Socio Demographic Analysis of the Tuberculosis Patients Associated with Anaemia

SUBMITTED BY

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In the name of ALLAH

The most Gracious

The most Merciful

CERTIFICATE

This is to certify that the thesis "Socio Demographic Analysis of the Tuberculosis Patients Associated with Anaemia" submitted to the Department of Pharmacy, East West University, Mohakhali, Dhaka in partial fulfillment of the requirement for the degree of Bachelor of Pharmacy was carried out by Rupak Rouf ID-2008-1-70-062.

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CERTIFICATE

This is to certify that the thesis "Socio Demographic Analysis of the Tuberculosis Patients Associated with Anaemia" submitted to the Department of Pharmacy, East West University, Mohakhali, Dhaka in partial fulfillment of the requirement for the degree of Bachelor of Pharmacy was carried out by Rupak Rouf ID-2008-1-70-062 under our guidance and supervision and that no part of the thesis has been submitted for any other degree. We further certify that all the sources of information, laboratory facilities availed of this connection is dully acknowledged.

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Acronyms

AIDS- Acquired Immune Deficiency Syndrome

BMI - Body Mass Index

CBC- Complete Blood Count

DOT- Directly Observed Treatment

Fe- Iron

FEP- Erythrocyte protoporphyrin

Hb- Haemoglobin

HIV- Human Immunodeficiency Virus

ICH- Institute for Child Health

IDA- Iron Deficiency Anaemia

MCH- Mean Corpuscular Hemoglobin

MCV- Mean Cell Volume

MCHC- Mean Corpuscular Hemoglobin Concentration

MDR - Multi-Drug Resistant

MDR-TB- Multidrug-resistant Tuberculosis

MTB- Mycobacterium Tuberculosis

NIDCH- National Institute of Diseases of the Chest and Hospital

NTCP- National TB Control Program

NTM- Non Tuberculous Mycobacteria

PHAC- Public Health Agency of Canada

RBCs- Red Blood Cells

RDW- Red Cell Distribution Width

TfR- Serum transferrin receptor concentration

TB – Tuberculosis

UNICEF- United Nations International Children's Emergency Fund

USAID - United States Agency for International Development

WHO - World Health Organization

XDR - Extensively Drug Resistant

Abstract

Bangladesh is one of the endemic region of Tuberculosis and Anaemia is a common complication of pulmonary tuberculosis. Environmental factors such as lacking of health hygienic, poor sanitation, water, food habits, living area, malnutrition, lack of medical care etc. are mainly associated with anaemia in TB. The major objective of this study was to determine different risk factors that are associated with Anaemia in Tuberculosis patients. The study was done at the general ward in National Institute of Diseases of the Chest and Hospital (NIDCH), Mohakhali, Dhaka, Bangladesh. In this study 32 cases of TB patients were taken from the pulmonary TB patients who were infected or suspected to be infected by *Mycobacterium tuberculosis*. A structured questionnaire was used for data collection and blood sample were collected from them. This study gives the brief description of the demographic data of the studied patients including their age, sex, religion, living condition and area, working place, coughing condition, smoking condition and their height and weight. It was found that among the patients 65% were male and 35% were female, indicating that male patients were more prone to the disease than female patients. Majority of the patients belonged to the age group of 18-28 years (75%), followed by 29-39 years (67%), and ≥ 40 years (35%). About 78% were unmarried and widowed and 79% were married. The study also shows that among the 23 patients 67% were uneducated/others and among the educated patients there where 44% people have education level between class 1-5, 67% between class 6-10 and 9% between class 10-Higher educations. The data indicates that among the patients there are 95% day labour, 82% employed, 75% bussinessmen & others and 50% housewife & unemployed. 79% have their monthly expenditure between 2500-15000 Tk. and 75% have between 2500-9000 Tk. Among them 83% live in Village, 78% in city, 67% in rural area and 100% in the slum area. Among studied tuberculosis patients 60% people have never smoked, 87% are currently smoking and 80% have smoked before & occasionally. The study also shows the coughing condition of the patients where 80% people have coughing problem before getting tuberculosis infection, 75% people don't. In the study 89% people are new smear positive, 50% people are new smear negative and 87% of people are relapse case and are infected because of previous treatment failure. The result of the study showed that different factors are also associated with anaemia in tuberculosis along with the major cause.

CHAPTER- 1

INTRODUCTION

1 Introduction:

Tuberculosis (TB) is the world's second most common cause of death from infectious disease, after HIV/AIDS. There were an estimated 8.3 million new cases of TB in 2000 and 1.8 million deaths from TB were reported in the same year. Moreover, TB was the cause of 11% of all adult AIDS deaths (Lee et al, 2006).

TB can cause diverse laboratory abnormalities such as anemia, increased erythrocyte sedimentation rate, low serum albumin level, hyponatremia, abnormal liver function, leukocytosis, and hypocalcaemia. A number of studies have documented anemia in patients with TB, however, these studies involved only small numbers of patients and the results were not uniform. Moreover, there has been no study on the evolution of TB-associated anemia after establishment of short-term combination anti-TB chemotherapy in the 1980s. In this context, we attempted to characterize TB-associated anemia by clarifying its prevalence, characteristics, and evolution with anti-TB treatment involving large numbers of patients (Lee et al, 2006).

Fe-deficiency anaemia is the most common cause of anaemia in developing countries. In these settings, many chronic infections, including tuberculosis (TB), are highly prevalent. Fe is an essential nutrient for both host and mycobacteria that play a pivotal role in host immunity and mycobacterial growth (Sahiratmadja et al, 2007).

Fe-deficiency anaemia has been reported in many developing countries. In these countries many chronic infectious diseases are present at high rates, including pulmonary TB. The prevalence of anaemia in our healthy control group, living in a poor and TB-endemic area, was surprisingly low (6·7 %), females being more affected than males. In the present study children aged less than 15 years and pregnant women, individuals at high risk of anaemia, were not included. Like others we observed that in developing countries Fe deficiency is becoming a less important cause of anaemia compared with infection (Sahiratmadja et al, 2007).

Both Fe deficiency and anaemia of chronic inflammation may coexist in patients with pulmonary tuberculosis, especially in developing countries. Anaemia of chronic inflammation has several features in common with Fe-deficiency anaemia, thus confusing the aetiological diagnosis. Raised erythrocyte volume distribution width, a hallmark of Fe-deficiency anaemia, is also observed in anaemic tuberculosis patients. Other characteristic laboratory findings of Fe-

deficiency anaemia, such as low Fe and transferrin saturation in blood and hypochromic and microcytic erythrocytes, are all seen in anaemia of inflammation. It is, therefore, difficult to establish the exact mechanism of associated anaemia in pulmonary tuberculosis patients with the routine investigations undertaken for diagnosis of anaemia (Devi et al, 2003).

Inflammation appears to be a major contributor to anaemia associated with pulmonary tuberculosis. Fe and other haematinic supplements can initiate an initial improvement in some haematological indices, but ultimate recovery from anaemia occurs only with recovery from the pulmonary tuberculosis (Devi et al, 2003).

It is well known that most patients with active pulmonary TB have anaemia, but the precise mechanism remains unclear. Blood loss in the sputum (haemoptysis) has been mentioned in textbooks as one of the causes. However, original studies were never performed and haemoptysis was not associated with anaemia in the present study population. Furthermore, deficiencies of Fe and other nutrients, caused by loss of appetite and fever, are associated with a low BMI (Sahiratmadja et al, 2007).

1.1 Tuberculosis:

Tuberculosis, or TB, is an infectious bacterial disease caused by Mycobacterium tuberculosis, which most commonly affects the lungs. It is transmitted from person to person via droplets from the throat and lungs of people with the active respiratory disease. In healthy people, infection with Mycobacterium tuberculosis often causes no symptoms, since the person's immune system acts to "wall off" the bacteria. The symptoms of active TB of the lung are coughing, sometimes with sputum or blood, chest pains, weakness, weight loss, fever and night sweats. Tuberculosis is treatable with a six-month course of antibiotics (Kumar et al, 2007).

Tuberculosis, MTB or TB is a common and in some cases deadly infectious disease caused by various strains of mycobacteria, usually *Mycobacterium tuberculosis* in humans. Tuberculosis usually attacks the lungs but can also affect other parts of the body. Most infections in humans result in an asymptomatic, latent infection, and about one in ten latent infections eventually progresses to active disease, which, if left untreated, kills more than 50% of its victims

