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Prevalence of Pulmonary Tuberculosis: A Two Years Retrospective Study in the Northern Area of KP, Pakistan

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Abstract

Tuberculosis (TB), an airborne infectious disease caused by Mycobacterium tuberculosis, accounts for considerable morbidity and mortality worldwide. The current study provides an estimate of the prevalence of the bacteriologically positive pulmonary tuberculosis (PTB) population in the northern area of KPK, Pakistan. A cross-sectional study was designed for the suspected population of PTB and all the individuals were interviewed for symptoms suggestive of PTB diseases. Two sputum specimens were collected from all eligible individuals and were examined by Ziehl-Neelsen smear microscopy. A total of 959 and 820 eligible individual samples were collected in the year 2016 and 2017 (January to December), respectively. In the year 2016, 91 individuals were bacteriologically positive and the prevalence of PTB was found at 9.48 % (n-91) (45 % were male and 55 % were female). Similarly, in the year 2017, 52 individuals were bacteriologically positive and the prevalence of PTB was found at 6.34 % (48% were male and 52% were female). The highest prevalence of PTB was found within the age group 21-40 years 25.4% (n-45) (51.1% were male and 48.8% were female) and 42.3% (n-22) (54.5% were male and 45.4% were female) in the year 2016 and 2017 respectively. The highest infection rate in this group might be due in terms of their jobs and regular interaction with society. However, early diagnosis is crucial to prevent the multi-drug resistance cases of PTB and further strengthen the TB control program.

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Introduction

Tuberculosis (TB) is a contagious disease caused by Mycobacterium tuberculosis, a global health problem causing great morbidity and mortality worldwide (Zumla *et al.,* 2015). The TB pathogen mostly attacks the lungs and causes pulmonary tuberculosis (PTB). PTB is the most dangerous type of tuberculosis because that can pass from an infected person through tiny droplets or aerosol during coughing and sneezing, and this droplet contains the bacteria that can be inhaled by the healthy person (Turner *et al.,* 2017). In a survey, it was presented that half of the world population was infected from TB infection either in latent or an active form (Daftary *et al.,* 2018). In the year 2014, 1.5 million people died from TB and 9.6 million were infected (Zumla *et al.,* 2015). TB is one of the neglected and most prevalent health problems that lead to a great human loss in Pakistan. Pakistan ranked 8th in high TB burden, donating about 44 % of the total burden of Eastern Asia. According to the WHO report, 80 people were infected with TB out of 100,000/year in Pakistan and 5.1 % of the total population (Das *et al.,* 2020). The increasing number of multidrug-resistance TB (MDR-TB) is a great challenge for Pakistan. However, the lower number of TB registered cases in treatment is the major factor in the control and elimination of TB. The National TB control program estimated that in the year 2013, about 12, 997 MDR cases were reported and the total registered cases were 1570 (13 %) (Qadeer *et al.,* 2016; Ali *et al.,* 2020).

The MDR-TB cases vary from 2.3 % and 7.9 % in treated individuals and untreated individuals, respectively (Ejaz *et al.,* 2010). According to an estimation, every year 5, 5000 new TB cases occur in different districts of Khyber Pakhtunkhwa (KP) province of Pakistan (Ayaz *et al.,* 2012; Akhtar *et al.,* 2014; Khan *et al.,* 2015; Ahmad *et al.,* 2016).

Although a few large scales studies have evaluated the prevalence of tuberculosis in different provincial cities and towns of Pakistan, i.e., (Saleem *et al.,* 2013; Qadeer *et al.,* 2016). So far, there is no published data available in the northern areas of KPK, Pakistan (Fig. 1) to show the prevalence rate of PTB. Therefore, the present study was conducted to examine the prevalence of pulmonary tuberculosis among suspected PTB individuals and the demographic characteristics of the subjects.

Materials and methods

Study area and design

The current study was conducted in the years 2016 and 2017 (January to December) at Ayub Medical Institute, Abbottabad, which is situated in the center of the northern area of KPK, Pakistan. It is one of the general hospitals in the country in which all kinds of patients with various illnesses, including TB cases, are referred for treatment.

The study was designed to examine the incidence of the PTB in the suspected TB individuals among those who visited the hospital for diagnosis. An attempt was also made to relate the TB status of the subjects to variables such as gender, and age during the study period.

