1994).

According to a 1989 WHO report, 1.3 million cases and 450,000 deaths from TB in developing countries occur in children under the age of 15 years. (WHO,1989).The World Health Organization and the International Union against Tuberculosis and Lung Disease estimated in 1990 that one-third of the world's population was infected with the tubercle bacillus and that there were 7-8 million new cases of TB annually. 95% of the new cases occurred in the developing world, with more than 5 million in Asia and the Western Pacific and more than 1 million in sub-Saharan Africa. Almost 80% of TB cases in developing countries occur among those under age 50 years .The global annual mortality was estimated at 2.5 million, with 98% of deaths occurring in developing countries. Worldwide, TB is believed to be responsible for 25% of avoidable deaths in young adults (Parry, 1996).

Kochi (1991) has estimated that about one third of the worlds population or about 1.7 billion people is infected with mycobacterium tuberculosis. The great majority of world's population and thus, the

majority of infected persons reside in developing countries. In industrialized countries, 80% of infected individuals are aged 50 years or more, while in developing countries 75% of infected persons are less than 50 years old (Kochi, 1991).

In the pre chemotherapy era, mortality from TB was about 50% to 60%. Today death rate in developing countries is not as high because a significant proportion of cases are detected and treated Nevertheless, an estimated 2.7 million persons died from TB in 1992: 1.1 million in the Southeast Asian region 672,000 in the Western Pacific region, 468,000 in the African region and 426,000 in the remainder of the world .TB causes over 25% of avoidable adult deaths in the developing world (Murray *et al*,1990).

Over 8 million cases of TB occurred in 1992 and of these cases, 3.3 million were in South East Asian region, 1.9 million in the western pacific region, 1.2 million in Sub-Saharan Africa and 1.6million including 199.000 cases in industrialized countries were in the remainder of the world. TB has a devastating effect in the developing world where 955 of cases occur and Eighty percent of these cases occur in persons who are in their reproductive years (ages 15to 59) ((WHO, 1989).

Tuberculosis incidence rates were highest in the WHO African Region (290/100 000 per year; range, 265/100 000-331/100 000), as was the annual rate of increase in the number of cases (6%). Nine percent (7%-12%) of all new TB cases in adults (aged 15-49 years) were attributable to HIV infection, but the proportion was much greater in the

African Region (31%) and some industrialized countries, notably the United States (26%). There were an estimated 1.8 million (5th-95th centiles, 1.6-2.2 million) deaths from TB, of which 12% (226 000) were attributable to HIV. Tuberculosis was the cause of 11% of all adult AIDS deaths. (Elizabeth *et al*, 2003).

The prevalence of M. tuberculosis–HIV co- infection in adults was 0.36% (11 million people). Co-infection prevalence rates equaled or exceeded 5% in 8 African countries. In South Africa alone there were 2 million co-infected adults. (Elizabeth *et al*, 2003)

Tuberculosis (TB) has long been under control in developed countries. However, the stability of this comfortable position eroded (Britton *et al*, 1993). More than 7 million people are affected by active TB in developing countries where poor infrastructure thwarts control efforts and TB interacts with HIV infection. TB is highly prevalent in the tropics not because it is a tropical disease, but because it is an opportunistic disease of poverty, overcrowding, and malnutrition which are seen in higher incidence in tropical countries with relatively newly exposed populations and countries where health infrastructure is hindered by economic disadvantages and political instability.(Britton, 1993)

Figures (1.1),(1.2),(1.3) showed frequencies calculated in 2005 respectively about estimated Numbers of new TB cases, estimated TB incidence rate and estimated HIV prevalence in new TB cases.