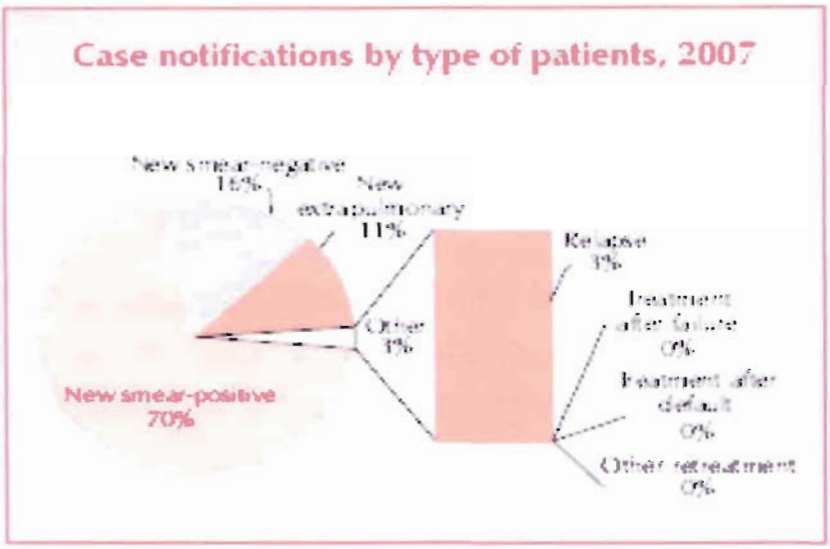


Figure1: Case notifications by type of TB patients according to WHO, 2007

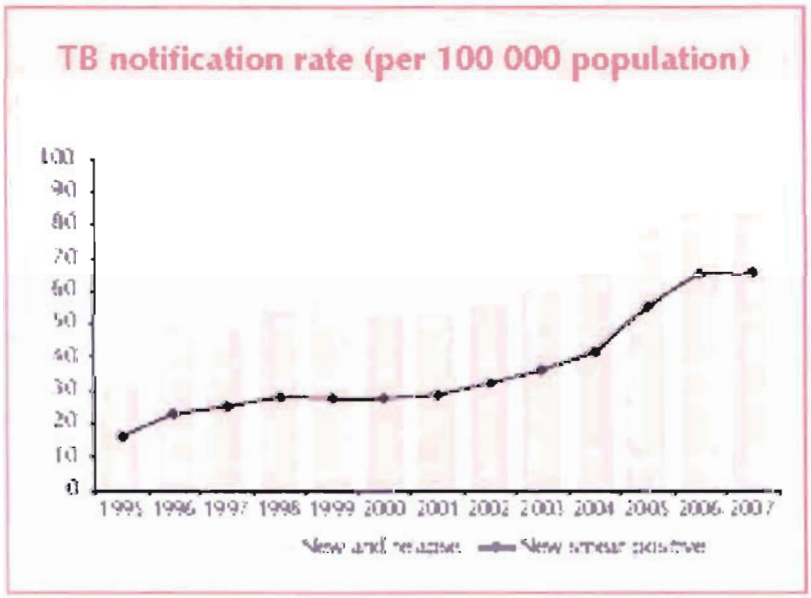


Figure 2: TB Notification rate (per 1,00,000 population) according to WHO, 2007

1.1.1 Causes of TB:

The cause of TB, *Mycobacterium tuberculosis* (MTB), is a small aerobic non-motile bacillus. High lipid content of this pathogen accounts for many of its unique clinical characteristics. The M. tuberculosis complex includes four other TB-causing mycobacteria:

- *M. africanum* is not widespread, but in parts of Africa it is a significant cause of tuberculosis.
- M. bovis was once a common cause of tuberculosis, but the introduction of pasteurized milk has largely eliminated this as a public health problem in developed countries.
- M. canetti is rare and seems to be limited to Africa, although a few cases have been seen in African emigrants.
- M. microti is mostly seen in immunodeficient people, although it is possible that the prevalence of this pathogen has been underestimated (Lee, 1948).

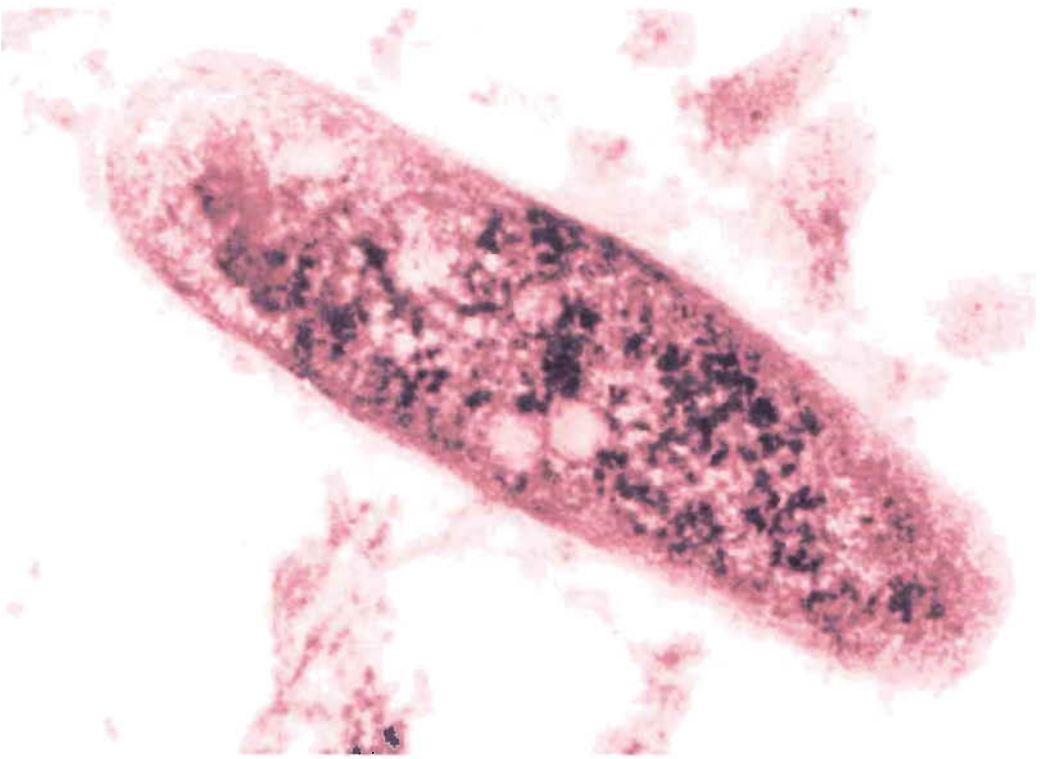


Figure 3: *"Mycobacterium tuberculosis"* the bacteria responsible for Tuberculosis disease

Figure 4: The growth of *"Mycobacterium tuberculosis"* in human lungs

Other known pathogenic mycobacteria include Mycobacterium leprae, Mycobacterium marinum, Mycobacterium avium and M. kansasii. The last two are part of the nontuberculous mycobacteria (NTM) group. Nontuberculous mycobacteria cause neither TB nor leprosy, but they do cause pulmonary diseases resembling TB (Lee, 1948).

1.1.2 Spreading of TB:

Tuberculosis (TB) germs (bacteria) are spread from person to person through the air. When someone with active, infectious TB disease of the lungs or airways breathes out (or coughs, sneezes, sings, plays a wind instrument or sometimes even just talks), tiny droplets containing TB germs are released into the air. These droplets can stay in the air for hours. If one breathes in these droplets, TB germs will get into lungs. One cannot get infected with TB by shaking hands, sitting on a toilet seat or sharing dishes with someone who has active, infectious TB disease (PHAC, 2011).

TB is not as contagious as other diseases, such as the flu or chickenpox. To get infected, one would usually have to spend many hours every day with someone with infectious TB disease. If someone lives in overcrowded housing with poor air circulation, they may be more at risk of getting latent TB infection (PHAC, 2011).

1.1.3 Active TB Disease:

Tuberculosis (TB) disease is caused by germs (bacteria) that are spread through the air from person to person. TB germs get into the air when someone with active, infectious TB disease coughs, sneezes, sings, plays a wind instrument or to a lesser degree, talks. These germs can stay in the air for hours. If someone breathe in the TB germs, their body's immune (defense) system may kill the TB germs. If body's defense system doesn't kill the TB germs, they can remain alive but inactive in the body. If TB germs become active (multiply and grow in the body), this is called active TB disease. Someone having active TB disease will feel sick and may infect other people (PHAC, 2011).

Active tuberculosis (TB) disease usually affects the lungs. Sometimes TB germs (bacteria) can spread through blood to other parts of the body. If this happens, the germs are most often found in the lymph nodes. Lymph nodes are an important part of body's defense system. They act as filters for germs and viruses. Lymph nodes are usually found in neck, in armpits and in groin. TB germs can also be found in:

- Kidneys
- Bones and joints
- Intestines
- Brain and spinal cord
- All over your body (called disseminated or miliary TB)

If one has active TB disease outside the lungs, they may feel sick or weak, lose weight, and have fever and night sweats. In addition, may have symptoms in the part of the body where the TB germs can be found. It can sometimes be difficult to diagnosis active TB disease outside of the lungs because the chest x-ray will be normal and sputum (phlegm) will not show any TB germs.

If one is infected with HIV, they are more likely to have active TB disease outside the lungs. Treatment of active TB disease in other parts of the body is the same as treatment of active TB disease in the lungs. People with active TB disease outside the lungs are usually not infectious to others because their TB germs don't usually get into the air to be breathed in by someone else (PHAC, 2011).

1.1.3.1 Symptoms of Active TB disease:

TB is a serious disease that attacks the lungs and sometimes spreads to other parts of the body (this is called active TB disease outside the lungs). You may have symptoms in the parts of your body where the TB germs are growing. If you have active TB disease in the lungs, you may have the following symptoms:

- A bad cough that lasts longer than three weeks
- Pain in the chest
- Coughing up blood or sputum (phlegm)
- Weakness or feeling very tired
- Weight loss
- Lack of appetite
- Chills
- Fever
- Night sweats (PHAC, 2011)

1.1.3.2 Diagnosis of Active TB disease:

There are three steps in diagnosing active tuberculosis (TB) disease:

- A complete medical history and medical examination

In the first step during the medical history, doctor will want to know if there are any symptoms of TB disease. The doctor will also want to know if one has been exposed to a person with active, infectious TB, if one has had a previous diagnosis of latent TB infection or active TB disease, or if have any other risk factors for developing active TB disease.

- A chest x-ray

The second step is the chest x-ray which is used to look for evidence of active TB disease in the lungs.

- Laboratory tests

The third step is a series of laboratory tests. If the doctor thinks one has active TB disease in lungs, they will be asked to give a sputum (phlegm) sample. If the doctor thinks one has active TB disease outside of lungs, they may have to give other types of samples. The sputum sample (or smear) is examined under a microscope. It is cultured (or grown) to find out if it contains the TB germ (bacteria). A positive culture confirms having active TB disease (PHAC, 2011).

1.1.4 Latent TB Disease:

Latent tuberculosis (TB) infection occurs if breathed TB germs (bacteria) into lungs and the immune (body defense) system has stopped them from growing. The TB germs remain alive but inactive in the body. Infected person don't feel sick and can't pass TB to others. Treatment of latent TB infection is important because it can prevent the development of active TB disease later in life (PHAC, 2011).

