Chapter-5

Discussion

(A) EPIDEMIOLOGY OF PTB:

The influence of environmental factors like temperature, humidity and plays a significant role in the survival and infectivity of various important parasitic infections like gastro-intestinal problems (Mathur et al.1984; Walia et al. 1986); skin diseases (Chopra and Charanjeet, 1994); malaria (Dutta et al.1991; Chopra et al.1988) etc. But there appears to be no report on variations of incidence of Pulmonary Tuberculosis (PTB) infection in humans in different months and also in relation to various abiotic variables viz. temperature, relative humidity and rainfall.

During present study it was observed that the incidence of PTB infection at Saharanpur varied differently in different months. The incidence was found to be maximum in the months-April to July i.e. Summer (significant at LSD$_{0.01}$: significantly more in March and August to October i.e. Moderate climate (Rainy type, significant at LSD$_{0.05}$) and insignificantly low incidence of the diseases in winters i.e. from November to February (non-significant at LSD$_{0.05}$). In both the years of study, it was maximum in May (15.0%; significant at LSD$_{0.01}$ in first year and 13.4%; significant at LSD$_{0.01}$ in second year) when mean temperature was 29.78°C-30.39°C mean relative humidity was 52.51% - 62.87% and mean rainfall ranged from 0.97 mm-3.46 mm; and minimum in January (2.5% in first year and 2.8% in second year) having mean temperature 12.94°C-13.59°C; mean relative humidity 83.23% - 86.96% and mean rainfall ranging from 129 mm -2.65 mm.

The statistical analysis observed that the degree of relationship of PTB incidence with abiotic variables i.e. Temperature, Relative Humidity and Rainfall varied. However, the incidence of the disease was found in all the months of both the years of study, in the first year, the PTB incidence had positive correlationship with temperature (r-value +0.8762): negative correlation with relative humidity (r-value=-0.8731) and positive correlation with rainfall value +0.2377). In the second year, the incidence of the infection again positive correlation with temperature (r-value +0.9398); negative
with relative humidity ($r$-value-0.634) and positive correlation with rainfall $r$-value +0.5143)

The study showed that in summers when the temperature is high (generally maximum), relative humidity is comparatively low and rainfall is generally minimum, the incidence of PTB infection was encountered to be at its maximum peak levels, it showed that temperature alone or in combination with other variables influenced the rate of infection to a major extent positively. In rainy season, when the temperature is high, relative humidity is also high and rainfall is at its maximum, the prevalence of infection is moderately high but less than that in summer. It shows that high rainfall combined with high temperature significantly affects PTB incidence. In winters, the temperature is low (generally lowest), relative humidity is high as compared to summers and rainfall is low, the incidence of infection is at its lowest percent It shows that low temperature is unfavourable for the prevalence and surveillance of PTB infection proving the winters to be a healthy season. Thus, abiotic variables showed a great influence on the susceptibility of PTB infection in humans. A combination of these variables or their interaction seemed to be more responsible for variation in the incidence of Infection.

In recent past the epidemiological status of PTB infection has been observed all over the globe in developed as well as in developing countries. The situation of PTB infection in developing countries including India is still more worse and alarming than in developed countries Prasad et al. (1960) studied the symptomatology of tuberculosis patients in two surveys carried out in 1955 and 1965. The results showed that cough was present in 86.4% cases while haemoptysis and fever in 11.8% and 75% of cases respectively. A large percentage of 74% had multiple symptoms.

Snider et al. (1985); and Krishnamurthy and Chauduri (1990) stated that the risk of arising new cases of tuberculosis was 69% from those recently and who got reinfected (reinfection & reactivation) in a South Indian rural population. According to Roy and Rizvi (1991), exact incidence of tuberculosis meningitis is still unknown, whereas incidence of tuberculosis in India was reported to be 0.13%. Singh et al. (1993) observed that in investigations of Renal TB, a positive tuberculosis test was present in 95% of the cases. Further they observed that Genitourinary tuberculosis was found in
15-25% of pulmonary TB cases at Varanasi in India and other developing countries while its incidence was less in Western countries Mishra et al. (1995) studied 100 cases of tuberculous meningitis. Out of 23472 children examined in all, they reported that the total incidence was 0.42% of the disease during the period of Jan 1992 to Dec 1992, at Allahabad. Chandra et al. (1995) reported that in Allahabad TB meningitis was one of the commonest cause of disability in groups of patients with upper motor neuron lesion (59.14%).

Karak et al. (1996) observed that in Calcutta the prevalence of atypical Mycobacteria in AFB positive culture was 11.74% which caused pulmonary infections. Agarwal (1991) described magnitude of TB in India and stated that more than 140 lakhs people have TB. Of these, 35 lakhs were sputum positive and about 22 lakhs cases were being added every year. Among these 10 lakhs were sputum positive, More than 1000 people died from TB everyday, He further viewed that one sputum positive case can infect 10-15 healthy individuals in one year. Also, less than 30% of patients could complete the full course of treatment Preliminary reports of WHO have shown MDR TB to be as high as 13% of all TB cases (WHO, 1997).

