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A study of Mycobacterium tuberculosis among respiratory patients coming to the center for infections and Endemic Diseases in Sirte city, Libya between 2018 and 2023

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ABSTRACT

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BACKGROUND: Tuberculosis (TB) remains a major global health challenge, with significant morbidity and mortality, particularly in developing countries. Libya has an incidence rate of 53 cases per 100,000 population, but there is no information about other regions, especially from Sirte. This study aimed to assess the epidemiology of *Mycobacterium tuberculosis* among respiratory patients in Sirte (2018–2023) to address this gap. **METHODS:** A cross-sectional study was conducted on some respiratory patients attending the National Center for Control of Communicable and Endemic Diseases in Sirte, Libya. It included 136 patients. Ziehl-Nielsen stain and the GeneXpert test were used to examine sputum and make the diagnosis. Using SPSS, demographic and clinical data were analyzed, and associations were found using chi-square tests. **RESULTS:** This study found an 8.08% TB prevalence (11/136 cases), with higher rates in females (13%) than males (5%) ($P>0.5$). The age group from 16 - 26 years showed the most widespread occurrence at 45.45% and the group from 26 - 37 years demonstrated 31.25% prevalence. The reported cases did not include children between 5 - 15 years old or adults from 58-67years. All infections were recorded among Libyan nationals, with no notable differences based on nationality ($P>0.5$). The highest prevalence rate of 45.45% appeared in the age group between 16 and 26 years old. Following this group were people between 26 and 37 years old showing a 31.25% occurrence. No instances of this condition were documented in children between the ages of. **CONCLUSION:** The results indicate an 8.08% prevalence of tuberculosis in patients. These results found an 8.08% tuberculosis (TB) prevalence in patients which occurred at greater percentages among young adults and Libyan nationals. Although statistical significance was not reached about gender and nationality differences, the detected patterns point to potential sociodemographic impacts. The research underscores the requirement to develop better screening methods and implement targeted public health projects while establishing complete surveillance systems that will enhance tuberculosis control in Libya.

1 Introduction

Tuberculosis is a communicable infectious disease caused by the bacterium *Mycobacterium tuberculosis*. It primarily affects the lungs (pulmonary TB) but can disseminate to other organs (extra pulmonary TB), including lymph nodes, bones, and the central nervous system. An estimated 10.6 million new cases and 1.3 million deaths from tuberculosis (TB) are recorded worldwide each year, making it a persistent major public health burden (WHO, 2023). Libya was expected to have a prevalence of 53 infections per 100,000 people (National TB Control Program (NTCP), 2022), which is significantly higher than that of nearby nations like Tunisia (32) and Algeria (45).

The epidemiological patterns have changed markedly since the initial national survey conducted in 1959, which documented prevalence rates ranging from 1.19% to 2.47% in the eastern regions (Ministry of Health, 1960). Recent research reveals significant developments patterns, including male predominance among cases (53.6%; Raja *et al.*, 2015) and a high pulmonary TB prevalence of 50.9% in North-western Libya (Awatef *et al.*, 2022). Geographic disparities are evident, with incidence rates ranging from 0.04/1,000 in Tarhona to 0.12/1,000 in Alkoms (Aldhuh *et al.*, 2018), while Benghazi reports a substantial proportion of extra pulmonary TB (23.7%; Benghazi TB Research Group, 2021). Emerging data reveal an 18% post-pandemic rise in drug-resistant TB (Elzagallaai *et al.*, 2023) and diagnostic gaps among migrant populations (Hassan *et al.*, 2022).

This study presents the first systematic assessment of TB epidemiology in Sirte (2018–2023), addressing critical knowledge gaps in this strategic city, which has undergone significant demographic shifts since 2011. By investigating local incidence, risk factors, and diagnostic challenges (notably, the difficulty in distinguishing symptoms of TB (chronic cough, haemoptysis, and/or fever) from those due to another respiratory condition (American Thoracic Society (ATS), 2023), the study aims to inform targeted control interventions and to improve surveillance in a post-conflict setting.

2 Materials and Methods:

2.1. Study design and study area: This cross-sectional research was carried out at the National Center for Disease Control located in Sirte, Libya, encompassing 136 documented cases from 2018 through January 2023.

Study design and study area: This was a cross-sectional study conducted in Sirte National Center for

Disease Control, Libya and 136 cases examined during the period 2018–January 2023.

2.2. Data collection: Demographic and clinical data (age, gender, nationality, and TB status) were collected from patient and records.

2.3. Sample collection and diagnosis: was based on early morning sputum analysis using Ziehl-Nielsen staining for acid-fast bacilli and GeneXpert assay. The staining involved heat fixation, Carbol-fuchsin application, acid-alcohol decolorization, and methylene blue counterstaining (Bayot *et al.*, 2022).

2.4. Statistical analysis: was performed using SPSS software, with the Chi-square test applied to assess associations between variables.

3 Results:

Tuberculosis continues to pose a significant global health challenge, especially in developing nations (Adigun & Singh, 2022), and has been the subject of many research efforts throughout Libya. Nevertheless, there is a deficiency of data that specifically examines the prevalence of *Mycobacterium tuberculosis* infection in Sirte City.