1.1.4.1 Symptoms of Latent TB disease:

One having latent TB infection won't feel sick. He or she may not know whether they have been exposed to TB or not. The best way to find out is to get a TB skin test. If one suspects to get infected with TB, then test for HIV must be done. It's important to know if someone has HIV because it can make the body defense (immune) system weak and increase risk of developing active TB disease.

A person with latent TB infection:

- Usually has a positive skin test
- Has a normal chest x-ray and a negative sputum test
- Has TB germs that are alive but inactive
- Does not feel sick
- Cannot spread TB germs to others (PHAC, 2011)

1.1.4.2 Diagnosis of Latent TB disease:

To find out if one has a latent tuberculosis (TB) infection, a TB skin test will be given. A small needle will inject some testing material under the surface of the skin. If infected with TB, the spot where the needle was injected will swell up a bit and feel hard within 48 to 72 hours. Two or three days after the test, the reaction measured is given whether the test is positive or negative (PHAC, 2011).

- **A positive skin test**

A positive TB skin test usually means having latent TB infection. More tests are done to make sure whether having active TB disease or not. Doctor may order a chest x-ray or a test of sputum (phlegm) to look for TB germs (bacteria). A positive test without latent TB infection can happen in people who have been vaccinated with BCG vaccine or who have been infected with other TB-like germs (PHAC, 2011).

- **A negative skin test**

A negative TB skin test usually means not infected with TB. But a negative test can also happen if one has only recently been infected. It takes three to eight weeks after exposure to a person with infectious TB disease for the skin test to become positive. A negative test can also happen if the body's defense (immune) system is weak. For example, if one has HIV infection or active TB disease, the skin test may be negative even if TB germs are in the body (PHAC, 2011).

- **Blood test for diagnosing latent TB infection**

In addition to the skin test, blood tests for latent TB infection are also now available. These tests are not recommended for routine diagnosis of latent TB infection and are only used under special circumstances (PHAC, 2011).

1.1.5 Drug-Resistant Tuberculosis:

Drug-resistant tuberculosis happens when the usual drugs used to kill the TB germs (bacteria) no longer work. Drug-resistant TB is of special concern for persons with HIV infection or other conditions that can weaken the immune system (PHAC, 2011).

Occurrence of drug-resistant TB

One can get drug-resistant TB if:

- Breathe in germs from someone with drug-resistant TB disease
- Already have TB disease and didn't take all of the TB drugs
- Develop active TB disease again, after being treated in the past (PHAC, 2011)

1.1.5.1 Multidrug-resistant TB (MDR-TB):

TB that is resistant to the two most important "first-line" antibiotics used to fight TB is called multidrug-resistant TB or MDR-TB. A person with MDR-TB disease needs special antibiotics and must take drugs for a longer time. Unfortunately, these drugs usually have more side effects and are not as effective as the first-line drugs (PHAC, 2011).

1.1.5.2 Extensively drug-resistant TB (XDR-TB):

Extensively drug-resistant TB (XDR-TB) can develop when MDR-TB germs become resistant to two or more of the best second-line drugs. XDR-TB is extremely difficult to treat as there are very few drugs left that can be used (PHAC, 2011).

1.1.6 Types of TB:

Tuberculosis (TB) is divided into two categories: pulmonary and extrapulmonary.

a) Pulmonary Tuberculosis Types

- Primary Tuberculosis Pneumonia
- Tuberculosis Pleurisy
- Cavitary Tuberculosis
- Miliary TB
- Laryngeal Tuberculosis

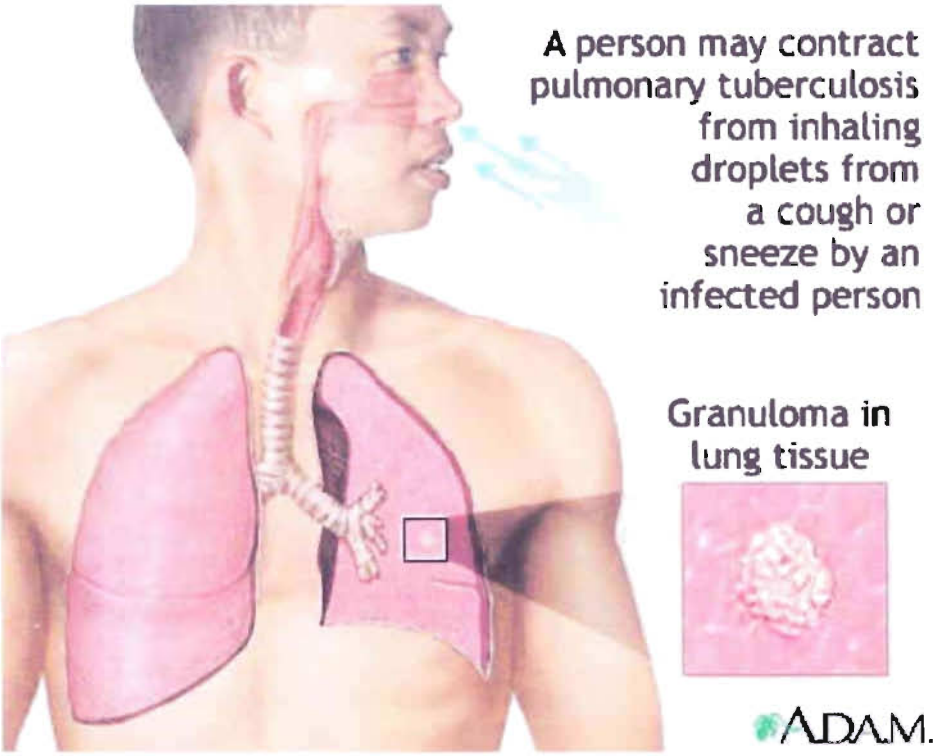


Figure 5: Granuloma in human lung tissue causing pulmonary tuberculosis

b) Extrapulmonary Tuberculosis

This type of tuberculosis occurs primarily in immunocompromised patients.

- Lymph Node Disease
- Tuberculosis Peritonitis
- Tuberculosis Pericarditis
- Osteal Tuberculosis
- Renal Tuberculosis
- Adrenal Tuberculosis
- Tuberculosis Meningitis (Golden, 2005)

1.1.7 Risk Factors:

1.1.7.1 Weakened immune system

A healthy immune system can often successfully fight TB bacteria, but your body can't mount an effective defense if your resistance is low. A number of diseases and medications can weaken your immune system, including:

- HIV/AIDS
- Diabetes
- End-stage kidney disease
- Cancer treatment, such as chemotherapy
- Drugs to prevent rejection of transplanted organs
- Some drugs used to treat rheumatoid arthritis, Crohn's disease and psoriasis
- Malnutrition
- Advanced age

1.1.7.2 International connections

TB risk is higher for people who live in or travel to countries that have high rates of tuberculosis, such as:

- Sub-Saharan Africa
- India
- China
- Mexico
- The islands of Southeast Asia and Micronesia

1.1.7.3 Poverty and substance abuse

- Lack of medical care.
- Substance abuse. (e.g. Long-term drug or alcohol use weakens immune system and makes more vulnerable to tuberculosis.

1.1.7.4 Work or living environment

- Health care work. Regular contact with people who are ill increases chances of exposure to TB bacteria.
- Living or working in a residential care facility. People who live or work in prisons, immigration centers or nursing homes are all at risk of tuberculosis.
- Living in a refugee camp or shelter. Weakened by poor nutrition and ill health and living in crowded, unsanitary conditions, refugees are at especially high risk of tuberculosis (WHO, 2010).

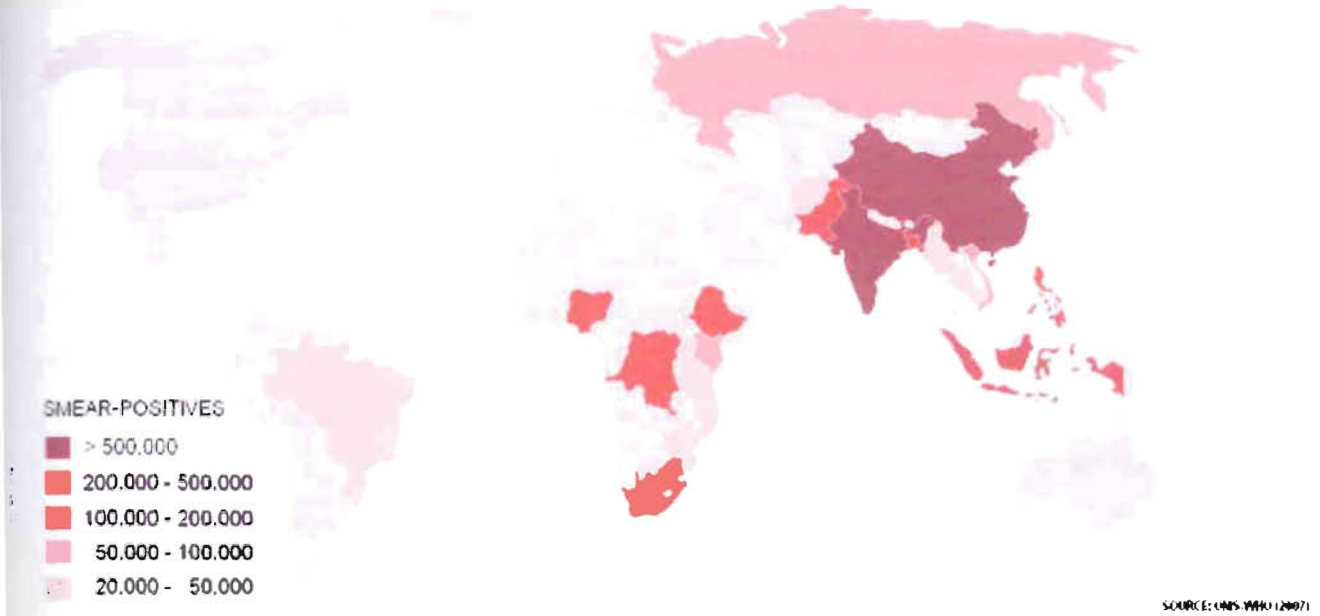


Figure 6: Map showing the 22 high-burden countries that according to WHO account for 80% of new TB cases arising each year

1.1.8 Clinical Features:

- When the disease becomes active, 75% of the cases are pulmonary TB, that is, TB in the lungs. Symptoms include chest pain, coughing up blood, and a productive, prolonged cough for more than three weeks. Systemic symptoms include fever, chills, night sweats, appetite loss, weight loss, pallor, and fatigue.
- Tuberculosis also has a specific odour attached to it, this has led to trained animals being used to vet samples as a method of early detection.
- Other 25% are extrapulmonary tuberculosis where infection sites include the pleura in tuberculosis pleurisy, the central nervous system in meningitis, the lymphatic system in scrofula of the neck, the genitourinary system in urogenital tuberculosis, and bones and joints in Pott's disease of the spine. An especially serious form is disseminated TB, more commonly known as miliary tuberculosis. Extrapulmonary TB may co-exist with pulmonary TB as well (Kumar et al, 2007).