WHO (1996) reported that highest incidence of TB across the globe was Central Africa where death rate exceeded 200/100,000 a year and in Asia, particularly India; where death rate was between 100 and 200/100,000 a year. Sachan (1997) reported that in Agra maximum number of patients died of tuberculosis in year 1995 than in any other year in the history. Arora and Babu (1997) reported that prevalence rate of TB and probably active TB varied from 13-25 per 1000 persons aged 5 years and above. Ip et al. (1998) evaluated 183 consecutive cases of Bone Marrow Transplant (BMT) recipients and reported that 10 patients were found to develop pulmonary tuberculosis post BMT, yielding an incidence of 5.5%.

Kumar et al. (1999) reported that PTB (85.02%) was the commonest of all other forms of TB. He further revealed a higher association of PTB in patients with head and neck cancer (42%). Gupta et al. (1999) described the role of ELISA test in diagnosis of suspected cases of genitourinary tuberculosis and concluded that Ig M was positive in 87.0% of the cases, Nigam et al. (1999) reported that both Ig G and Ig M were significantly higher in children having tuberculosis infections,
Ghoshal and Roy (2000) said that smears examination for presence of acid and alcohol-fast bacillus (AFB) was of supreme importance for its specificity and also in identifying the principal mode of transmitting infection by sputum Prabhakar (2000) reported that TB is estimated to kill approximately 5,00,000 individuals per year; 1000 every day, and one every minute in India. He further reported that the prevalence of TB as to today was 2 to 8/1000 sputum positive cases with an incidence of 1.3 in Bangalore (Karnataka) to 2.6 in Tiruvallur taluk (Tamil Nadu) per 1000 population. Bakhle (2000) reported that over 50% of adults in India are infected with \( M \) \( \text{tuberculosis} \) and there are totally 1.4 crores cases of active TB. About 30 lakh new cases are detected each year. He also indicated the alarming fact that India harbours 1/3 of all TB cases in the world and twice as many as China.

The present results on epidemiological status of PTB infection revealed that in first year among SPE, there were 51.44% (non-significant at ANOVA \( 0.05 \) as compared to Mx -ve) to be PTS positive, either in symptomatic or nonsymptomatic form and in second year, the percentage of PTB was 47.99% (non-significant at ANOVA \( 0.05 \) as compared to Mx -ve) among the infected patients, the frequency of symptomatics was found to be more non-symptomatics. In the first year there were 1.34% (significant at ANOVA \( 0.05 \) as compared to non-symptomatics) symptomatics and 28.66% (significant at ANOVA \( 0.01 \) as compared to symptomatics) non-symptomatics. Similarly in second year, symptomatics were 73.18% (significant at ANOVA \( 0.01 \) as compared to non-symptomatics) and non-symptomatics were 26.82% (significant at ANOVA \( 0.01 \) as compared to symptomatics).

Out of PTB infected/Mx. +ve cases, 10.28% (significant at ANOVA \( 0.01 \) as compared to Mx. +ve) in first year and 11.73% (significant at ANOVA \( 0.01 \) as compared to Mx -ve) in the second year, were those who were reinfected while others were infected first time (as diagnosed). Among symptomatics, more frequency of chronic cases of PTB were encountered than the acute cases. In the first year acute cases were 30.53% (significant at ANOVA \( 0.05 \) as compared to chronic) and chronic cases were 40.81% (significant at ANOVA \( 0.05 \) as compared to acute). In the second year acute cases were 40.08% (significant at ANOVA \( 0.05 \) as compared to chronic) and chronic cases being 59.92% (significant at ANOVA \( 0.05 \) as compared to acute). It seemed that cough and
cough with multiple symptoms was very much prevalent. However other symptoms may vary from patient to patient or from area to area and depending upon other factors like age, sex, socio-economic conditions, habits and habitats.

The previous literature indicates that there is low frequency of bacillary Gases (AFB positive) in Tumkur district, Raj Narain et al. (1961) reported 4.1 per 1000 bacillary cases. Karak et al. (1996) reported 20% (i.e 90/450 sputum specimens) sputum samples were positive for AFB (stained by Ziehl-Neelson Method) and 19.1% (i.e. 86/450) were culture positive for AFB at Calcutta. Four patients (i.e. 0.88%) showing smear positive but culture negative, were already receiving specific antitubercular drugs, which may be the cause of failure to grow in culture media, Out of 86 positive cultures, 15 (17.04%) were cases of atypical mycobacteria and the rest 71 were cases of *M tuberculosis* infection.

Arora and Babu (1997) described salient findings of NSS carried out in 1955-57 and reported that the rate of bacteriologically positive cases per 1000 population varied from 2-8 Kumar et al. (1999) reported 7.68% samples to be AFB positive in clinically suspected cases of tuberculosis with various malignancies. Bakhle (2000) estimated that a single case of TB infection spreads infections to 15-20 people in a year. Prabhakar (2000) stated that a single sputum positive patient can infect 10-20 normal healthy individuals especially the more vulnerable age group below the age of 5 years in a year time.