Study population and sampling procedure

An appropriate sampling procedure was applied to include all the individuals eligible for clinically identified TB cases who were either visited or referred to Ayub medical Institute during the study period. All the individuals were interviewed for the symptoms relating to TB, such as coughing, fever, chest pain, etc. Two sputum specimens were collected from all the individuals eligible for TB and processed according to appropriate protocols.

The first sample was collected in the health facility center and was labeled the spot specimen. The second sample (morning sample) was collected at home on the second day under the instructions of the technician. The individuals who presented signs and symptoms suggestive of TB sputum samples were further investigated for acid-fast bacilli (AFB).

Samples processing and analysis

The collected sputum samples were brought to the central lab of the TB control program for TB

investigation on the same day and kept at 4 °C for further processing. Smears were made for samples and were stained for the Ziehl-Neelsen method (Meyers, Walsh and Portaels, 2011). In addition, all the positive samples and 30 % of random checks of all smears were investigated again for quality checks.

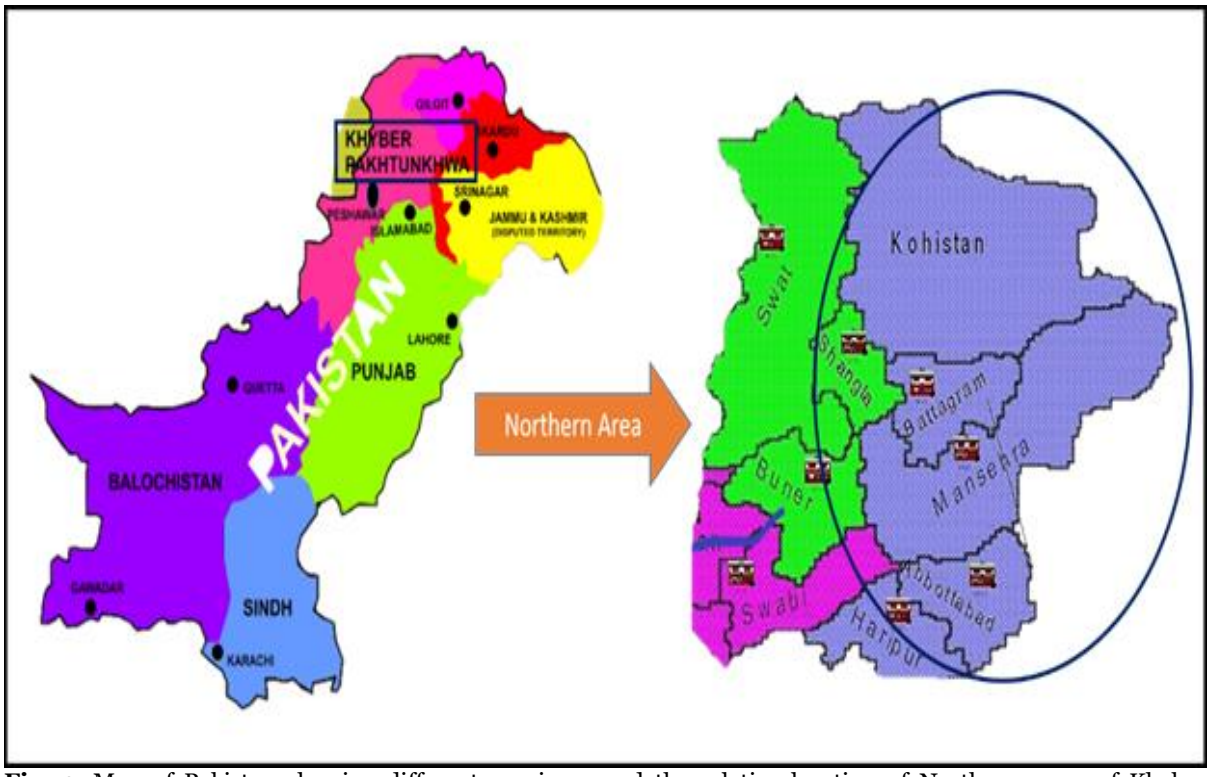

Fig. 1. Map of Pakistan showing different provinces and the relative location of Northern areas of Khyber Pakhtunkhwa (KP) in the green circle (Source, Pakistan administrative regions).

PTB case definition

Individuals who had two positive smears were positive for acid-fast bacilli under microscopy results were diagnosed as sputum positive for acid-fast bacilli (AFB) with active TB and those who had no such results were considered negative.