1.1.9 Treatment:

Medications are the cornerstone of tuberculosis treatment. But treating TB takes much longer than treating other types of bacterial infections. With tuberculosis, one must take antibiotics for at least six to nine months. The exact drugs and length of treatment depend on one's age, overall health, possible drug resistance, the form of TB (latent or active) and its location in the body (Kim et al, 2003).

Treatment of active tuberculosis (TB) disease takes at least 6 months. The antibiotics used to kill the TB germs (bacteria) only work when the TB germs grow and TB germs grow very slowly. Patients probably start to feel better after only a few weeks of taking TB drugs. However, it is important to keep taking the drugs regularly because the TB germs are still alive in the body. If the patient stop taking the drugs, or don't take drugs regularly, drug-resistant TB may develop. Patient will get sick all over again, but this time they need to take drugs longer to be cured and there will be more side effects (PHAC, 2011).

1.1.10 Anti-Tuberculosis drugs:

In case of latent tuberculosis, it is needed to take just one type of TB drug. Active tuberculosis, particularly if it's a drug-resistant strain, will require several drugs at once. The most common medications used to treat tuberculosis include their dose, mechanism of action and target site are:

Drugs	MIC (g/ml)	Mechanisms of action	Targets
Isoniazid	0.01–0.20	Inhibition of cell wall mycolic acid Protein synthesis	Enoyl acyl carrier reductase (InhA)
Rifampin	0.05–0.50	Inhibition of RNA synthesis	RNA polymerase, β subunit
Pyrazinamide	20–100 (pH5.5or 6.0)	Depletion of membrane energy	Membrane energy metabolism
Ethambutol	1–5	Inhibition of cell wall arabinogalactan	Arabinosyl transferase synthesis
Streptomycin	2–8	Inhibition of protein synthesis	Ribosomal S12 protein and 16S rRNA
Kanamycin	1–8	Inhibition of protein synthesis	16S rRNA
Capreomycin	4	Inhibition of protein synthesis	16S rRNA, 50S ribosome
Fluoroquinolones	0.2–4.0	Inhibition of DNA synthesis	DNA gyrase
Ethionamide	0.6–2.5	Inhibition of mycolic acid synthesis	Acyl carrier protein reductase (InhA)
PAS	1–8	Inhibition of folate pathway and mycobactin synthesis	Thymidylate synthase (ThyA)

Table1: Current tuberculosis drugs and their targets (Zhang, 2006)

1.1.11 Side effects of Anti-Tuberculosis drugs:

Drugs used to treat active TB disease are relatively safe. Sometimes the drugs may cause side effects. Some side effects are minor. Others are more serious.

- Skin rash
- Itching
- Yellowish skin or eyes

- Brown or very dark urine
- Loss of appetite
- Nausea (feeling sick to your stomach)
- Vomiting
- Dizziness
- Abdominal pain
- Bleeding easily
- Flu-like symptoms
- Ringing in the ears
- Fever for three days or more
- Sore joints
- Tingling fingers or toes
- Memory Problem
- Psychotic thinking (feeling out of touch with reality)
- Blurred or changed vision
- Tingling or numbness around the mouth (Nicas et al, 2005)

1.1.12 The DOT Program:

Treatment of active tuberculosis (TB) disease takes at least 6 months. DOT stands for Directly Observed Treatment. It is a program designed to help one take their drugs regularly. If one is on a DOT program, they will meet with a health-care provider every day or several times a week. DOT helps in several ways. The health-care provider will remind the patient to take all of the drugs to complete treatment. If the patient completes the treatment, he will be cured of TB disease. The health-care provider can also see if the drugs are working as they should, watch for side effects and answer questions the patients may have about TB (WHO, 2010).

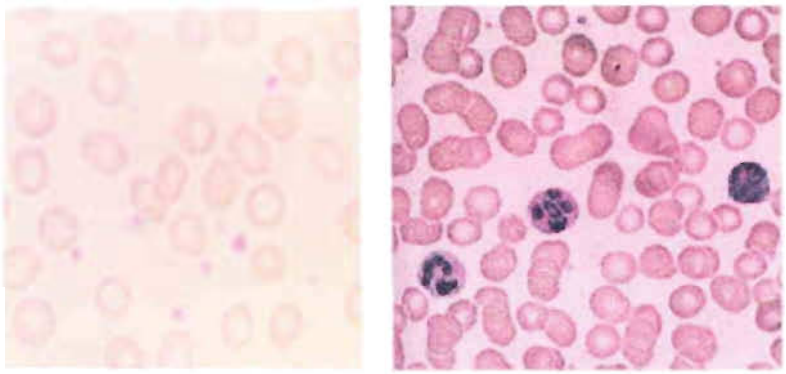
1.1.13 The six components to Stop TB Strategy:

- Pursue high-quality DOTS expansion and enhancement
- Addressing TB/HIV, MDR-TB and the needs of poor and vulnerable populations.
- Contribute to health system strengthening based on primary health care

- Engage all care providers
- Empower people with TB, and communities through partnership
- Enable and promote research (WHO, 2010)

1.2 Anaemia:

Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary by age, sex, altitude, smoking, and pregnancy status. Iron deficiency is thought to be the most common cause of anaemia globally, although other conditions, such as folate, vitamin B12 and vitamin A deficiencies, chronic inflammation, parasitic infections, and inherited disorders can all cause anaemia (WHO, 2008).



Anaemic Blood Normal Blood

Figure 7: Clinical features of an Anaemic and Normal patient's blood sample

Iron deficiency is the most common and widespread nutritional disorder in the world. As well as affecting a large number of children and women in developing countries, it is the only nutrient deficiency which is also significantly prevalent in industralized countries. The numbers are staggering: 2 billion people – over 30% of the world's population – are anaemic, many due to iron deficiency, and in resource-poor areas, this is frequently exacerbated by infectious diseases. Malaria, HIV/AIDS, hookworm infestation, schistosomiasis, and other infections such as tuberculosis are particularly important factors contributing to the high prevalence of anaemia in some areas (WHO, 2008).

Worldwide, approximately 20 percent of women, 50 percent of pregnant women, and 3 percent of men are iron deficient. Iron is an essential component of hemoglobin, the oxygen carrying pigment in the blood. Iron is normally obtained through the food in the diet and by the recycling of iron from old red blood cells (UNICEF, 2002).

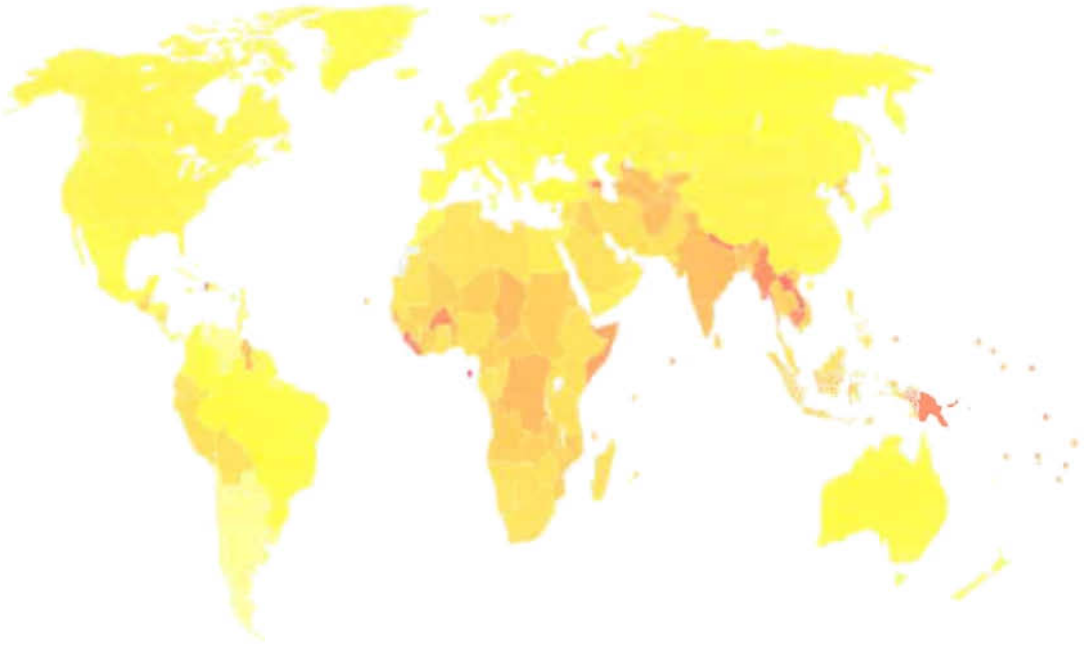


Figure 8: "Iron-deficiency anaemia'" by country (per 100,000 inhabitants)

Anaemia is a decrease in number of red blood cells (RBCs) or less than the normal quantity of hemoglobin in the blood. However, it can include decreased oxygen-binding ability of each hemoglobin molecule due to deformity or lack in numerical development as in some other types of hemoglobin deficiency (WHO, 2008).