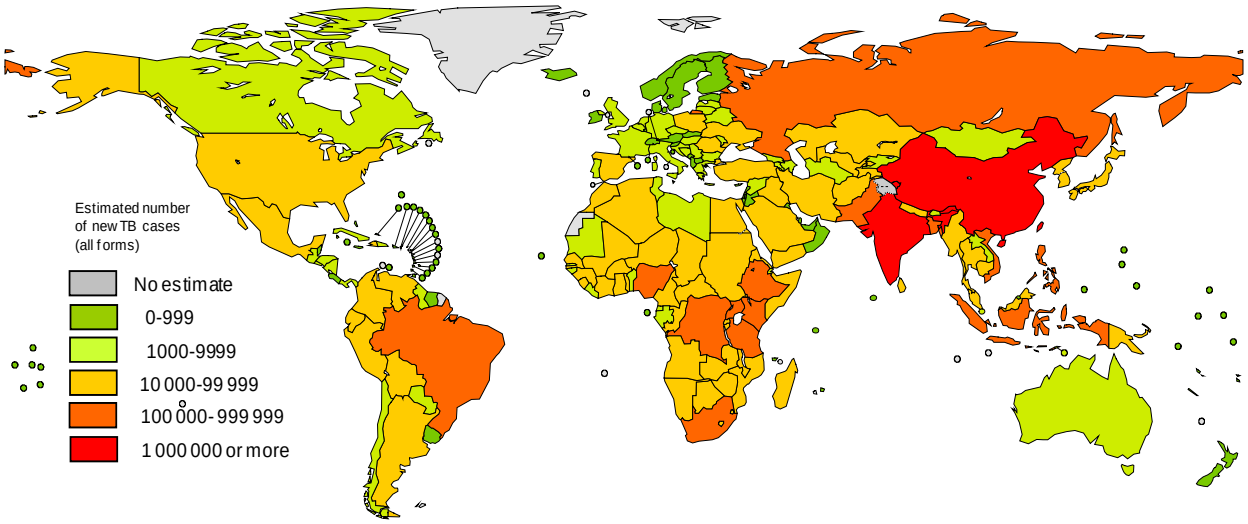


Figure (1.1) :**Estimated numbers of new cases, 2005**

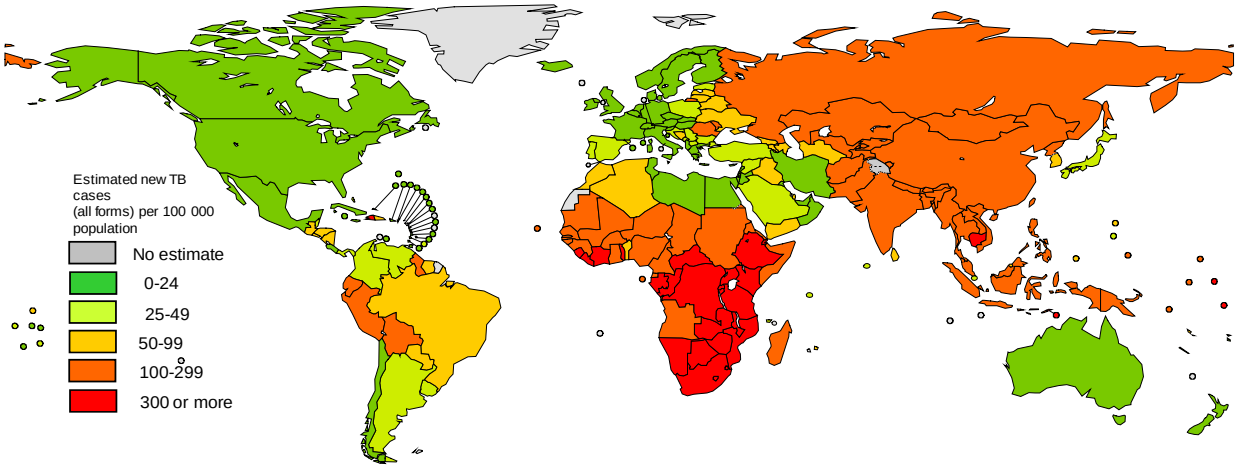


Figure (1.2): **Estimated TB incidence rate,2005**

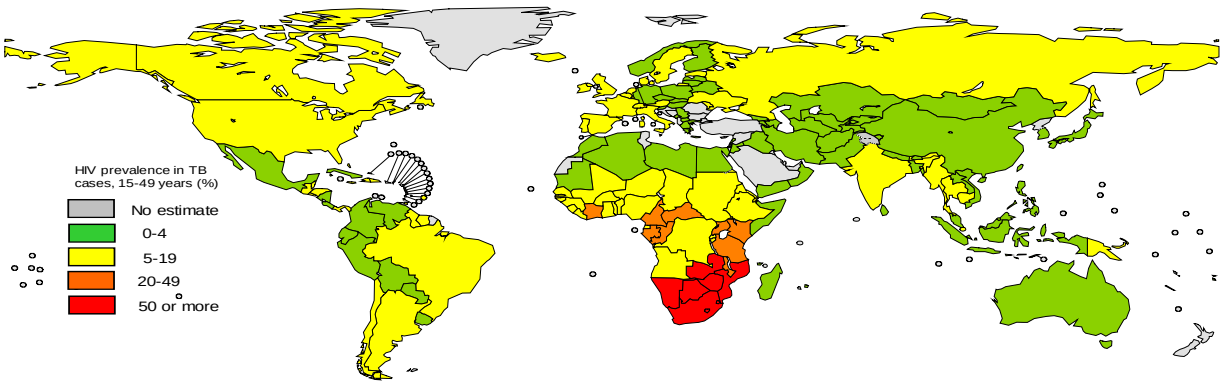


Figure (1.3): **Estimated HIV prevalence in new TB cases, 2005**

1.3. Situation in Sudan

Tuberculosis remains to be one of the main public health problems in Sudan. This vast country (one million square miles) with its meager resources, underdeveloped health infrastructure and civil war since 1955 has many hurdles in the way to achieve WHO standards of 70% case detection and cure rate of 85%. The best indicator of the extent of the tuberculosis in Sudan is the average annual risk of infection (ARI). A tuberculin survey was conducted in 1976 and then again in 1986 in children 0-14 years old. An ARI of 1.8% corresponding to 90 per 100000 cases of smear positive TB was recorded. The estimated average incidence of all forms of TB is 180 per 100000 and in a population of 24 400 000 in 1987 the total new cases were estimated to be 43 000. These figures lead to detection rate coverage of 38.7% due to the very low reporting of cases from war zones in Southern Sudan. (Hatim, 2001).

In surveys conducted in1932 in different areas in the Sudan the highest infection rate of 3.4 % was registered in Dongla (MOH, 1965). Careful tuberculin surveys were conducted among Southern tribes in period 1928-1932, prevalence was found to be 0.2/1000 in Upper Nile and it was observed that the disease was nowhere common than among the Shulluk who were more settled and in contact with Northern Sudan. (Bayomi, 1979). In the period (1945-1981) children represented less than 2% of hospital admission due to TB. This figure rose to 12% in the period (1949-1954) (MOH,1965). From (1971-1979) 1453 children with TB were reported in Khartoum hospital (MOH report, 1971-87).

With outbreak of the Second World War (1940) there was reason to expect an increase in the incidence of TB as a result of unsettled condition and lack of food particularly in the Eastern Sudan following the temporal Italian occupation. Moreover the disease appeared more commonly in Eritrea and Ethiopia, which then had more contact with Sudan than before the war. During the period of war Sudan witnessed a collapse of the country's economy and hence a reduction in personal income. In 1949 specialized unit for TB was established in the ministry of health. In 1950 a pilot tuberculosis TB program started in Khartoum. An advisor in TB from WHO Eastern Mediterranean region visited Sudan in 1953 to arrange for pilot project for mantoux testing and BCG vaccination. The project started in March 1954 and showed that 50% of population under 25 years of age was Mantoux negative. By 1954, tuberculin survey was carried out by Haseeb (1954) in Khartoum province. Among urban population, 21.9-24.4% became infected by the age of 10 years and 36.2- 44.4% by the age of 20 years compared to 34.4% by the age of 10 years and 69% by the age of 20 in rural area. (Bayomi, 1979).