During present study, the microscopic examination of sputum smear for AFB test indicated that there were only 17.45% (significant at ANOVA 0.01 as compared to AFB -ve) AFB +ve i.e. the bacillary cases (infectious population) in the first year and 15.08% (significant at ANOVA 0.05 as compared to AFB-ve) in second year, Out of PTB infected patients, 82.55% (significant at ANOVA 0.01 as compared to AFB +ve) were AFB-ve i.e. non-bacillary cases in the first year and 84.92% (non-significant at ANOVA 0.05 as compared to AFB +ve) in the second year.

Similar findings about the epidemiological status and AFB tests in populations have been reported earlier by the workers such as , Karak et al. (1996), Arora and Babu (1997), Kumar et al. (1999) and Prabhakar (2000). The present study showed that the high frequency of AFB negative cases may be due to the fact that tuberculosis may not
have yet ulcerated into the bronchi of the patient and/or the patient may have been put on antitubercular treatment (ATT) which is known to convert a sputum positive patient to sputum negative, within a month or so, and the concentration of tubercle bacilli may be too less to detect on examination of sputum smear. Similarly, Chakraborty and Chakraborty (2000) also stated that on starting the antitubercular treatment, the sputum culture for AFB becomes negative in over 90% cases within 3 months of initiation of treatment.

Alvarez and McCabe (1984) reported that renal tuberculosis was predominantly a disease of young to middle age adults with peak incidence 30 years of age. Roy and Rizvi (1991) reported minimum incidence of the disease tuberculosis meningitis in the patients below the age of 6 months. Mehta and Sachdeva (1993) observed that tuberculosis of the gut can occur at any age but were most frequent between 20 and 75 years of age. Further in symptomatics they reported the percentage of infection to be in the order 21-40 > 40+ > 0-20 years age groups and in non-symptomatics the percentage of infection was in the order 0-20 > 40+ > 21-40 years age group.

Mishra et al. (1995) reported that children at Allahabad between the age of 7 to 12 months were more prone (26%) to tuberculosis meningitis, whereas those below 6 months of age had minimum incidence (8%). Karak et al. (1996) reported that in Calcutta out of 15 patients positive for a typical mycobacteria in pulmonary infection, 8 were in age group upto 30 years, 3 in 31-40 years (minimum) and 4 in age group above 40 years. Dholakia (1997) reported that half of all TB cases in India occurred in the age group of 15-44 years, which were economically productive years of the persons. Further, he suggested that prevention of TB deaths and effective control of this disease can thus have a significant beneficial impact on economic progress of the country. He also estimated that among all the infectious diseases, tuberculosis causes the maximum number of deaths, the estimated death rate being 3 million in 1995, of which 6% occurred among children aged less than 15 years.

Puri et al. (1998) reported a case suffering from PTB with Pancytopenia, who had previously also been treated for tuberculosis. Ip et al. (1998) observed that the patients in the age group of 17 to 40 years developed tuberculosis post BMT. Gupta and Bhangu (1999) found that among leprosy patients 60% were in age group of 11-30
years, with male preponderance (76%). Eapen et al. (1999) analysed records of age and sex of patients with tuberculosis lymphadenitis from 1974 to 1998 at Calicut and found that mean and median age of patients rose steadily in the 25 years (mean from 26.9 to 34.4 and median from 24 to 32 in 1974-78 10 1994-98 respectively).

Singh and Goel (2000) reported bone and joint tuberculosis in patients between age group 15-70 years at Varanasi. Prabhakar (2000) reported that the annual rate of infection (ARI) was around 1% to 2.3% with a sharp increase in the rate of infection in the younger age group below the age of 5 years, at Chennai. Mostly the disease occurred 2-3 years after infection, mortality rate being 6% in younger ones and 1% in adults. The more vulnerable age group was below the age of 5 years. Davies et al. (2000) reported that most of the cases of Genital tuberculosis (65.8%) were in the age group of 21-30 years.

In the present study, among different age groups, percentage of PTB infection in tuberculosis patients was maximum in the age group 21-30 years (29.61-29.91% significant at ANOVA0.01). The incidence was minimum in 0-10 years age group (2.49% - 2.79%). The incidence of PTB infection in different age groups was in the order 21-30>31-40>11-20>70>41-50>51-60>61-70>0-10. The percentage of infection in symptomatic cases in different age groups were in the order: >70 > 61-70 > 21-30 > 31-40 >41-50> 11-20> 51-60 > 0-10.

Thus in both the years, the percentage of PTB infection in symptomatics was maximum in > 70 years age group and minimum in 0-10 years age group. Similar findings have been reported by Alvarez and Mc Cabe (1984), Roy and Rizvi (1991), Karak et al. (1996), Dholakia (1997), Lp et al. (1998), Gupta and Bhangui (1999) and Davies et al. (2000.)