Treatment

The bacteriologically positive individuals with PTB were referred to the concerned TB control center for anti-TB treatment under the TB control program of Pakistan.

Visitor's information and data collection instrument

To assess the prevalence of the study area, the appropriate questionnaire was prepared. All the individuals were interviewed using the structured questioners, it consists of questions on sociodemographic characteristics, past family history, and other risk factors.

Data analysis

All the data were collected, presented and organized in the form of tables and figures. Also, the data was organized in a group with an age gap difference 20 years. Then, the data were analyzed using statistical tools, i.e., Graph pad Prisms.

AFB for the status and other major variables such as age, sex, treatment history, etc.

Ethical consideration

The current study was approved by the ethical research committee of the Department of Microbiology and Advanced Studies and Research Board of Hazara University Mansehra, KPK Pakistan.

The accessing and processing of the data were according to the prior permission of the central TB control laboratory of Ayub Medical Institute, Abbottabad KP Pakistan.

Results

Our study indicated that during the year 2016 (January to December), a total of 959 suspected visitor samples were collected from visitors who were suspected of TB. Results showed that out of total 479 (50%) were male and the age of the study group as 0-20 (42/479) (8.7%), 21-40 (200/479) (41.7%), 41-60 (158/479) (33%), 61-80 (74/479) (15.4%), 81-100 (5/479) (1.04%). Also, the suspected female was 480 (50%) and age of the study group 0-20 (47/480) (9.7 %), 21-40 (222/480) (46.2%), 41-60 (151/480) (31.4%), 61-80 (57/480) (12.8%), 81-100 (3/480) (0.62%) shown in the (Fig. 2). Similarly, in the year 2017, a total of 820 suspected samples were collected from suspected persons who visited the hospital for those diagnosed with pulmonary tuberculosis. Out of 820, the 495 (60.3%) were male and the 325 (39.6%) were female. The age and gender-wise distributions of the suspected visitors with percentage and quantity were shown in (Fig. 3).

Table 1. Prevalence of PTB in different gender and an age-wise group of the total positive population in the year 2016.

Age groups	Male positive (%)	Female positive (%)	Total (%)
1-20 Years	3 (7.3%)	8 (16%)	11 (12.08 %)
21-40 Years	23 (56 %)	22 (44%)	45 (49.4 %)
41-60 Years	7 (17%)	9 (18%)	16 (17.5 %)
61-80 Years	7 (17%)	8 (16%)	15 (16.4 %)
81-100 Years	1 (2.43%)	3 (6.0%)	4 (4.3 %)
Total	41 (45%)	50 (55%)	91

The microscopic examination results revealed that, in the year 2016, a total of 91 out of 959 subjects individuals were reported AFB positive PTB.

In total 91 positive cases, 41 (45%) were male and age of the group as study group as 0-20 (7.3%), 21-40 (56 %), 41-60 (17%), 61-80 (17%), 81-100 (5/479) (1.04%), In the same way, the AFB positive female was 50 (55%) and age of the study group as 0-20 (16%), 21-40 (44%), 41-60 (18%), 61-80 (16%), 81-100 (6.0%) the number and percentage of the AFB positive smears shown in the (Table 1).

Table 2. Age and gender-wise distribution of bacteriologically positive PTB population in the year 2017.

Age group	Male positive (%)	Female positive (%)	Total (%)
1-20 Years	3 (12 %)	4 (14.8 %)	7 (13.4 %)
21-40 Years	12 (48 %)	10 (37 %)	22 (42.3 %)
41-60 Years	6 (24 %)	6 (22.2 %)	12 (23.0 %)
61-80 Years	4 (16 %)	7 (26 %)	11 (21.1 %)
81-100 Years	0	0	0
Total	25 (48%)	27 (52%)	52

The prevalence rate of pulmonary TB was recorded at 9.4% in the year 2016. Likewise, in the year 2017, a total of 52 individuals reported AFB smears of positive PTB, consisting of 25 (48%) males and 27 (52%) females and the prevalence rate was 6.34%. The demographic distribution of the AFB positive PTB population with age group is explained in (Table 2) with percentages and numbers of the infected populations. Our results also showed that the highest proportions of the AFB positive were found in the age group 21-40 (Fig. 4). In the year 2016, it was 49% (45 individuals) (23 were male and 22 were female). Similarly, 42.3% (22 individuals) (12 were male and 10 were female) in the year 2017.