The current study in Table (1) revealed an 8.08% TB prevalence (11/136 cases) among respiratory patients at Sirte's Center for Infectious Diseases (2018–2023). In our study showed the highest prevalence (45.45%) in the 16–26 age group, a secondary peak (31.25%) appeared in the 26–37 group, while no cases were recorded in children (5–15 years) or adults aged 58–67. Other age groups showed lower rates (4.34–7.4%). Chi-square analysis revealed no significant age-related association ($P = 0.5$).

Table (1): The overall prevalence of tuberculosis (TB) infection in some respiratory patients visiting the Center for Infectious and Endemic Diseases from 2018 to January 2023 in Sirte city according to the age groups

Age groups	Positive	Negative	Total
5-15y	0	1(100%)	1
26≥y	5(31.25%)	11(68.75%)	16
27-37y	1(5%)	19(95%)	20
38-47y	1(4.34%)	22(95.6%)	23
48-57y	2(7.4%)	25(92.5%)	27
58-67y	0	18(100%)	18
68-77y	1(5.88%)	16(94.1%)	17
>78y	1(7.14%)	13(92.8%)	14
Total	11(8%)	125(92%)	136
Chi-Square Tests / $P = 0.5$			

Table (2) revealed higher TB infection rates among females (13%) compared to males (5%), though the difference was not statistically significant ($P > 0.5$).

Table (2): The prevalence of tuberculosis infection (TB) in some respiratory patients visiting the Center for Infectious and Endemic Diseases from 2018 to January 2023 in Sirte city according to gender.

Gender	Positive	Negative	Total
Male	4(36%)	77(62%)	81(5%)
Female	7(64%)	48(38%)	55(13%)
Total	11	125	136
Chi-Square Tests /P=>0.5			

Table (3) showed that all TB-positive cases (11; 8.46%) were among Libyan nationals, with no infections detected among other nationalities, and no statistically significant association observed ($P > 0.5$).

Table (3): The prevalence of tuberculosis (TB) infection in some respiratory patients visiting the Center for Infectious and Endemic Diseases from 2018 to January 2023 in Sirte city according to Nationality.

Nationality	Positive	Negative	Total
Libyan	11(8.46%)	119(91.53%)	130
Sudanese	0	2(100%)	2
Bangladesh	0	1(100%)	1
Nigerian	0	1(100%)	1
Syrian	0	1(100%)	1
Egyptian	0	1(100%)	1
Total	11(8.08%)	125(96.15%)	136
Chi-Square Tests /P>0.5			

4 Discussion:

This study seeks to fill that gap by providing the first documented analysis of TB prevalence in this region revealed an 8.08% TB prevalence (11/136 cases) among respiratory patients. This contrasts with higher rates reported in other Libyan regions: 42.1% pulmonary TB prevalence in Tobruk (Guyth *et al.*, 2015; n=625) and 16.7% culture-positive specimens in Tripoli (Barouni *et al.*, 2014; n=3,590). These disparities may reflect methodological differences in study duration, sample size, or diagnostic approaches. Consistent with global data showing increased TB incidence in adolescence (Snow *et al.*, 2018), in our study showed the highest prevalence (45.45%) in the 16–26 age group, aligning with Ismail *et al.*'s (2014) findings in Tobruk. A secondary peak (31.25%) appeared in the 26–37 group, while no cases were recorded in children (5–15 years) or adults aged 58–67. Other age groups showed lower rates (4.34–7.4%). Although chi-square analysis revealed no significant

age-related association ($P = 0.5$), the distribution suggests a multifactorial Etiology involving biological, social, and environmental influences.

The higher TB infection rates among females contrasts with Al-Obaidi *et al.*, (2022) in Tripoli, who reported higher male prevalence, while the Benghazi study (2021) showed more female cases due to active screening in women's clinics. The National TB Program (2023) highlighted regional differences, and Al-Mansouri (2020) linked high female rates in Misrata to household exposure. These differences show how geography, screening methods, and socioeconomic variables affect TB epidemics in Libya.

The our results revealed TB-infection rate only in Libyan patients, these findings align with the National TB Control Program (2023), but differ from Al-Obaidi's (2022) study in Tripoli, which reported 15% infection among African expatriates. This variation may reflect regional differences or screening disparities. The small number of non-Libyan participants is a limitation. The results are also consistent with Guyth *et al.* (2015), who found most TB cases among Libyans.

5 Conclusions:

The study concluded that the prevalence of tuberculosis in Sirte City was 8.08%, with all cases occurring among Libyan nationals, and higher rates observed in females and the 16–26 age group. Although differences were not statistically significant, the findings suggest possible influences of demographic and social factors. The study recommends expanding early screening programs, especially for youth, improving public health awareness, and including non-Libyan residents in future surveys. Broader studies are needed to confirm these patterns and support national TB control efforts.

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Conflict of interest: The authors declare that there are no conflicts of interest

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