Further, the present study showed that among SPE the maximum PTB infection (Mx.+ve) In the middle age group (21-40 years) may be because of the reason that the persons in this age group are more exposed to outer world as compared to other age groups, They remain actively and socially more involved in the day to day works, look after their family and social affairs, thus having greater chance of exposure to infection as compared to low and higher age groups. The lower age group i.e. 0-10 years is mostly taken care of by the elderly people of the family and thus remains
protected from the infection. The more incidence of symptomatic infection in elderly people may be due to low immunity, which becomes with age.

The PTB infection seemed to be selective to the male sex. Various workers have described the percentage of infection to be more in males than in females. Mishra et al. (1995) in the study of tuberculosis meningitis in children found that male sex was predominant (71%) over females at Allahabad. Karak et al. (1996) reported that out of 15 patients found to be positive for a typical Mycobacteria pulmonary infection, incidence in males (9) was higher than in females (6) at Calcutta. Arora and Babu (1997) described salient findings of National Sample Survey (NSS) and reported that prevalence rate of tuberculosis was lower in females than in males, especially in the age group of >35 years at Pondicherry. Also, the prevalence rate, especially in men showed continuous increase with age. In contrast, Eapen et al. (1999) reported that tuberculosis lymphadenitis was predominant in females among all age groups (63%) except 0-10 years. It is an indirect evidence for increase in age of primary infection and possibly a decreasing rate of infection. Mehta and Sachdev (1993) observed that tuberculosis of the gut occurred with approximately equal prevalence in men and women, at Chandigarh. Gupta and Bhangui (1999) reported male preponderance (76%) in leprosy patients at Calcutta.

In present study, the sex-wise data revealed that the percentage of PTB infection incidence was considerable higher in males as compared to females in both the years of study i.e infection in males (62.01%- 67.91%, significant at ANOVA0.05) and in females (32.09%- 39.99% significant at A.NOVA0.05) In symptomatics also, the percentage of PTB infection in males was higher as compared to females. It was 74.31% -76.58% (significant at ANOVA0.05) in males and 65.05% - 67.66% (significant at .ANOVA0.05) in females during the study period. The more infection in males may be due to reason that comparatively they are more exposed to the infected cases at their working sites/offices & in traveling etc.

Similar findings have already been reported earlier by Mishra, et al. (1995), Karak et al. (1996), Arora and Babu (1997), Chopra et al. (1997) and Gupta and Bhangui 1999).
TB infection has been reported to be higher in lower socio-economic class as compared to higher socio-economic class.

Spence et al. (1993) has shown the association between poverty and TB. Within the developed world the highest rates of disease were seen in the poorest sections of the community. The percentage of TB infection was 74.3% in an overcrowding area as compared to 25.7% in non-overcrowding areas. Also that the maximum percentage of symptomatic infection was found to be 71.8% in overcrowding area, while maximum percentage of non-symptomatic infection was observed to be 31% in non-over crowded area of this locality.

Mishra et al. (1995) reported that in socio-economic classes there was maximum number of cases of tuberculosis meningitis in children with third grade of malnutrition (47%) followed by second grade (35%) on the basis of the classification of Indian Academy of Pediatrics. The children with low body weight were found to be more prone for tuberculosis meningitis (65%). In contrast, Bhandari et al. (1984) observed maximum number patients with second grade of malnutrition followed by third grade in case childhood tuberculosis, Hegde (1996) said that poverty, overcrowding, bad sanitary surroundings, population migration, wars, famines and pestilence were cause of much of human misery in Mangalore (Karnataka). Grover (1996) reported that out of 20 million active TB cases, 85% of the tuberculosis burden was in the poor developing countries and of this India beared 50% of cases. Arora and Babu (1997) reported that prevalence of TB was high in overcrowded slums at Pondicherry where low-income groups of population live.

Davies (2000) reported that the great majority of people at Liverpool, USA suffering from TB were amongst the persons availing poorest health care facilities. Prabhakar (2000) observed that TB continues to be a major health problem in India and other developing countries with poor economy, over crowding, under nourishment, unchecked population explosion compounded in recent years with dual infection, HIV and TB. Bakhle (2000) stated that though tuberculosis is more common in poor and malnourished people, it spreads without regard for socio-economic status.

The present study observed that among different socio-economic classes i.e. lower, middle and upper, the percent incidence of PTB infection was maximum in lower
class and minimum in upper class in both the years of study. It was 61.99% - 63.13% (Significant at ANOVA_{0.01}) in lower and 8.39%- 9.35% (Significant at ANOVA_{0.05}) in upper class. In symptomatics, the percentage of infection was maximum in lower (72.36%-75.22% significant at ANOVA_{0.01}) and minimum in upper (63. 33% - 70.00%. non-significant at ANOVA_{0.05}) socioeconomic class.