In 1980 TB cases increased due to the impact of civilization, accompanied by social changes, the mixing of population, the effect of civil war and the influx of refugees with a lot of TB cases. Among 6250 refugees in Sudan TB prevalence was found to be 3%, which was at least 2 times higher than prevalence reported in rural areas in Africa (Toscani, 1988). In 1990 TB was the cause of admission of 91 cases and 3.7% of the hospital deaths in Northern states hospitals. (MOH, 1990). HIV prevalence among TB patients was more than 10% in Southern Sudan

and negligible in Northern Sudan. (Mccarthy *et al*, 1995). Altigani, A. (1995) found it to be 19% in Juba. In 1999 Sudan National TB programme (NTP) reported that cure rate of 72%, detection rate of 44% and conversion rate of 91% have been achieved.

Diab,(1999) sampled 397 household contact children of smear positive tuberculous patients aged from 3 months to 6 years. These were screened with Mantoux test and structured questionnaires were administered to the adults patients as well as to the parents of household contact children whenever, it was possible. 9.3% were from poor families, 44.4% of males and 48.3% of females were infected. The mean age of infected and non infected was 3.25 and 3.15 years respectively. The infection rate was higher among children of tuberculous mothers (53.3%) than among contacts of fathers (41.2%) and 40.4% among contacts of other relatives (sisters, brothers).

A/mageid,(2001) on his descriptive community based study sampled 465 by stratified multistage cluster sampling. The results obtained explored broadly the presence of essential critical factors that may enhance the occurrence and the spread of TB. Briefly those included poor socioeconomic status particularly with regard to income and educational level, low community awareness toward different TB aspects such as the route of transmission, highly exposed and susceptible groups to TB infection, carrier stage, length of time needed for the disappearance of TB signs and symptoms, and for completion of treatment after anti TB drugs ……etc. Unhealthy practices such as tobacco smoking, drinking raw milk, living in ill ventilated and over crowded rooms, use of traditional medicines and environmental factors, such as poor natural

ventilation and absence of artificial ventilation, over crowding and poor health services intended in the area.

Amir,(2004) stated that TB appears to be the disease of poor although it can catch every one. The most age group affected is the productive one (60.2%). Males were significantly more affected, specially the hard labor workers of the lower social class. TB is negatively related to education especially to health education. TB hiders the activity of the patient and this extends to the family (co-patient). TB was positively related to the large size of the family and negatively to the number of the house rooms.

Tuberculosis is a major cause of morbidity and mortality in Southern Sudan. In 2004, TB incidence was estimated to be 220 per 100,000 people countrywide, and in Southern Sudan, the national tuberculosis program (NTP) reported a total of 2,539 cases of which 1,064 were sputum smear-positive (SS+) TB, the infectious type of TB. Although the exact incidence of HIV/AIDS among TB cases is not known, HIV prevalence appears to be on the rise. Data from limited population surveys show HIV prevalence rates, ranging between one and eight percent among the general population, with higher rates found among those living in border towns to neighboring countries. It is estimated that between 15 and 20 percent of all TB patients in Southern Sudan are infected with HIV. This amounts to nearly 4,040 TB patients already living with the disease. (WHO,2006). In Kassala state the registered smear positive cases for TB were 312 cases for the year 2006, 357 in 2007 and 251 for the first six month of the year 2008 (NTP,2008)

Chapter Two

Materials and Methods

2.1 Study Area:-

Kassala State, one of the Eastern States of Sudan extends between latitudes (14-45) (15-17) North and longitudes (34-40) and 37 East. The State has an area of 42282 square kilometers and shares borders with Eritrea in the East, Red Sea State in the North, River Nile and Khartoum States in the Northern West and Gedarif State in the West .The State is composed of eleven localities.

2.2 Study Population:-

The total population of Kassala State is about 1,768,603 and comprises of Hadandawa , Bani Amer , Amarar , Bishareen and Halanga tribes. These tribes coexist with people from Northern Sudan and Falata tribes who are of West African origin. The study population are those who visited Kassala Teaching Hospital TB Centre as out patients from these tribes.

2.3 Study Design:

Cross Sectional study, based on the number of hospital admissions, who have been recorded on visits and diagnosed as TB positive. Information was collected on host related factors, socio-economic status, environmental factors, behavioral factors, contact and co infection with HIV.

2.4 Criteria for selection:

New cases with smear positive pulmonary Tuberculosis who visited Tuberculosis Medical Units (TBMUs) in kassala Teaching Hospital from April to July 2008

2.5 Sample size:

A convenient sample of 57 people was selected for this study.

2.6 Study Tools:

Structured questionnaire.

2.7 Ethical Consideration:

Before administration of the questionnaire, the Ministry of Health was approached for guidelines on observance of patient's privacy and ethical values. This was provided and the Ministry actually undertook supervision of all activities of the research and all subjects included in this study gave informed consent.

2.8 Technique:-

Using criteria mentioned above, TBMUs in kassala Teaching Hospital were enrolled in the study. Health workers and HIV councillors were briefed about the purpose of the study.

Then questionnaire and HIV test results were filled in for all patients selected for this study.

Collected information (data) was computerised, and analysis was performed, using SPSS software programme.