Age or gender group	Hb threshold (g/dl)	Hb threshold (mmol/l)
Children (0.5–5.0 yrs)	11.0	6.8
Children (5–12 yrs)	11.5	7.1
Teens (12–15 yrs)	12.0	7.4
Women, non-pregnant (>15yrs)	12.0	7.4
Women, pregnant	11.0	6.8
Men (>15yrs)	13.0	8.1

Table 2: WHO's Hemoglobin thresholds used to define anemia (1 g/dL = 0.6206 mmol/L)

1.2.1 Types of Anaemia:

There are many types of anaemia with specific causes and characteristics. Some of these include:

- anaemia of B12 deficiency
- anaemia of chronic disease
- anaemia of folate deficiency
- drug-induced immune hemolytic anaemia
- hemolytic anaemia
- hemolytic anaemia due to g6pd deficiency
- idiopathic aplastic anaemia
- idiopathic autoimmune hemolytic anaemia
- immune hemolytic anaemia
- iron deficiency anaemia
- pernicious anaemia
- secondary aplastic anaemia
- sickle cell anaemia (UNICEF, 2002)

1.2.2 Causes of Anaemia:

a) Blood Loss:

Blood loss is the most common cause of anaemia, particularly iron-deficiency anaemia. Blood loss can be short term or persist over time. It can be caused by heavy menstrual periods, bleeding in the digestive or urinary tracts, surgery, trauma, or cancer. If bleeding is significant, the body can lose enough RBCs to cause anaemia.

b) Low Levels of RBC Production

Lower than normal levels of RBC production can result from a poor diet that lacks iron, folic acid, or vitamin B12. It also can be caused by conditions that make it difficult for the body to absorb nutrients into the blood.

Chronic diseases like kidney disease and cancer can decrease the body's ability to produce enough RBCs. Infections, medicines, or radiation used to treat another disease or condition may damage the bone marrow, making it unable to produce RBCs fast enough to replace those that die or are destroyed.

During pregnancy, the foetus needs additional blood cells to develop. The mother may not be able to produce enough RBCs for herself and the foetus, which can result in anaemia.

c) High Rates of RBC Destruction

Higher than normal rates of RBC destruction can be the result of inherited blood disorders like sickle cell anaemia, thalassaemia, and certain enzyme deficiencies. These disorders create abnormalities in the RBCs that cause them to die off in a shorter period of time than healthy RBCs (Ramzi et al, 2005).

1.2.3 Major Risk Factors:

1.2.3.1 Inadequate Iron Intake/Absorption/Stores

- Vegetarian eating styles, especially vegan diets
- Macrobiotic diet
- Low intakes of meat, fish, poultry or iron fortified foods

- Low intake of foods rich in ascorbic acid
- Frequent dieting or restricted eating
- Chronic or significant weight loss
- Meal skipping
- Substance abuse
- History of iron deficiency anemia
- Recent immigrant from developing country
- Special health care needs

1.2.3.2 Increased Iron Requirements/Losses

- Heavy/lengthy menstrual periods
- Rapid growth
- Pregnancy (recent or current)
- Inflammatory bowel disease
- Chronic use of aspirin or nonsteroidal anti-inflammatory drugs (e.g., ibuprofen) or corticosteroid use
- Participation in endurance sports (e.g., long distance running, swimming, cycling)
- Intensive physical training
- Frequent blood donations
- Parasitic infection (Stang et al, 2005)

1.2.4 Signs and Symptoms of Anaemia:

The most common symptom of anaemia is fatigue (feeling tired or weak). It may be more difficult to find the energy to do normal activities if you have anaemia. Other signs and symptoms of anaemia include:

Major Symptoms are associated with:

- Pale skin, lips, tongue and inner surface of eyelids (conjunctiva)
- Fatigue
- Irritability
- Weakness
- Shortness of breath
- Low blood pressure with position change from lying or sitting to standing (orthostatic hypotension)
- Sore tongue, Brittle nails, concave nails
- Unusual food cravings (called pica)
- Decreased appetite (especially in children)
- Headache - frontal
- Low haematocrit and hemoglobin in a RBC
- Low serum ferritin (serum iron) level (UNICEF, 2002)

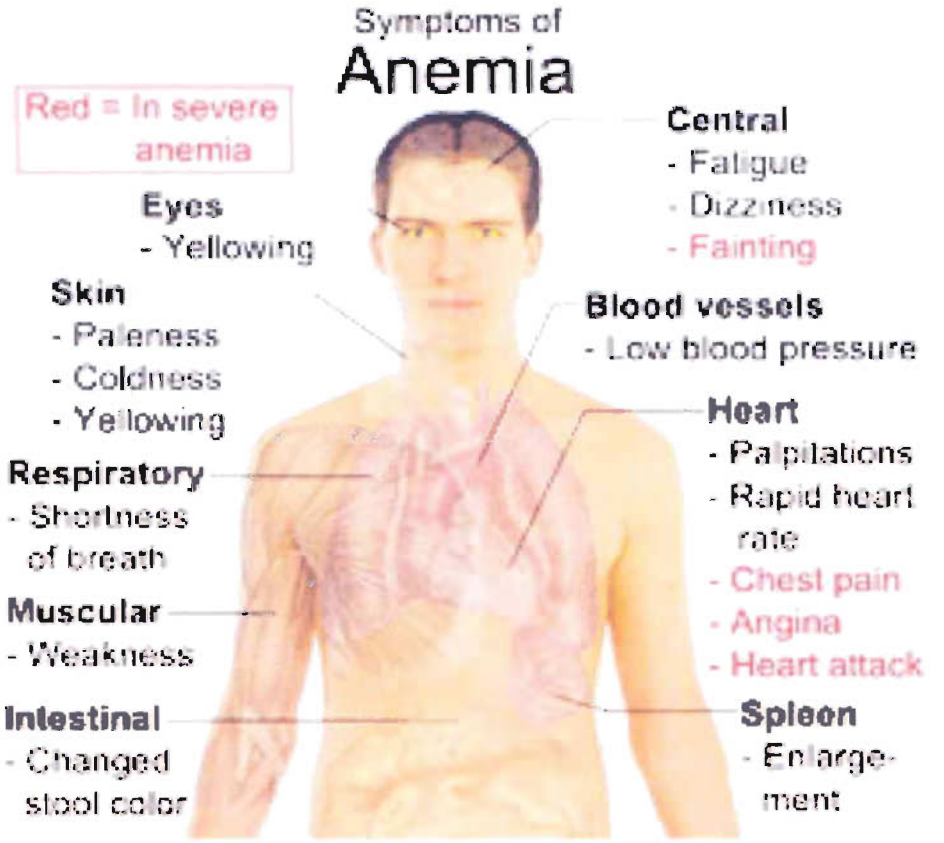


Figure 9: Symptoms of anaemia in the different parts of the body

1.2.5 Consequences of Nutritional Anaemia

- Impaired cognitive performance at all stages of life
- Significant reduction of physical work capacity and productivity
- Increased morbidity from infectious diseases
- Greater risk of death of pregnant women during the perinatal period
- Negative foetal outcome: intrauterine growth retardation, low birth weight, prematurity (UNICEF, 2002)

1.2.6 Diagnosis of Anaemia:

Anaemia is diagnosed using a person's medical history, a physical exam, and tests. Doctor can use these methods to determine the cause, severity, and treatment for the particular type of anaemia one may have. Mild to moderate anaemia may have no symptoms or very mild symptoms. In fact, anaemia is often discovered unexpectedly on blood tests looking for other conditions (Ramzi et al, 2005).

a) Medical and Family History

Doctor may ask detailed questions about many symptoms common to anaemia, including feeling tired and weak. One may be asked if they had an illness or condition that could cause anaemia and whether they are taking medicines that could cause anaemia. The doctor may ask about patient's diet and whether they have family members who have anaemia or a history of anaemia.

b) Physical Exam

Doctor will do a physical exam to determine how severe the anaemia is and to check for possible causes. This exam may include listening to the heart for a rapid or irregular heartbeat, listening to the lungs for rapid or uneven breathing, or feeling the abdomen to check the size of the liver and spleen. The doctor may perform a pelvic or rectal exam to check for common sources of blood loss.

c) Diagnostic Tests and Procedures

Doctor may order various tests or procedures to determine the type and severity of anaemia one have. Usually, the first test used to diagnose anaemia is a complete blood count (CBC). The CBC tells a number of things about a person's blood, including:

- The haemoglobin level. Haemoglobin is the iron-rich protein in red blood cells (RBCs) that carries oxygen through the body. The normal range of haemoglobin levels for the general population is 11–15 g/dL. A low haemoglobin level means a person has anaemia.
- The haematocrit level. The haematocrit level measures how much of the blood is made up of RBCs. The normal range for haematocrit levels for the general population is 32–43 percent. A low haematocrit level is another sign of anaemia.

The normal range of these levels may be lower in certain racial and ethnic populations (Ramzi et al, 2005).

The CBC also checks:

- The number of RBCs. Too few RBCs means a person has anaemia. A low number of RBCs is usually seen with either a low haemoglobin or a low haematocrit level, or both.
- The number of white blood cells. White blood cells are involved in fighting infection.
- The number of platelets in the blood. Platelets are small cell fragments that are involved in blood clotting.
- RBC size. The mean cell volume measures the average size (volume) of RBCs. In iron deficiency anaemia, the RBCs are usually smaller than normal. This is called microcytosis.