It showed that percentage of incidence of PTB infection (Mx +ve) is much higher in lower economic class persons as compared to upper and middle economic class in both the years of study. A possible reason of this significant difference is that the low-income group patients generally cannot afford to consult doctors for treatment at an early stage of infection. As a result of which the infection continues to develop undisturbed in their body/lungs. Hence at later stage the sputum becomes AFB positive. Moreover the TB is considered to be a social taboo, so the people generally hide the infection which become worse with time. While in case of upper class the people are more literate aware so they generally contact doctors in early stage of symptoms and take drug treatment and thus minimising the chance of AFB +ve sputum.

It is obvious that high percentage of infection in low economic group was probably due to poor diet, hard over working conditions, poor hygienic conditions, lack of education and lack of health awareness. It is generally believed that dampness is basically sign of low socio-economic status. Dampness is usually associated with low sunlight availability. These factors combine and lead to increase mycobacterial proliferation, thus help in spreading the infection in people of damp housing area. Thus, it can be said that the rate of tuberculosis invariably decreases as the standard of living and nutrition improve. The findings were similar to the works of earlier workers except that of Krishnaswami \textit{et al.} (1998) who have reported that there was no change in the TB pattern of lower and higher economic groups at Madras.

Among vegetarian and non-vegetarian patients, their was no significant difference in percentage of tuberculosis infection (Mx. +ve) However, the infection was found to be more prominent in non-vegetarians. It was observed to be 47.66% -51.96% in non-vegetarians and 48.04% - 52.34% in vegetarians. In symptomatic cases higher percentage 77.42% - 77.78% of infection was observed in non-vegetarians and lower
percentage (65.48% - 68.60%) in vegetarians. But, the difference was non-significant at $\text{ANOVA}_{0.05}$. It seemed that the PTB infection is non-selective to the feeding habits of persons at Saharanpur and can equally infect the vegetarians and non-vegetarians.

The infection seemed to be more prevalent among smokers. The present study observed that the percentage of PTB infection was higher in smokers (64.80% - 68.44% significant at $\text{ANOVA}_{0.05}$) than in nonsmokers (31.56% - 35.20%; significant at $\text{ANOVA}_{0.05}$). In symptomatics, the percentage of PTB infection was again higher in smokers 73.56% - 75.10% significant at $\text{ANOVA}_{0.05}$ than in nonsmokers 67.26% - 69.03% significant at $\text{ANOVA}_{0.05}$. Thus it is clear that the infection was significantly more prone to smokers than nonsmokers. There are a number of reasons for this difference.

However, Arora and Babu (1997) said that prevalence in the villages of Pondicherry was not appreciably less than in cities, in the present study, on the basis of habitat (urban vs rural population), it was found that the higher percentage of infection was suspected in patients in urban (53.91% - 56.07% non-significant at $\text{ANOVA}_{0.05}$) than in the rural population (43.93% - 46.09% non-significant at $\text{ANOVA}_{0.05}$) in both the years. Similarly, the percentage of PTB infection in symptomatic cases was higher in SPE of urban (73.33% - 76.68%; non-significant at $\text{ANOVA}_{0.05}$) than in patients of rural areas (68.79% - 69.09%; non-significant at $\text{ANOVA}_{0.05}$).

There are many probable factors responsible for lower percentage of the infection in rural areas. In rural area per capita space is more, fresh air is plenty and the atmosphere is pollution free. Apart from these factors the houses in villages get plenty of sunlight as they are generally isolated and the villagers spend more time in outdoor acts and farmworks, thus having more time to live under the sun rays. The role of sunlight in Killing *Mycobacterium tuberculosis* is well known. In urban areas (except higher-class) people generally reside in complex houses with narrow lanes, thus having low chances of sunlight exposure. The office/factory workers also work inside the rooms, thus having less exposure to sunlight, as compared to villagers. This low exposure might help in spreading the infection among urban population. Also, generally TB hospital are located in urban areas and the indiscriminate spitting habit of the patients (infected sputum) may be one of the major causes of droplet infection
to the healthy population living in the urban areas.

There seems to be no report on TB infection among different blood groups. The present study showed that the persons of all the blood groups viz A, B, AB and O were infected with PTB infection. Similar trend was observed in both the years. The Mx. +ve i.e. PTB infection was in the order O (34.69% - 35.85%) > B (26.41% - 26.53%) > AB (20.41% - 24.53%) > A (13.21% - 18.37%) in both the years. It is important here to mention that the number of SPE was also in the similar order i.e. O>B>AB>A.

However, the percentage of persons infected in relation to number of SPE in different blood groups was almost the same i.e. ranging from 47.62% to 52.94% in the first year and 50.00% to 54.16% in second year, which signifies that the PTB infection was not selective to any particular blood group. It appears that variations in percentage of infection in different blood groups were just because of the prevalence ratio of different blood groups in the population surveyed. The analysis of variance (ANOVA) also revealed that the variations in all the 4 blood groups were non-significant at ANOVA_{0.05} in both the years of study.