Chapter three

Results

3.1 The respondents questionnaire information:

(see appendix 1 for the questionnaire given to the respondents)

3.2 Results of analysis of patient's information on risk factors associated with tuberculosis:

3.2.1 Study Population:

Results showed different tribes among respondents (Table 3.1). The most dominant tribe was Bani Amir (35.1%)

3.2.2 Host related Factors

3.2.2.1 Age:

Results revealed that 31.6% of the study population was at age group 30-39 years old (Table 3.2).

3.2.2.2 Gender:

The majority of the respondents (63.2%) were males while the rest (36.8%) were females (Table 3.3).

3.2.2.3 Marital Status:

The distribution of this group was almost equal between married (47.4%) and single (40.4%) (Table3.4).

3.2.3 Socio-economic Factors

3.2.3.1 Education:

Most of the target population (47.4%) were illiterate (Table 3.5).

3.2.3.2 Occupation:

82.5% of the study population were unemployed (Table 3.6).

3.2.3.3 Monthly Income:

82.5% of the respondents had no monthly income (Table 3.7), probably as a result of unemployment.

3.2.4 Environmental Factors

3.2.4.1 Type of Residence:

Results illustrate that 36.8% of target group lived in huts, 28.1% in mud houses ,19.3 in tents and 15.8% in bricks-built houses (Table 3.8).

3.2.4.2 Family Size:

47.4% of respondents had a family size arranging between 5-10 members in a house (Table 3.9).

Table(3.1):Distribution of study population by tribes.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hadandawa	15	26.3	26.3	26.3
	Western Tribes	16	28.1	28.1	54.4
	Bani Amir	20	35.1	35.1	89.5
	Shukria	1	1.8	1.8	91.2
	Northern Tribes	2	3.5	3.5	94.7
	Halenga	1	1.8	1.8	96.5
	Rashaida	2	3.5	3.5	100.0
	Total	57	100.0	100.0	

Table (3.2): Age distribution among study group.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 20	2	3.5	3.5	3.5
	20 - 29	14	24.6	24.6	28.1
	30 - 39	18	31.6	31.6	59.6
	40 - 49	17	29.8	29.8	89.5
	50 - 59	4	7.0	7.0	96.5
	60 and more	2	3.5	3.5	100.0
	Total	57	100.0	100.0	

Table (3.3): The Distribution of the Target Group according to their gender.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	36	63.2	63.2	63.2
	Female	21	36.8	36.8	100.0
	Total	57	100.0	100.0	

Table (3.4): The Marital Status of the Respondents.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	23	40.4	40.4	40.4
	Married	27	47.4	47.4	87.7
	Divorced	4	7.0	7.0	94.7
	Widowed	3	5.3	5.3	100.0
	Total	57	100.0	100.0	

Table (3.5): Educational Level of the Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Illiterate	27	47.4	47.4	47.4
	Khalwa	13	22.8	22.8	70.2
	Primary	13	22.8	22.8	93.0
	Secondary	4	7.0	7.0	100.0
	Total	57	100.0	100.0	

Table (3.6): The Occupation of the Target Group.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed	10	17.5	17.5	17.5
	Unemployed	47	82.5	82.5	100.0
	Total	57	100.0	100.0	

Table (3.7): The Monthly Income of the Respondents.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	47	82.5	82.5	82.5
	Less than 150 SDG	2	3.5	3.5	86.0
	150 - 200 SDG	4	7.0	7.0	93.0
	251 - 300 SDG	2	3.5	3.5	96.5
	301 - 350 SDG	1	1.8	1.8	98.2
	More than 350 SDG	1	1.8	1.8	100.0
	Total	57	100.0	100.0	

Table (3.8): Type of Residence of the Study Population.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mud	16	28.1	28.1	28.1
	Bricks	9	15.8	15.8	43.9
	Hut	21	36.8	36.8	80.7
	Tent	11	19.3	19.3	100.0
	Total	57	100.0	100.0	

3.2.5 Behavioral Factors

3.2.5.1 Smoking:

82.5% of the study population do not practice smoking and 17.5% were smokers (Table 3.10).

3.2.5.2Drinking Raw Milk:

56.1% of study group did not drinking raw milk , while 43.9% usually drank raw milk (Table 3.11).

3.2.6 Family Members with Chronic Cough:

77.2% of the respondents had no contact with any one who ever experienced chronic cough, while 22.8% had households with chronic cough (Table3.12).

3.2.7 TB/HIV Co-infection:

21.1% of respondents had co- infection TB/HIV, while 78.9% showed negative results Table (3.14).

Table (3.9): The Distribution of the Study Group according to their family size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 - 5	20	35.1	35.1	35.1
	5 - 10	27	47.4	47.4	82.5
	More than 1	10	17.5	17.5	100.0
	Total	57	100.0	100.0	

Table (3.10): Smoking Among The Study Population

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	10	17.5	17.5	17.5
	No	47	82.5	82.5	100.0
	Total	57	100.0	100.0	

Table (3.11): The Percentage of Those who Drunk Raw Milk among Target Group.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	25	43.9	43.9	43.9
	No	32	56.1	56.1	100.0
	Total	57	100.0	100.0	

Table (3.12): Exposure to Those with a History of Chronic Cough.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	13	22.8	22.8	22.8
	No	44	77.2	77.2	100.0
	Total	57	100.0	100.0	

Table (3.13): The prevalence of HIV/AIDS among study group.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Positive	12	21.1	21.1	21.1
	Negative	45	78.9	78.9	100.0
	Total	57	100.0	100.0	

3.3 Association between HIV test result and other risk factors:

3.3.1 Association with Age:

Results illustrate that sexually active group (those aged 30-39 and 40-49 years old) had the highest frequency among HIV positive cases (Figure 3.1).