If the CBC result confirms that one have anaemia, doctor may order additional tests to determine the cause, severity, and correct treatment for the condition. Some of the tests may include:

- Haemoglobin electrophoresis. This test evaluates the different types of haemoglobin in the blood. The haemoglobin electrophoresis test is used to diagnose types of anaemia caused by abnormal haemoglobin in the RBCs.

- Reticulocyte count. Reticulocytes are young RBCs. This test measures the number of new RBCs in the blood. The reticulocyte test is used to determine whether the bone marrow is producing RBCs at the proper rate. A higher than average count usually indicates either blood loss or destruction of RBCs earlier than their normal life of 120 days. A lower than average count indicates a decreased production of RBCs by the bone marrow. People with pernicious anaemia have low reticulocyte levels.

Several tests can be used to check the level of iron in blood and body. These tests include serum iron, serum ferritin, transferrin level, or total iron-binding capacity. Because anaemia has many causes, the doctor may order tests for conditions such as kidney failure, lead poisoning (in children), and deficiencies of vitamins (B12, folate).

If the doctor suspects of having anaemia because of internal bleeding in the stomach or intestines, several tests may be used to discover the source of the bleeding. A test to check the stool for blood may be done in the doctor's office.

If blood is found in the stool, additional tests may be used to find the source of the bleeding. One such test is endoscopy. In this test, a tube with a tiny camera is used to view the lining of the digestive tract.

In some cases, the doctor may want to do a bone marrow aspiration or biopsy. A bone marrow biopsy is a minor surgical procedure to remove a small amount of bone marrow tissue. Bone marrow aspiration or biopsy test shows whether the bone marrow is healthy and making enough blood cells. For a bone marrow aspiration, doctor removes a small amount of bone marrow fluid through a needle (Ramzi et al, 2005).

1.2.7 Laboratory Diagnostic Test Value:

When iron status is adequate, iron stores and erythropoiesis remain normal. With iron depletion, stores are reduced while erythropoiesis is maintained. Iron deficiency is associated with depleted stores and abnormalities in iron metabolism and red blood cell biochemistry. Although there is no single laboratory test that specifically indicates iron deficiency anemia, several tests are used to determine iron status and the presence of anemia (Stang et al, 2005).

Gender/Age (yrs)	Hemoglobin<g/dL	Hematocrit<%
Females		
12-14.9	11.8	35.7
15-17.9	12.0	35.9
18+	12.0	35.9
Males		
12-14.9	12.5	37.3
15-17.9	13.3	39.7
18+	13.5	39.9

Table 3: Hemoglobin and Hematocrit Diagnostic Values of Anemia (Stang et al, 2005)

Other test parameters values:

Parameters	Value
Ferritin	<15 ug/L
Serum transferrin receptor concentration (TfR)	>8.5 mg/L
Transferrin saturation	<16%
Erythrocyte protoporphyrin (FEP)	>70 ug/dL
Mean Cell Volume (MCV)	<82/85 fL
Mean Corpuscular Hemoglobin (MCH)	27-33 pg
Mean Corpuscular Hemoglobin Concentration (MCHC)	31-35 g/dl
Red Cell Distribution Width (RDW)	>14%

(For the patients of <15 yrs/>15 yrs of age)

Table 4: Other CBC test values (Stang et al, 2005)

1.2.8 Treatments:

Treatments for anemia depend on severity and cause.

- Mild to moderate iron deficiency anemia is treated by oral iron supplementation with ferrous sulfate, ferrous fumarate, or ferrous gluconate.
- Vitamin supplements given orally (folic acid) or subcutaneously (vitamin B-12) will replace specific deficiencies.
- In anemia of chronic disease, anemia associated with chemotherapy, or anemia associated with renal disease, some clinicians prescribe recombinant erythropoietin, epoetin alfa, to stimulate red cell production.
- In severe cases of anemia, or with ongoing blood loss, a blood transfusion may be necessary (Alleyne et al, 2008)

CHAPTER- 2

OBJECTIVE & SIGNIFICANCE

2.1 Objectives of the study:

The major objective of this study was to-

Find out the association of Anaemia in tuberculosis patients analyzing the socio demographic data.

2.2 Significance of the study:

Tuberculosis (TB) is a major public health problem in Bangladesh. In 2008, the World Health Organization (WHO) ranked Bangladesh in sixth position among the world's 22 high-burden TB countries. The TB mortality rate (45 deaths per 100,000 populations) in Bangladesh is 45 percent higher than the Southeast Asian region average (31 deaths per 100,000 populations). National TB Control Program (NTCP) of Bangladesh introduced DOTS (the internationally recommended strategy for TB control) in 1993. While the treatment success rate is fairly high at 92 percent, around one-third of the cases go undetected, resulting in a larger number of undiagnosed and untreated cases that spread the disease further (USAID, 2009).

Data from National Nutrition Surveys indicate that anaemia is a major public health concern within Bangladesh. The Nutrition surveys carried out in rural Bangladesh in 1981-82 indicated that about 74 percent of pregnant and lactating women were anaemic. Among the children below five years, 73 percent suffered from iron deficiency anaemia (IDA). The country document on nutrition (1992) revealed that about 20 percent of maternal deaths were attributable to anaemia and post-partum hemorrhage. Inadequate intake and impaired absorption of iron, heavy parasitic infestation and recurrent infections are identified as the common causes (WHO, 2011).

Bangladesh is one of the endemic region of Tuberculosis and Anaemia is a common complication of pulmonary tuberculosis, the reported prevalence ranging from 16 to 76% in different studies. A lower blood haemoglobin concentration was found in patients with tuberculosis than in non-tubercular patients (Devi et al, 2003).

Environmental factors such as lacking of health hygienic, poor sanitation, water, food habits, living area, malnutrition, lack of medical care etc. are mainly associated with anaemia in TB. This study can provide information about various factors that are associated with anaemia in TB patients and its rate of severity. It will also be informative to the health sector of Bangladesh as well as to the other endemic areas of the world.

This study is expected to deliver the important information that anaemia can be associated with Tuberculosis patients considering various parameters. The risk factors of anaemia in TB must be well known, which will create awareness among the health care providers and patients.

CHAPTER- 3

MATERIALS AND METHODS

3.1 Type of the study:

It was a cross sectional study.

3.2 Place of the study:

The study was done at the general ward in National Institute of Diseases of the Chest and Hospital (NIDCH), Mohakhali, Dhaka, Bangladesh. In 10 separate blocks, the hospital has accommodation for 685 patients suffering from Pulmonary Tuberculosis and allied diseases of the chest. Of the total 170 beds are allotted for Non-Tubercular Chest diseases and 330 for Pulmonary Tuberculosis cases. 85 beds are allocated for Asthma patients in National Asthma Center building. 70 beds are reserved for MDR TB Patients and 100 beds are paying beds. In order to facilitate management of patients, the Hospital beds are divided and put in 10 medical units and 5 surgical units with care of unit chiefs.

3.3 Study population:

In this study 32 cases of TB patients were taken from the pulmonary TB patients who were infected or suspected to be infected by *Mycobacterium tuberculosis*.

3.4 Inclusion criteria:

The following was included-

- Both Male and female patients diagnosed with pulmonary TB
- Patient with ages between 18-54 years
- Only the indoor patients who were admitted in the hospital for the treatment of pulmonary TB
- Patients who where treated for TB before and for the first time treatment

3.5 Exclusion criteria:

The following was not included in the study-

- MDR TB patients
- Outdoor patients

- Pregnant women

3.6 Study approach:

After getting approval of the research proposal from the honorable faculty member, formal permission was obtained from the concerned authorities of "National Institute of Diseases of the Chest and Hospital (NIDCH).

3.7 Study period:

Study period was from January, 2011 to July, 2011.

3.8 Data collection paper:

A data collection paper along with patient's consent paper was made in order to compile all the information and data of the patient in an organized manner.

3.8.1 Demographic data:

The demographic data generally contains a patient's personal information, his or her family history, living area, sign and symptoms of TB and history of taking anti helmentic or TB drugs. Data about demographic characteristics of patients was collected at the beginning of the study.

3.8.2 Measurement of BMI:

Each patients Height (in m.) and Weight (in kg.) was determined by measuring tape and weight measuring machine. Then the BMI (Body Mass Index) was determined by the formula,

$$\mathrm{BMI} = \frac{\mathrm{mass\ (kg)}}{(\mathrm{height\,(m)})^2}$$

3.9 Sampling technique:

In this study, purposive sampling was followed. From each patients who where wiling to give blood, 5 ml. of blood sample where taken in order to find out Hb, MCV, MCH, MCHC & RDW-CV.

3.10 Data analysis:

All the data were checked after collection then the data were entered into SPSS (version 17.0). Then χ^2 test was done to find out the associated between various socio demographic variable to anaemia.

3.11 Sample analysis:

About 5 ml. of patient's blood sample was analyzed in the 'Sysmax Haematology Analyzer' in the Pathology department of the ICH & Shishu Sasthya Foundation Hospital, Mirpur, Dhaka under the authorized supervisor.