**B** PATHOLOGY OF PTB:

Various haematological, biochemical and tissue reactions against infection have been reported. Singh et al. (1993) reported that in investigation of renal TB, elevated ESR and lymphocytosis though common are not useful for diagnosis. Also, a positive tuberculin test is present in 95% of the cases, but it is of little help.

Shijubo et al. (1993) said that acute phase reactants such as ESR, c-reactive protein, intracellular adhesion molecule (ICAM-1) and polyclonal gamma globulins are increased in DT. Jain (1997) found out that the white cell variable, usually with predominant lymphocytes and monocytes in aspirate from tuberculosis serous effusions in extra PTB. The aspirate is an exudate (i.e. protein content is more than 3.0gm%). Vijayan (2000) reported that DT patients might have mild normochromic anaemia with a normal WBC count Neutrophilia is more common than lymphocytosis or monocytosis.
The present study revealed that PTB infection caused various changes in haematological parameters in the blood of patients (Tables 11.01-11.02 and Figs. 11.0.1-11.0.2). Among various haematological parameters of the patients suffering from PTB infection in its acute stage; the values of HB (9.82 g%), TEC (3.96×10^6 cells/cu. mm), MCV (69.32 u3), MCH (21.37 u mg), MCHC (26.98%), Lymphocytes (28.4%) and Eosinophils (2.2%) were found to decrease; while the values of ESR (46.53 mm), PCV (42.97%), TLC (21500 cells/cu.mm), Polymorphs (71.8%) were found to increase, as compared to the blood samples of non tuberculous/Mx -ve persons in the SPE.

Further, in chronic cases also, HB (7.57g%), TEC (3.87×10^6 cells/cu.mm), PCV (24.03%), MCV (73.31 u3) MCH (25.00 umg), MCHC (28.31 %) were again less than Mx. -ve persons; also the lymphocytes (19.7%) and eosinophils (0%) were much reduced further than acute cases. The values of ESR (73.50 mm), TLC (24600 cells/cu.mm), Polymorphs (81.0%) were much increased against the values of non-tuberculous individuals. LSD values when calculated indicated that the values were non significant at LSD_{0.05} in acute and chronic cases for HB, TEC, PCV, MCV, MCH, MCHC, Lymphocytes, Eosinophils, Monocytes and Basophils The values were significant at LSD_{0.05} for acute and chronic cases for TLC only For ESR, in acute cases the value was significant at LSD_{0.05} and chronic cases the values was significant at LSD_{0.01} For polymorphs in acute cases the value was non-significant at LSD_{0.05} but in chronic cases it was significant at LSD_{0.05}

The higher values of ESR in the patients of both acute and chronic groups were due to anaemia in them. The possible reasons of changes in different haematological parameters as also reported by Harrison (1991) may be due to depletion of host's nutrition, suppression of bone marrow by certain endogenous pyrogens Interleukain (IL-1) and tumor necrosis factor (TNF) which lead to anaemia, low degree of fever, eosinophilia etc. Besides this, the changes in haematological parameters like decrease in TEC, Hb, PCV, MCH, MCHC and increase in ESR may lead to development of microcytic anaemia. Haemolysis of RBCs, suppression of bone marrow and deficiency of folic acid may also result in these changes,
The present study also revealed the biochemical changes in the blood of PTB infected patients. The values of SGOT (38.13 IU units), SGPT (42.17 IU units), S.bilirubin (0.97 mg/dl) and S.Alkaline Phosphatase (206.71 IU/L) were found to increase in acute cases, which further increased in chronic cases of PTB infection. The increased values of SGOT (43.71 IU/units), SGPT (48.61 IU units), S. Bilirubin (1.81 mg/dl) and S. Alkaline Phosphatase (247.69 IU/L) were observed in chronic cases. However, only Serum total proteins were found to decrease in acute cases (6.63g%) and further more decreased in chronic cases (5.53g%) of PTB infection as compared to normal/non-tuberculous patients of the SPE LSD values when calculated indicated that the SGOT and S. Alkaline Phosphatase values were significant at LSD\(_{0.05}\) in acute cases and significant at LSD\(_{0.01}\) in chronic cases. SGPT was found to be significant at LSD\(_{0.01}\) for both acute and chronic cases. s. Bilirubin was found to be nonsignificant at LSD\(_{0.05}\) in acute but was significant at LSD\(_{0.05}\) in chronic cases of PTS infections. In contrast to our findings Jain (1997) reported that the protein level was usually high in pleural effusion in tuberculous meningitis. In present study the changes in biochemical parameters may be due to the increased activity of alkaline phosphatase and transaminases the blood because damaged hepatic cells.