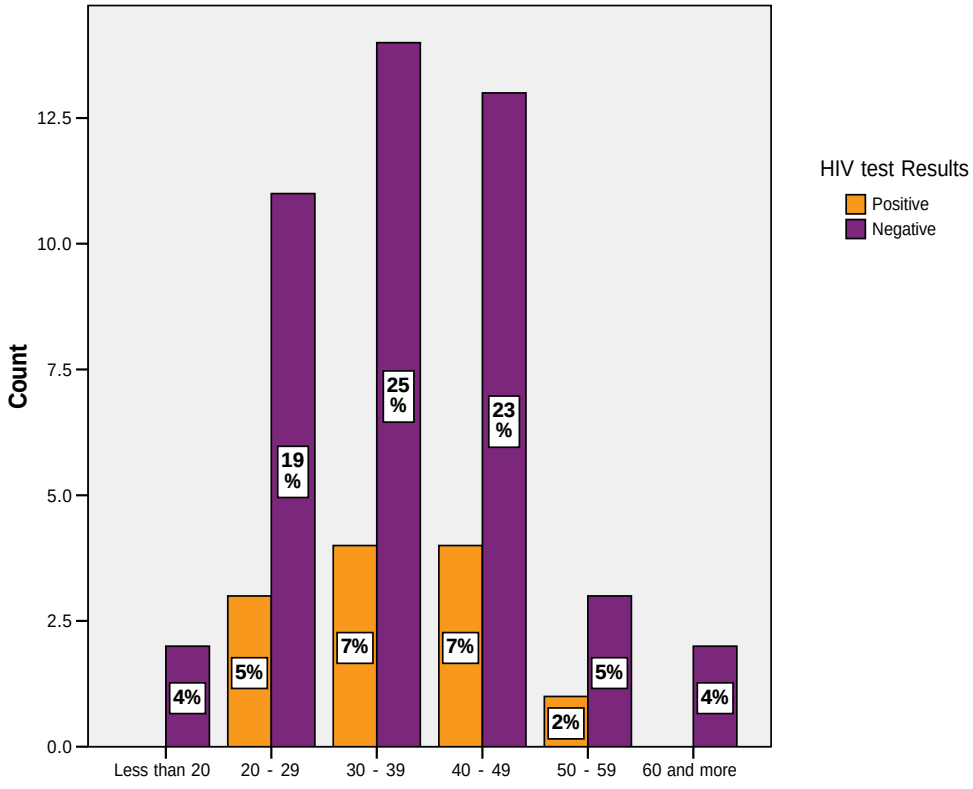


Figure (3.1) The association between age and HIV test results

3.3.2 Distribution of HIV among males and females:

Figure (3.2) Showed the frequency of HIV positive cases in males and females.

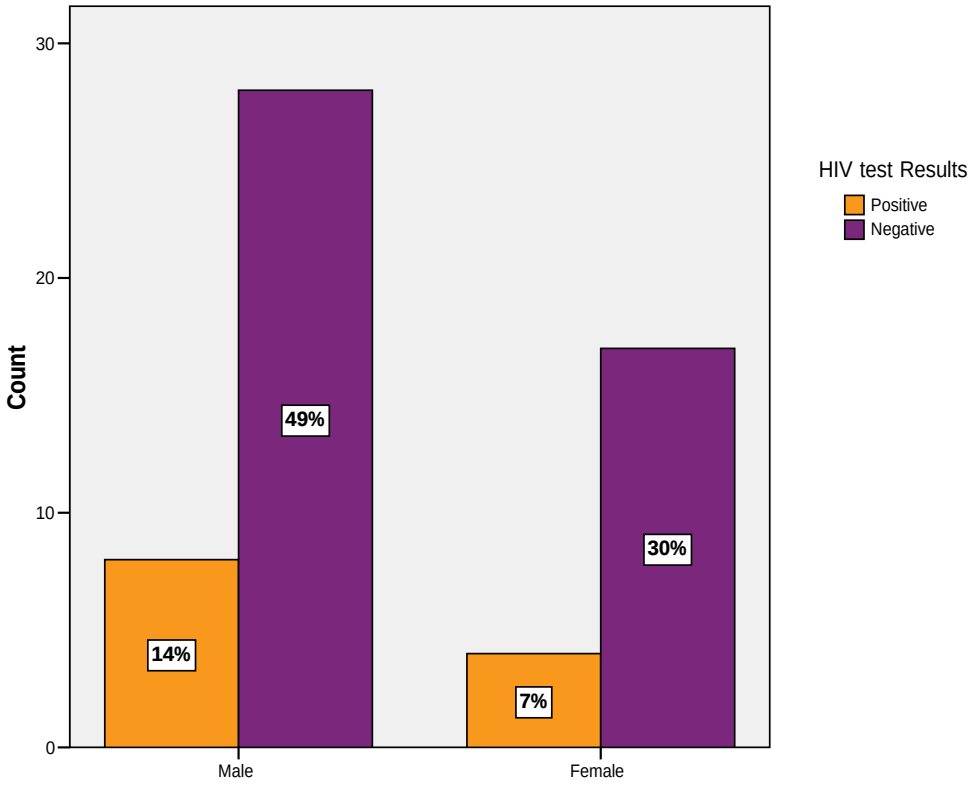
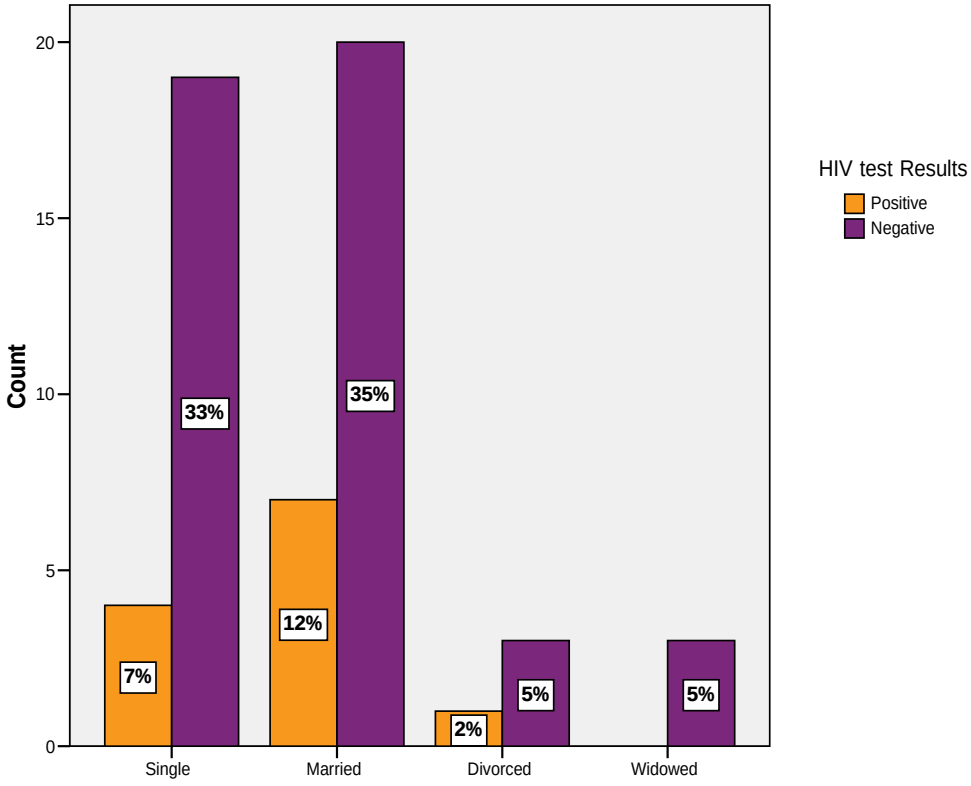