Discussion

Tuberculosis, a communicable disease, is one of the main causes of mortality in the world. One-third of

the world's total population is infected with tuberculosis. Out of these, 5 to 10 % population develops disease at some stage of their lives (Onyango, 2011). Tuberculosis in Pakistan is one of the highly prevalent health issues causing morbidity in all types of age groups, such as children, young and adults, as well as the leading cause of death. In view of this, there is a crucial need to develop an acceptable estimate of the PTB problem. It will enable the National TB control program planner and different organizations to develop appropriate strategies for combating all types of TB and assess the burden of TB over time.

The current study employed a retrospective laboratory-based study providing pieces of evidence on the prevalence of tuberculosis in the suspected population in the Northern areas of KPK, Pakistan.

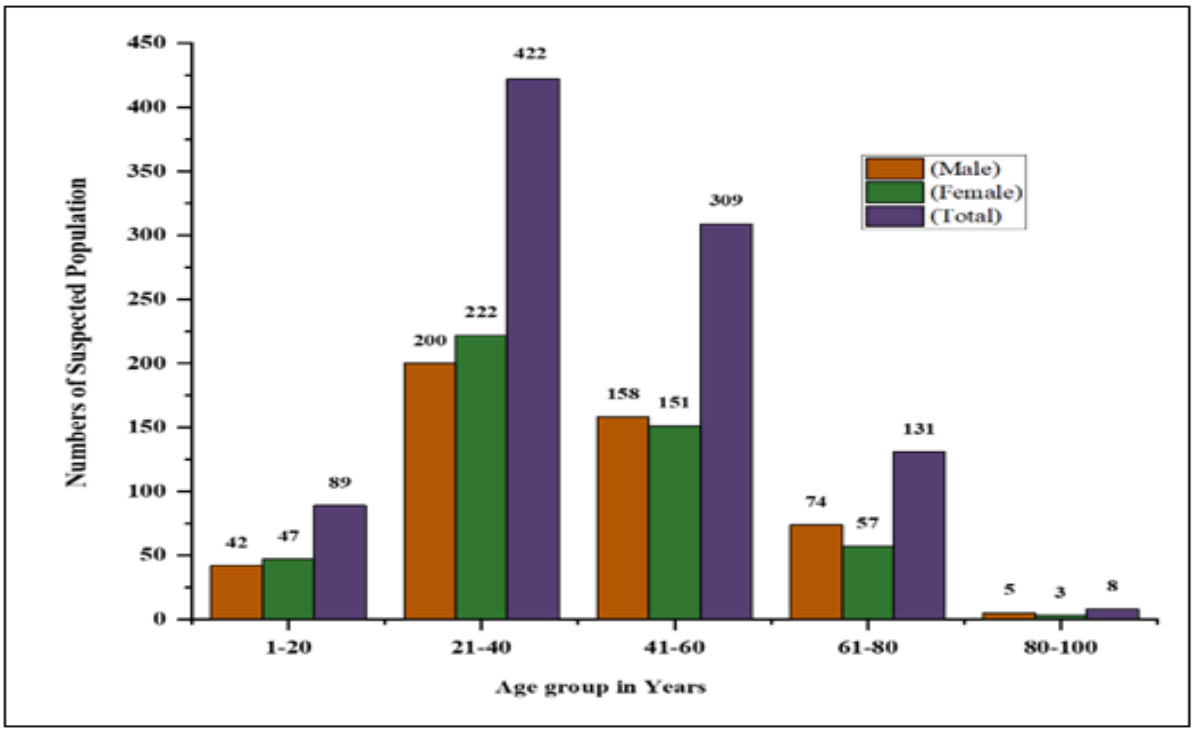

Fig. 2. The number of suspected individuals for PTB in different age groups in the year 2016. The age group 21-40 has a maximum number of suspected PTB cases.

The estimated prevalence of the bacteriologically positive PTB suspected population was 9.4 % in the year 2016 and 6.34 % in 2107 which showed an agreement with some other studies that presented diverse rates ranging from 6 to 12 % (Bhat *et al.,* 2009; Zaman, 2010). Our study findings also show similarities with the findings of (Bhat *et al.,* 2009), who conducted the same type of study in the Madhya Pradesh tribal population of central India with a frequency rate of 7.9 %. The reason for such high prevalence might be under development and the lowest quality standard of the developing countries. The reason for the high prevalence may be possible due to the unawareness of the public about the causes and speed of tuberculosis.