(C) **IN VITRO EFFICACY OF DRUGS AGAINST MYCOBACTERIUM SP:**

Most of the work has been done on the treatment of TB with Allopathic drugs. Chandrashekaran *et al.* (1992) reported that availability of the powerful drug rifampicin has reduced the duration of antituberculosis treatment and also increased the efficacy of treatment regimens, Woods and Witebsky (1995) reported resistance to isoniazid and to both isoniazid and rifampicin with regard to resistant M, *tuberculosis*, from several institution. WHO (1997) reported that MDR TB cases resistant to at least isoniazid and rifampicin are increasing worldwide. Takarnizawa *et al.* (1997) reported case of solitary pulmonary cavity in the apex of the left lung, having M. Avium infection, who was treated with isoniazid, rifampicin, and streptomycin under a tentative diagnosis of pulmonary tuberculosis, Sakuma *et al.* (1997) reported a case having multiple intracranial tuberculoma who was treated with antituberculous drugs viz. isoniazid, ethambutol, pyrazinamide and streptomycin. Sachan (1997) reported
that a patient can be categorised a case of MDR TB when he is resistant to two or more first line drugs including isoniazid and rifampicin.

Chambers et al. (1998) reported the reduction of *M. tuberculosis* in the sputum of patients with PTB, during administration of amoxicillin/clavulanate, ofloxacin and isoniazid drugs, in *vivo*. Among all the drugs administered, isoniazid was most effective, reducing *M. tuberculosis*, Thanka et al. (1999) described a case of rifampicin induced acute renal failure and other side effects possibly due to rifampicin toxicity, thus highlighting the life threatening complication of rifampicin. Praharaj et al. (1999) reported the incidence of HIV infection in tuberculosis patients and determined the susceptibility pattern of *M. tuberculosis* to first line anti-tubercular drugs, commonly used. The resistance to one drug was 9.2%, whereas multidrug resistance was 3.2% in HIV infected patients. Behl et al. (1999) reported that isoniazid, rifampicin and ethambutol against *M. tuberculosis* infection were the drugs of first choice and can be used as excellently effective antimycobacterial prophylactic antibiotics. Iseman (2000) stated that a combined resistance to rifampicin and isoniazid can be referred to as MDR TB, since in actuality, majority of these cases has resistance to other drugs as well. Singh and Goel (2000) used rifampicin isoniazid, ethambutol and pyrazinamide against bone and joint tuberculosis and found positive results in healing the disease. Similarly, *in vitro* antimicrobial activities against *Mycobacterium* sp. have also been studied. Jacobs (1995) reported that fluoroquinolones were highly active *in vitro* against many mycobacterial species. Salie et al. (1996) reported that the organic extracts of Arctotis auriculata and Helichrysum crispum inhibited the growth of *Mycobacterium Smegmatis*, *in vitro*. Lounis et al. (1997) that isoniazid was more bactericidal than any of the aminoglycosides or fluoroquinolones tested against *M. tuberculosis*. Bergmann and Woods et al. (1997) evaluated the reliability of mycobacterial growth indicator tubes (MGIT) for testing susceptibility of *M tuberculosis* to ethambutol and streptomycin. Selvakumar et al. (1997) studied *in vitro* antimicrobial activity of trifluoperazine (TFP) by broth dilution method using Youman's and Karlson's medium against *M. tuberculosis* and reported the minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC) of TFP against the bacterial to be 8 and 32 mg/L respectively, Jain (1998) observed profound inhibitory effect of garlic oil in
comparison with that of primary antitubercular drugs - isoniazid, PAS and streptomycin, both \textit{in vitro} and \textit{in vivo}. Cavalito and Bally (1998) described the antibacterial activity of garlic was due to allicin. Kumar \textit{et al.} (1999) found out that the resistance pattern to antitubercular drugs was in the order INH/isoniazid (17.07\%) > PAS (8.5\%) > streptomycin (6.7\%) > rifampicin (4.6\%) > ethambutol (0.35\%).