Figure (3.2) Distribution of cases tested for HIV according to their gender

3.3.3 Marital status

Figure (3.3) The frequency of HIV positive cases among married patients was higher than that among singles.



Figure(3.3) The marital status of those tasted for HIV

3.3.4 Level of Education:

As shown in Figure (3.4) the majority of respondents were between illiterate.

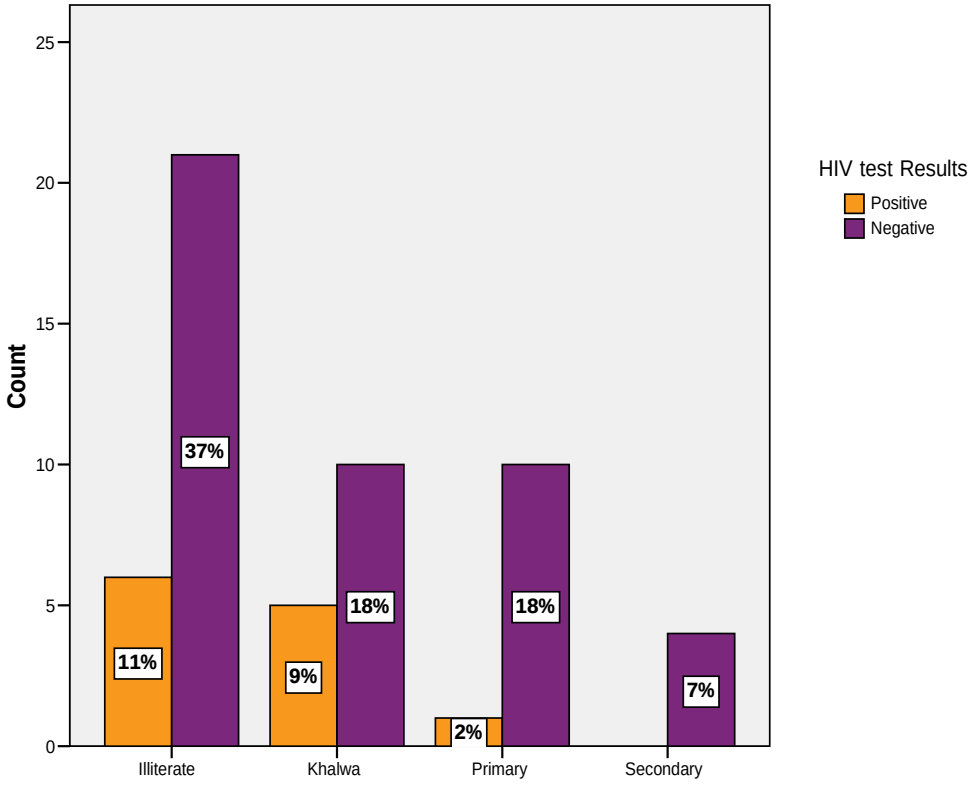
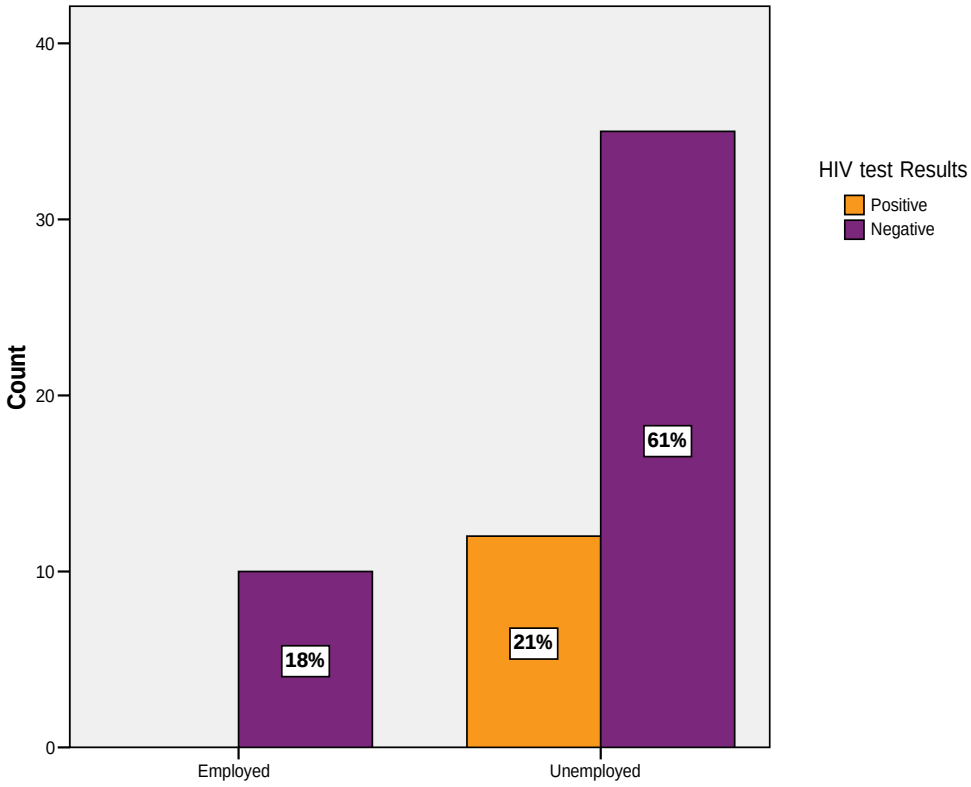