One of the most important implications of our results was that the majority of the infected bacteriologically positive individuals in our study group were found to be in such an age group whose families were dependent on them for earning, providing economic support, etc. There is a high rate of smear-positive individuals for PTB in the 21 to 40 years age group, i.e., 45 (49 %) in the year 2016 and 22 (42.3 %) in the year 2017 already mentioned in the results. This age group is the working class of the area and is considered the backbone of society in a country. The main reason for the high frequency of this particular group is that they regularly interact with the community in terms of jobs and have higher chances of receiving the infection.

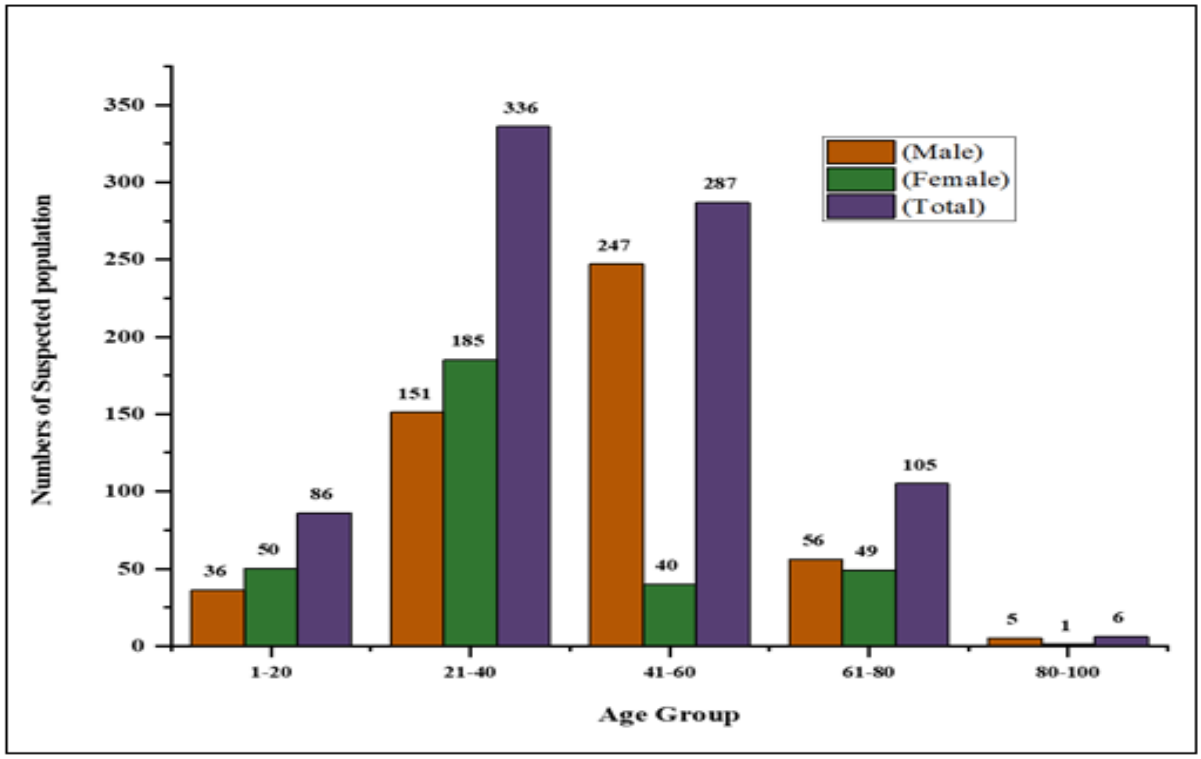

Fig. 3. Age and gender-wise distribution of the suspected population of PTB visited the hospital for TB diagnosis in the year 2016. Same as in 2016, the age group 21-40 had a maximum number of suspected TB individuals 2016.

These observations have been supported by (Holmes, Hausler and Nunn, 1998; Negin, Abimbola and Marais, 2015), who have described the maximum incidence of tuberculosis in the 15-35 years age group. Furthermore, it has been noted that females were found to be more infected with tuberculosis as compared to males in good agreement with the results (Holmes *et al.*, 1998). In contrast, the study (Bhat *et al.,* 2009) reported that the prevalence of tuberculosis is significantly higher in males as compared to females.