The present study determined that \textit{in vitro} antimicrobial efficacy of different drugs Allopathic, Ayurvedic and Homeopathic at different potencies/concentrations, against \textit{Mycobacterium} sp. in YK medium cultured at 37°C and observed for growth at a week interval time for 4 weeks. The inhibitory actions of Allopathic drugs (Streptomycin, Rifampicin, Pyrazinamide and Isoniazid) at different potencies against \textit{Mycobacterium sp} showed that there was no growth (no change in (OD) for all the four drugs at all the potencies up to a concentration of 100ug/ml. It showed that up to this concentration all the four drugs were found effective inhibiting the bacteria. At 10ug/ml concentration rifampicin, pyrazinamide and isoniazid continued inhibiting \textit{Mycobacterium sp} but streptomycin failed to inhibit as observed on 21\textsuperscript{st} and 28\textsuperscript{th} day, thereby indicating least effectiveness of streptomycin. Amongst all the 4 drugs. The lowest concentration (1ug/ml) of all the 4 drugs was ineffective as growth of \textit{Mycobacterium sp} was observed on 21\textsuperscript{st} day. However, minimum absorbance was recorded for rifampicin at concentration of 1ug/ml on 21\textsuperscript{st} and 28\textsuperscript{th} day. It showed that among all the allopathic drugs tested, rifampicin was more effective in inhibiting the bacteria. The inhibitory actions of Ayurvedic drugs (Swarn Vasant Malti, Mahalakshmi Vilas Ras, Rajmrigank and Shringyadi) at different potencies against \textit{Mycobacterium sp}, revealed that no growth was observed against all the four drugs upto a concentration of 1 mg/ml on 21\textsuperscript{st} and 28\textsuperscript{th} days. It showed that up to this concentration all the four drugs were found effective inhibiting the bacteria. But below this concentration i.e. at 100 ug/ml and lower up to 1 ug/ml all the 4 drugs were found ineffective on 21\textsuperscript{st} day. However, Mahalakshmi Vilas Ras was found to be most effective against \textit{Mycobacterium sp}, for corresponding concentrations as compared to other Ayurvedic drugs tested. Shringyadi churana was found to be least effective against the bacteria. Jain (1998) also observed profound inhibitory effect of garlic oil in comparison with that of primary antitubercular drugs.
The inhibitory actions of Homeopathic drugs (Arsenic Iodatum 30, Stannum iodat 30, Kalium iodat 30, Silicea 30) at different concentrations against *Mycobacterium sp.* showed that all the potencies could not completely inhibit the bacteria from the concentration of 10 mg/ml to 1ug/ml. Amongst all the four Homeopathic drugs Arsenic iodatum 30 was found to be most effective at the concentration of 1ug/ml as compared to other drugs at this concentration Silicea 30 was found to be least effective on 21st and 28th day at the concentration of 1 ug/ml in comparison to other drugs at this concentration.

For all drugs tested i.e Allopathic, Ayurvedic and Homeopathic at different potencies/concentrations no growth (no change in OD) was observed on 14th day. This may be due to the reason that *Mycobacterium sp* is very slow growing and requires more time than this to get a detectable OD. However, during this period the drugs also exerted their influence as in few drug concentrations no growth of the bacteria was observed on 21st day also. Thus it can be said that up to 14 days the drugs exerted their chemotherapeutic influence effectively. After this period, at some concentration or the other all the drugs were found ineffective in inhibiting the bacteria completely as indicated by the change in OD. It may be because of the degradation of the properties the drugs due to prolonged period incubation, which may have failure to inhibit the bacteria completely.

It was concluded that PTB infection was encountered maximum in summer and minimum in winter, with moderate incidence being encountered in rainy months. Various abiotic factors temperature, relative humidity and rainfall influenced the prevalence of the disease, differently. The infection was related to climatic conditions, age, sex, socio-economic status, habits and habitats of persons at Saharanpur. However, the disease was not selective to blood groups of patients. Amongst PTB infected patients the frequency of symptomatic was higher in comparison to non-symptomatics. The infection was more in males, middle aged persons, urban population and lower socio-economic class. The bad habits such as smoking, alcohalism and careless spitting; malnutrition, overcrowding, extra-strain, overwork, poor ventilation; unhygienic conditions and socio-economic factors seemed to contribute much in spreading the PTB infection. The infection caused significant
changes in ESR, TLC, Polymorphs, SGOT, SGPT, Serum bilirubin and Serum alkaline phosphatase in the infected patients. Comparing the overall efficacy of different drugs, it was revealed that Allopathic drugs were most effective as compared to Ayurvedic, which in turn were better than Homeopathic drugs against \textit{Mycobacterium} sp.

Saharanpur being the border city of Uttar Pradesh state, the most famous city of the state and many holy places around it therefore attract a number of people not only from different parts of the country but also from abroad for various socio-religious rituals and for pilgrimage almost throughout the year. This causes overcrowding, scarcity of nutritious food and water; poor sanitation leading to unhygienic conditions, which may result in the spread of various infectious microbial diseases including PTB. The PTB infection may result from inhalation of minute droplets (droplet nuclei) produced by talking, coughing or sneezing. These particles remain suspended in the air for prolonged periods and are small enough to be inhaled into terminal air passages, resulting in infection.

The Present study that there is a need of strict vigilence on the PTB patients of Saharanpur for the screening and monitoring of the disease. More emphasis should be given on treatment of AFB +ve cases since these are infectious population of the disease Completion of treatment is to be given more importance than diagnosis of cases. Sputum testing should be emphasised as a method of diagnosis rather than the current diagnosis on the basis of x-rays. Supervised short-course chemotherapy should be given to all TB patients (DOTS- Directly Observed Therapy-Short Courses). Finally, education about maintaining sanitary and hygienic conditions should be imparted right from the school level and proper vaccination against the disease should be encouraged. Further, more Ayurvedic and Homeopathic drugs or their combinations should be tried in order to observe the synergic effect against PTB infections. As these drugs are safer than Allopathic medicines, having no adverse side effects, can be a substitute to Allopathic treatment. Thus, a sound and healthy line of treatment other than Allopathic therapy could be established for PTB management.