Figure (3.4) Association between HIV test results and educational level

3.3.5 Occupation:

Results revealed that all respondents who tested HIV positive were unemployed (Figure3.5).



Figure(3.5) Association between occupation and HIV test results

3.3.6 Monthly income:

As shown in figure (3.6) all of HIV positive cases had no monthly income.

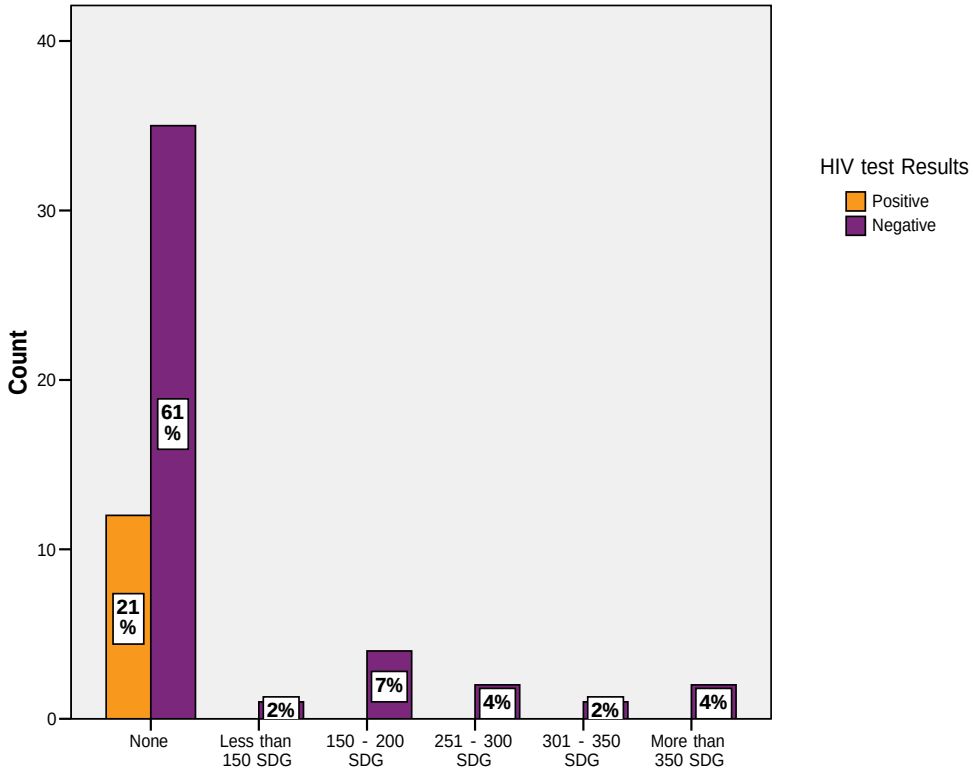


Figure (3.6) The monthly income among those who tested HIV-positive

Chapter Four

Discussion

4.1 Discussion

This descriptive hospital based study of host and environmental risk factors for TB was carried out in those attending the TBMUs in Kassala teaching hospital.

Among the study population ,Bani Amir was the dominant tribe (35.1%) among other tribes and that may suggest they were the most affected by TB and therefore sought medical care.

The study revealed that the majority of the study population was at age group 30-39 years old and this result is supported by Crompton, (1995) who reported that "Tuberculosis was considered a disease of middle aged and eldery population ".

The findings showed that TB is associated with male sex. This agrees with the findings of Holmes *et al* (1998) and Borgdorff *et al* (2000), who respectively, stated that "globally, the prevalence of infection with mycobacterium tuberculosis is similar in males and females, until adolescence, after which it is higher in males" and "TB is ‘more a disease of men than of women". Also males are more exposed by nature of their work and easy access to health centers because of their daily visit to the centre than females.

Most of the respondents were either single or married and the later showed a high risk of contact with other family members, leading to increased infectivity (see Table 3.4).