CHAPTER- 4

RESULTS

4.1 Distribution of Tuberculosis patients according to the presence of Anaemia (n=32):

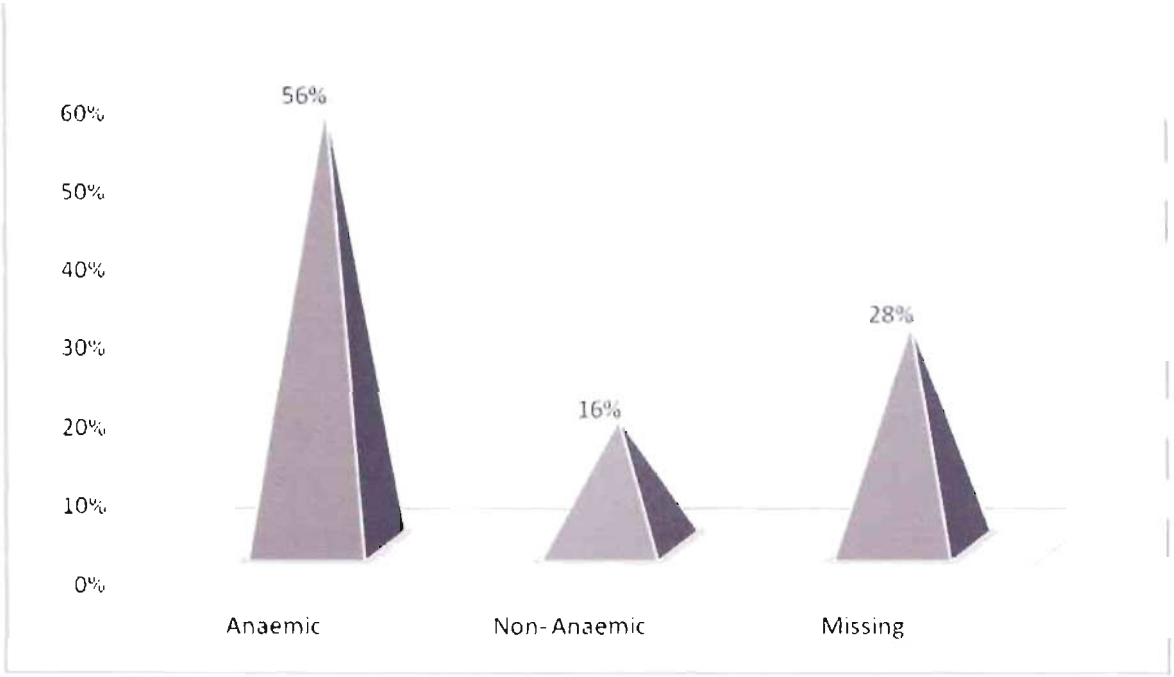


Figure: Distribution of tuberculosis patients according to Anaemic Condition

Among 32 tuberculosis patients there were 18 anaemic patients and 5 non- anaemic patients.

4.2 Distribution of Tuberculosis patients according to their age and sex (n=23):

Age Range (Years)	Male		Female	
	Anaemic n (%)	Non-anaemic n (%)	Anaemic n (%)	Non-anaemic n (%)
18-28	6 (75)	2 (25)	3 (75)	1 (25)
29-39	3 (75)	1 (25)	1 (100)	0
≥ 40	3 (100)	0	2 (67)	1 (33)
Total	12 (80)	3 (20)	6 (75)	2 (25)

Table 5: Age and sex distribution of Tuberculosis patients

In our survey there were 23 tuberculosis patients who had their age range between 18-57 years. In the above table we can see that in the age range between 18-28 years there are 75% male and 75% female anaemic tuberculosis patients, in the age range 29-39 years there are 75% male and 100% female anaemic tuberculosis patients and in the age range ≥ 40 years there are 100% male and 67% female patients.

4.3 Distribution of Tuberculosis patients according to their marital status (n=23):

Marital Status	Anaemic n (%)	Non-anaemic n (%)
Married	11 (79)	3 (21)
Unmarried & Widow	7 (78)	2 (22)
Total	18 (78)	5 (22)

Table 6: Marital status distribution of Tuberculosis patients

Among the 23 Tuberculosis patients 14 people were married among which 79% people are associated with anaemia and 9 were unmarried and widowed among which 78% people are associated with anaemia.

4.4 Educational status distribution among the Tuberculosis patients (n=23):

Educational Status	Anaemic n (%)	Non-anaemic n (%)
Uneducated/Others	6 (67)	3 (33)
Class 1-5	9 (90)	1 (10)
Class 6-10	2 (67)	1 (33)
Class 10- Higher	1 (100)	0
total	18 (78)	5 (22)

Table 8: Educational status distribution among the Tuberculosis patients

The above table shows that among 23 Tuberculosis patients there are total 9 uneducated/other patients among which 67% are anaemic and 33% non-anaemic. Among the educated patients between the class 1-5 has 10 patients among which 90% are anaemic and 10% non-anaemic. Between the class 6-10 has 3 patients among which 67% are anaemic and 33% non-anaemic. And in between the class 10-higher has 1 patient who is anaemic.

4.5 Occupational distribution among the Tuberculosis patients (n=23):

Occupational Status	Anaemic n (%)	Non-anemic n (%)
Unemployed & House Wife	2 (50)	2 (50)
Day Labor	4 (100)	0
Employed	9 (82)	2 (18)
Bussiness & Others	3 (75)	1 (25)
Total	18 (78)	5 (22)

Table 9: Occupational distribution among Tuberculosis patients

Among the 23 Tuberculosis patients the unemployed & House Wife have 4 patients among 50% are anaemic and 50% are non-anaemic, 4 patients are Day Labours and all are anaemic, 11 patients are Employed among which 82% are anaemic and 18% are non-anaemic, 4 patients are Bussinessmen and Others among which 75% are anaemic and 25% is non-anaemic. So we can see that the patients who worked outside like day labours and employed were more prone to the tuberculosis infection associated with anaemia.

4.6 Distribution of Tuberculosis patient according to their family members (n=23):

No. of family members	Anaemic n (%)	Non-anaemic n (%)
3 - 5 person	10 (77)	3 (23)
6 - 9 person	7 (87)	1 (13)
≥ 10 person	1 (50)	1 (50)
Total	18 (78)	5 (22)

Table 10: Distribution of Tuberculosis patient according to their family members

In the table we can see among the total 23 Tuberculosis patients there are 13 people who have 3-5 members in their family among which 77% are anaemic and 23% non-anaemic. 8 people have 6-9 members among which 87% are anaemic and 13% non-anaemic. 2 people have ≥10 members in their family among which 50% are anaemic and 50% non-anaemic.

4.7 Distribution of Tuberculosis patients according to their monthly expenditure (n=23):

Monthly Expenditure (Tk.)	Anaemic n (%)	Non-anaemic n (%)
2500-9000	15 (79)	4 (21)
≥ 10000	3 (75)	1 (25)
Total	18 (78)	5 (22)

Table 11: Distribution according to monthly expenditure

Among the 23 Tuberculosis patients that we surveyed have their monthly expenditure between 2500-15000 Tk. Total 19 patients have their monthly expenditure between 2500-9000 Tk. and among which 79% are anaemic and 21% are non-anaemic. 4 patients have their monthly expenditure ≥10000 among which 75% are anaemic nad 25% are non-anaemic. So those who have their monthly expenditure below 10000 are more prone to get tuberculosis infection associated with anaemia.

4.8 Distribution of Tuberculosis patients according to their living area (n=23):

Living Area	Anaemic n (%)	Non-anaemic n (%)
Village	5 (83)	1 (17)
City	7 (78)	2 (22)
Rural area	4 (67)	2 (33)
Slum area	2 (100)	0
total	18 (78)	5 (22)

Table 12: Distribution of Tuberculosis patients according to their living area

Among 23 tuberculosis patients total villagers are 6 among which 83% are anaemic and 17% are non-anaemic, 9 patients live in city among which 78% are anaemic and 22% are non-anaemic, 6 patients live in rural area among which 67% are anaemic and 33% are non-anaemic and 2 patients live in slum area of all are anaemic. So we can see that those who live in the city and slum area are more prone to the tuberculosis infection associated with anaemia.

4.9 Distribution of Tuberculosis patient according to the living condition (House Wall, House Roof and House Floor) (n=23):

Living Condition	House Wall		House Roof		House Floor	
	Anaemic n (%)	Non-anaemic n (%)	Anaemic n (%)	Non-anaemic n (%)	Anaemic n (%)	Non-anaemic n (%)
Brick/Cement	9 (82)	2 (18)	6 (75)	2 (25)	11 (73)	4 (27)
Clay	2 (67)	1 (33)	0	0	5 (83)	1 (17)
Bamboo	3 (100)	0	3 (75)	1 (25)	2 (100)	0
Others	4 (67)	2 (33)	9 (82)	2 (18)	0	0
Total	18 (78)	5 (22)	18 (78)	5 (22)	18 (78)	5 (22)

Table 13: Distribution of patients according to their living condition (House Wall, House Roof and House Floor)

Among the 18 anaemic tuberculosis patients majorities (82%) have their house wall made of brick/cement and minority (33%) made of clay. 82% of patients have their house roof made of other materials 25% patient have the house roof made of bamboo. Majority of the patients (73%) have their house floor made of brick/cement and minority (17%) made of clay.

4.10 Smoking condition of Tuberculosis patients (n=23):

Smoking Condition	Anaemic n (%)	Non-anaemic n (%)
Never	3 (60)	2 (40)
Currently	7 (87)	1 (13)
Before & Occasionally	8 (80)	2 (20)
Total	18 (78)	5 (22)

Table 14: Smoking Condition of tuberculosis patients

Among the 23 tuberculosis patients 5 patients have never smoked among which 60% are anaemic and 40% are non-anaemic, 8 patints are currently smoking among which 87% are anaemic and 13% is non-anaemic, 10 patients smoked before and occasionally among which 80% are anaemic and 20% are non-anaemic. So, total 65% people who have smoked before/occasionally and are now currently smoking are more prone to tuberculosis infection associated with anaemia.

4.11 Coughing condition of patients before getting tuberculosis infected associated with anaemia (n=23):

Coughing Condition	Anaemic n (%)	Non-anaemic n (%)
Present	12 (80)	3 (20)
Absent	6 (75)	2 (25)
Total	18 (78)	5 (22)

Table 15: Coughing condition before Tuberculosis infection

Among the 23 tuberculosis patients 15 people have coughing problem before getting tuberculosis infection among which 80% are anaemic and 20% are non-anaemic. 8 people did not have coughing problem before getting tuberculosis infection among which 75% are anaemic and 25% are non-anaemic. So we can assume that people those who have frequent coughing problem are more prone to having tuberculosis infection associated with anaemia.