The reasons for the high prevalence in females are due to illiteracy, consultation with untrained private practitioners and delayed sub-optimal case detection and treatment. Our study correlates with the published report (Agboatwalla *et al.,* 2003) that females were found mostly they discuss their health issues with their husbands or with other family members. Besides these males' duty in public health facilitates centers, they have a better insight into the diseases and more knowledge of various issues regarding TB. Ruler females are not permissible to endeavor out of the house easily, so their contact is limited also they have not a narrow vision of the consequences of the disease, perceptions as well as knowledge about the disease are so limited. Some people view that tuberculosis is a punishment from god side and powerfully stigmatize the disease.

Closed small spaces, close prolonged contact with other families as well as overcrowding provide a chance for infection because the droplets after coughing of the infected person can infect other healthy persons. The same study was also conducted by (Qadeer *et al.,* 2016) displayed that the majority of the TB patients were members which belong to deprived, poor and lower social classes. These findings recommend that tuberculosis is highly prevalent in the northern area of KPK, especially in young age group people and backbone class members. It will need a full-length epidemiological survey to strengthen the efforts for treatment and precautionary strategies to control the transmission of diseases in different villages and towns of the Northern areas of KPK, Pakistan.

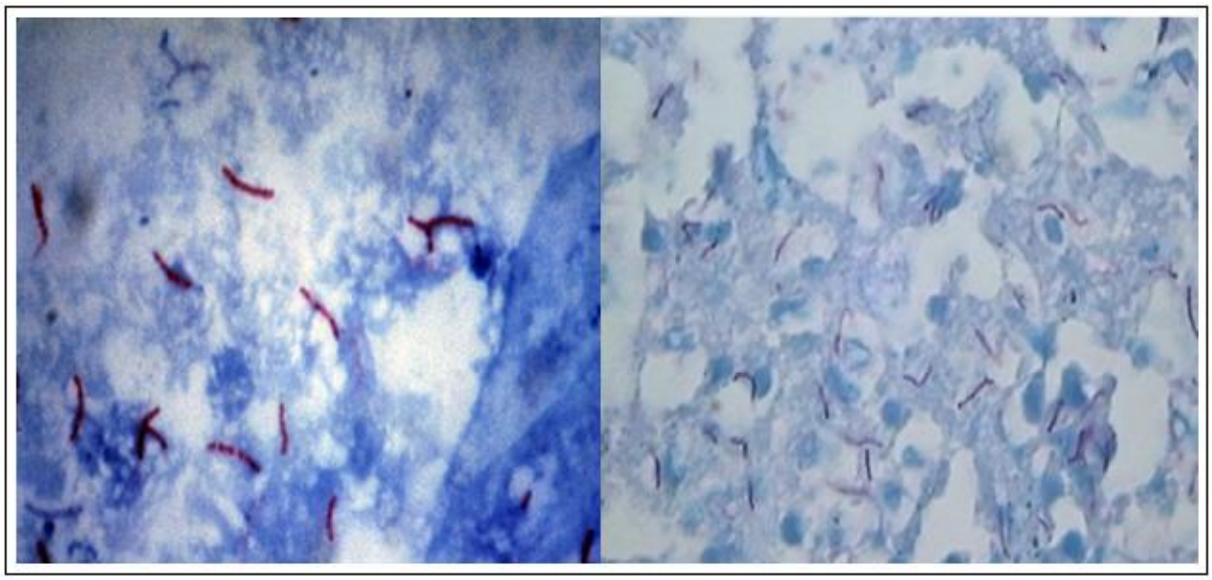

Fig. 4. The snapshot of the bacteriologically smear-positive sputum specimens under fluorescent microscopic results after Ziehl-Neelsen staining for acid-fast bacilli (Mycobacterium tuberculosis).

Conclusion

The overall finding of the current study provides vital information about pulmonary tuberculosis (PTB) in the Northern areas of KPK, Pakistan, and can serve as a baseline study for the future evaluation of the burden of disease and control measures. The study finding revealed that PTB is highly prevalent in the population of the area in all age groups, especially in the young people.

The higher prevalence of bacteriologically positive sputum specimens among males and females needs further exploration. Appropriate strategies for the prevention, targeted diagnosis, quick treatment, and awareness are needed to decline the maximum growth rate of pulmonary tuberculosis. In addition, further strengthen the TB control measures on a sustained and long-term basis in the area to have a significant impact on the disease prevalence in the community.

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Conflict of interest

There is no conflict of interest in the current paper.

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