Similarly the majority of the respondents was either illiterate or had few years of education and so lacked the potential for education, to empower them break the cycle of poverty and human misery. This low level of education because of their rural based where educational opportunities are not available which affect negatively on the awareness of the respondents with respect to the sound knowledge about TB, especially TB mode of transmission, treatment and prevention. This fact complying with Lacopino *et al* (1998) who considered that "education enables individual to make informed choices regarding health practices, access to health care services, interaction with health personnel and participation in the treatment regimens"

Most of the target group was unemployed and without or with low incomes compared to the real daily life cost. This situation deprived them of the perceived needs with good quality such as food, housing, education, healthcare…etc. This finding agree with Logie (1998) statement "poverty, in both absolute and relative forms, is the single most important drivers of ill health in the world and it is hardly surprising in developing countries". WHO 2000 pointed that "from 1985 to1992, the average rate of TB cases in the world was nearly eight times higher in areas with lowest household income than areas with highest household income. The possible reasons for this were: overcrowding, inadequate living conditions, malnutrition and poor access to health care".

Also most of the respondents were living in Huts and Mud houses which lack the criteria of standard housing because they are enclosed, dirty and dark spaces with in-adequate local or general ventilation. Those places, full of dust where TB bacilli can survive for along time that results in increased possibility of developing a disease.

The majority of those interviewed had a large family size, greater than five, living in small houses especially, those from rural areas which definitely increase the possibility of disease transmission due to overcrowding .Park (1997) concieved that overcrowding may promote the spread of respiratory infections such as tuberculosis, influenza and diphtheria.

On the other hand there was no association between smoking and TB among respondents in contrast to that stated by Ramin *et al* (2008) where Smoking was reported to increase the risk of TB in Africa and to that of Wang *et al* (2007) who stated that smoking is significantly associated with pulmonary tuberculosis.

Most of the respondents had no history of exposure to those who had experienced chronic cough although close contacts with infectious patients is a serious source of infection as reported by Citron (1989) who estimated that one undiagnosed, smear positive case of pulmonary TB infects about 10 persons during one year.

Drinking raw milk was not attributable to TB among those in the study. Citron (1989) and Grange (1997) findings showed respectively that raw milk was an important source of bovine infection to man and

tuberculosis due to M.bovis may be acquired by direct or indirect exposure to infected cattle, but the main source is usually infected milk. However the study does not agree with their findings and this is due to good knowledge among respondents about the importance of boiling milk.

The proportion of HIV positive- TB patients among the study group is high, which reflects the impact of HIV on TB infectivity. This agrees with findings of Elizabeth *et al* (2003)who reported that Nine percent (7%-12%) of all new TB cases in adults (aged 15-49 years) were attributable to HIV infection, but the proportion was much greater in the WHO African Region (31%) and some industrialized countries, notably the United States (26%). There were an estimated 1.8 million (5th-95th centiles, 1.6-2.2 million) deaths from TB, of which 12% (226 000) were attributable to HIV. Tuberculosis was the cause of 11% of all adult AIDS deaths. The prevalence of M tuberculosis–HIV co infection in adults was 0.36% (11 million people). Co infection prevalence rates equaled or exceeded 5% in 8 African countries. In South Africa alone there were 2 million co infected adults".

The study revealed that the sexually active group (30-39) showed high frequency of HIV positive cases.

Males showed higher frequency than females among HIV positive cases and these results indicate they are poverty stricken group and therefore more exposed, in addition to their sexual practices.

Meanwhile the study showed that the risk of HIV did not differ significantly among married and unmarried groups but higher in married groups who are supposed to be more stable. However these results showed lack of awareness concerning safe-sex. Also the relationship between HIV and marital status is complex and depends on various sex behavior practices.

As per study results the majority of respondents were illiterate. So they lack awareness about disease transmission and prevention methods in order to protect themselves which can be fulfilled by Education .The World Bank document stated that "Education is a proven means to prevent HIV/AIDS.

Results showed high frequency of those unemployed and without incomes among HIV positive cases. So, poverty occur and indicates poor health status, low labor productivity and low levels of literacy which increase the problems of reaching these populations through programmes aimed at changing sexual and other behaviors.

4.2 Conclusions

The study showed that Tuberculosis and HIV/ AIDS are taking place as important diseases in study area. Unless appropriate action is taken TB incidence will double as the prevalence of HIV reaches higher percentages. Also the study indicates that low level of literacy, low labor production and very poor health status are increasing the problems of reaching these populations with programmes aimed at changing sexual and other behavior characteristics.

To manage the problem of HIV/TB co infection effectively, TB and HIV programmes should coordinate activities through a TB/HIV coordinating body.

4.3 Recommendations

- Adult education for those particularly, passed the stage of school age for raising their awareness is of high significance

- Ways to avoid overcrowding in urban settings should be sought

- HIV counseling and testing must be widely available to TB patients

- Increased prevention strategies that take socio-cultural context into account are needed for married people.

- Information about the risks of tuberculosis in younger women should be incorporated into maternal health and HIV/AIDS programmes.

- Health education of patients and screening and follow up of contact children are recommended.

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4.5 Appendices

Appendix 1: **Patients Questionnaire to Identify Tuberculosis Risk Factors**

Case No ( ) Date: / / 2008

Age:_____ Tribe:_____

Sex: Male ( ) Female ( )

Marital Status:

Single ( ) Married ( ) Divorced ( ) Widow ( )

Education:

None ( ) Khalwa ( ) Primary ( ) Secondary ( ) Higher ( )

Occupation: Employed ( ) Unemployed ( )

Monthly income: _____

Type of residence:

Mud ( ) Bricks ( ) Hut ( ) Tent ( )

How many members in your house?

Two-Five ( ) Five-Ten ( ) More than Ten ( )

Do you smoke?

Yes ( ) No ( )

Has anyone in your household experienced chronic cough?

Yes ( ) No ( )

Do you drink raw milk?

Yes ( ) No ( )

HIV test result:

Positive ( ) Negative ( )