4.12 Distribution of Tuberculosis patients according to their physical condition (Bleeding, Fever, Anorexia, Weakness and Weight Loss) (n=23):

	Bleeding		Fever		Anorexia		Weakness		Weight Loss	
	Anaemic n (%)	Non-anaemic n (%)	Anaemic n (%)	Non-anaemic n (%)	Anaemic n (%)	Non-anaemic n (%)	Anaemic n (%)	Non-anaemic n (%)	Anaemic n (%)	Non-anaemic n (%)
Yes	12 (75)	4 (25)	16 (89)	3 (11)	17 (81)	4 (19)	17 (81)	4 (19)	17 (77)	5 (23)
No	6 (86)	1 (14)	2 (50)	2 (50)	1 (50)	1 (50)	1 (50)	1 (50)	1 (100)	0
Total	18 (78)	5 (22)	18 (78)	5 (22)	18 (78)	5 (22)	18 (78)	5 (22)	18 (78)	5 (22)

Table 16: Distribution of Tuberculosis patients according to their physical condition (Bleeding, Fever, Anorexia, Weakness and Weight Loss)

In this study, among 23 tuberculosis patients most of them are suffering from various types of physical problems. 16 patients have bleeding problem among which 75% are anaemic, 19 patients are suffering from fever among which 89% are anaemic, 19 people of each are suffering from anorexia and weakness among which about 81% of each are anaemic and 22 people are suffering from weight loss among which 77% people are anaemic. So we can assume that tuberculosis patients having such physical condition are more prone to getting anaemia problem.

4.13 Distribution of Tuberculosis patients according to their Tuberculosis type (n=23):

Tuberculosis Type	Anaemic n (%)	Non-anaemic n (%)
New Smear Negative	3 (50)	3 (50)
New Smear positive	8 (89)	1 (11)
Relapse case & Treatment failure	7 (87)	1 (13)
Total	18 (78)	5 (22)

Table 17: Patients distribution according to tuberculosis type

In the above table among the 23 tuberculosis patient 6 are new smear negative among which 50% are anaemic and 50% are non-anaemic, 9 patients are new smear positive among which 89% are anaemic and 11% are non-anaemic and 8 patients are relapse case and treatment failure among which 87% are anaemic and 13% non-anaemic. So, people having tuberculosis type relapse case and treatment failure were mostly associated with anaemia.

4.14 Distribution of Tuberculosis patients according to BMI (n=18):

Gender	Male n (%)		Female n (%)	
BMI (kg/m^2)	Below Average	Above Average	Below Average	Above Average
	9 (75)	3 (25)	5 (83)	1 (17)

Table 18: Distribution of Tuberculosis patients according to BMI

The average BMI range of Bangladeshi male is 22.1 kg/m^2 and for female is 21.7 kg/m^2. In our survey we have 18 anaemic tuberculosis patients among which the male patients below average range are 75% and above average are 25% and among the female patients below average are 83% and above average are 17%. So patients both male and female those who have BMI below the average are more prone to get tuberculosis infection associated with anaemia.

CHAPTER- 5

DISCUSSION & CONCLUSION

Discussion:

Tuberculosis (TB) is a major public health problem in Bangladesh. Bangladesh is one of the endemic region of Tuberculosis and Anaemia is a common complication of pulmonary tuberculosis. Demographic data of this study shows that there are many risk factors that are associated with anaemia in tuberculosis. People are usually infected because of their living condition, working condition and poor health (WHO, 2005).

This prospective study was done with 32 tuberculosis patients admitted in the hospital and was taking treatment for tuberculosis among which 23 patients has their clinical data required for this study. This study revealed the age distribution where patients (75%) between the age range 18-25 years are more frequently effected by tuberculosis than other aged patients. In other South Asian region this rate is almost the same. This may be because within this age range people used to have a job and stayed outside mostly and have to communicate with other people who might be tuberculosis infected (UNICEF, 2002).

In case of gender distribution in this study where male patients (67%) are more prone to the tuberculosis infection associated with anaemia than female patients (33%). Whereas in Canada the percentage of the rate in male is 59% and in female is 41%. This could propose that in Bangladesh male people mostly work in different condition than female where tuberculosis infection can easily be spread so male are more prone to tuberculosis infection (Fanning, 1999).

Among 32 tuberculosis patients married people (79%) where frequently affected by tuberculosis than unmarried & widowed people (78%). This may because married people usually have many members in their family living in the same house so tuberculosis infection can spread easily (Ramzi, 2005).

In this study people (79%) who were uneducated or have education level up to class 5 than the people (21%) have their education level from class 6 to higher are more prone to get tuberculosis infection. This is because people who were uneducated do not know about the tuberculosis infection, how it is spread or what the treatment options are.

People those who worked outside like employees (82%), day labor (100%), and businessmen (75%) where infected by tuberculosis more than those who are unemployed & house wives (50%).

In case of family members in this study, people who have more members in their family like 3-5 members (77%), 6-9 members (87%) are more prone to getting tuberculosis infection associated with anemia because more the family members more the chances of tuberculosis infection. And more the family members more the expenses for which they lack of healthier food and living condition and ultimately leads to tuberculosis associated with anaemia (USAID, 2010).

There is a relation between one's monthly expenditure and getting tuberculosis infection. People (79%) whose monthly expenditure is in between 2500-9000 Tk. are frequently affected by the tuberculosis infection associated with anaemia than the people (75%) whose monthly expenditure is in between 10000-15000 Tk. This is because poor people don't have any good place for living or healthy food to eat so they are more prone to get infected (USAID, 2010).

People who live in city (78%) and slum area (100%) are more prone to the tuberculosis infection associated with anaemia then the people live in village (17%) and rural areas (67%). This is because the these people work in the area where there is unhealthy environment and the slum people have the lack of nutrition causing them to getting tuberculosis infection associated with anaemia (Stang et al, 2005).

In this study we can see that people those who smoked before or currently smoking (83%) is to get tuberculosis infection easily than people who don't smoke (17%). So smoking is a factor of tuberculosis infection.

In case of tuberculosis type there are 89% people who where new smear positive and 50% people who where new smear negative. Other cases are relapse case & treatment failure (87%) patients. This is because most of the people stop taking medicines and don't finish the course (PHAC, 2011).

Tuberculosis patients most of the cases suffers from various types of physical problems such as bleeding (75%), fever (89%), anorexia (81%), weakness (81%), weight loss (77%) and so on.

These types of physical problems often lead a tuberculosis patient to suffer form anaemia (USAID, 2010).

Patient's height and weight is an important factor. Whose BMI (Body Mass Index) are not according to their age are more prone to get tuberculosis and they might also suffer from anaemia accordingly. The average BMI for Bangladeshi People is 22.1 kg/m^2 for man and 21.7 kg/m^2 for woman. In this study there are 75% of male have their BMI below the average and 83% of female have their BMI below the average. The tuberculosis patients (78%) those who have their BMI below the average are mostly associated with anaemia than those (22%) who have their BMI above the average (WHO, 2008).

Conclusion:

In Bangladesh people those who live in unhealthy condition or not getting nutritious food suffer poor health and weight loss as a result they are more prone to suffer from anaemia along with tuberculosis infection. Again working condition, illiteracy, smoking habit also is the associated risk factor for anaemia in tuberculosis.

Environmental factors such as lacking of health hygienic, poor sanitation, water, food habits, living area, malnutrition, lack of medical care etc. are mainly associated with anaemia in TB. So these risk factors must be well known by the people along with the cause and treatment of tuberculosis and anaemia to avoid such disease. Special steps must be taken by government to increase awareness among the people especially to the under privileged people. Treatment options must be available within the reach of the people and further steps must be take to run the DOT program more effectively.

CHAPTER- 6

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Annexure:

Anaemia in Tuberculosis Patient and Associated Risk Indicators

Identification no. Date:

Centre Name:

Address:

General Questionnaire

1. Name		
2. Age		
3. Sex	0= Male 1= Female	
4. Marital Status	0= Married 1= Unmarried & Widow	
5. Religion	0= Muslim 1= Buddha 2= Hindu 3= Christian	
6. Education Status	0= Uneducated/ Others 1= Class 1-5 2= Class 6-10 3= Class 10- Higher	
7. Profession	0= Unemployed/ Housewife 1= Day Labor 2= Employee 3= Business/ Other	
8. No. of Family Member		

9. Monthly Expenditure	Tk.	
10. Living Area	0= Village 1= City 2= Rural Area 3= Slum Area	
11. House Wall	0= Brick/ Cement 1= Clay 2= Bamboo 3= Others	
12. House Roof	0= Brick/ Cement 1= Clay 2= Bamboo 3= Others	
13. House Floor	0= Brick/ Cement 1= Clay 2= Bamboo 3= Others	
14. Smoking Condition	0= Never 1= Currently 2= Before 3= Occasionally	
15. Presence of Cough before TB	0= No 1=Yes	
16. How many days of cough before TB	Week/ Month	
17. Bleeding with Cough	0= No 1= Yes	

18. Fever	0= No 1= Yes	
19. Weakness	0= No 1= Yes	
20. Anorexia	0= No 1= Yes	
21. Weight Loss	0= No 1= Yes	
22. Any Medication taken before TB infected	0= No 1= Yes	
23. Any Anti-helmentic drugs taken before TB infected	0= No 1= Yes	
24. Site of TB	0= Pulmonary 1= Extra-pulmonary	
25. Type of TB	0= New Smear negative 1= New Smear positive 2= Relapse Case 3= Treatment Failure	
26. Height in cm.		
27. Weight in kg.		
28. Hb (gm/dl)		
29. MCV (fl)		
30. MCH (pg)		
31. MCHC (g/dl)		
32. RDW-CV (fl)		