

Nutritional Deficiencies, Vitamin D Levels, and other Risk Factors in Pediatric Tuberculosis Patients

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Abstract

Background: Tuberculosis (TB) is a major world health challenge affecting more than 9 million people every year of which more than 1 million are children. It presents non-specific symptoms and for this reason has been described as a silent epidemic, especially in the diagnosis of childhood TB, especially in bacteriological confirmation. Understanding the risk factors of TB in children is therefore important.

Objectives: to describe socio-economic, environmental, and health related characteristics of childhood TB patients in Nowshera, Pakistan, and their risk factors in order to propose public health interventions.

Study design: A Cross-Sectional-Study

Place and duration of study: This research study was conducted in Nowshera Medical College / Qazi Hussain Ahmed Medical Complex situated in Nowshera, Khyber Pakhtunkhwa province of Pakistan over a period of eight months starting from 1st January 2023 to 31st August 2023

Materials and Methods: A cross-sectional study was carried out at the paed ward and Biochemistry Department of Nowshera Medical College / Qazi Hussain Ahmed Medical Complex Nowshera from 1st January 2023 to 31st August 2023 and comprised of 130 patients. In this study, Convenience sampling (Non probability) was used. The data was collected by a structured questionnaire and analyzed by statistical package for the social sciences (SPSS version 24). Quantitative data were described by measures of central tendencies; mean and standard deviation and qualitative data were described by frequencies and percentages. Chi-square test was used to test the relationship between variables where the level of statistical significant was set at $P \leq 0.05$.

Results: Participants included mainly the study population of children aged 0-15 years, and the gender was equally split throughout boy 50% and girls 50%. A large percentage (69.2%) were from low-income earners' homes, and 66.9% of the respondents were from rural areas. Subjects' Body Mass Index (BMI) varied from less than 18 to more than 25. Of special interest, 43.8% of the children with TB had not been administered BCG vaccination. The source of infection, that is, contact with an adult TB patient, was reported in 43.8% while the rest were in the 56.2% who had no such history.

Conclusion: childhood TB in the population under study is significantly related with some factors namely; direct contact with TB patients, low economic status, crowded housing, poor ventilation and malnutrition.

Keywords: Tuberculosis, Nutritional status, Vitamin D, socioeconomic status

Citations:

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Introduction

Tuberculosis (TB) is still a global health concern with the estimate of 9 million new incidences every year and at least 10% of these are children. This form of TB that occurs in children is often considered the ‘silent killer’ mainly because it is overshadowed by the more common adult TB. This term speaks of the fact that TB in children is often not easy to diagnose because the symptoms they present do not fall within typical presentations and since getting bacteriological confirmation can be very difficult in children (Marais et al. , 2014)(1). TB in children on the other hand present with more general symptoms like cough, fever and weight loss unlike in adults and these symptoms can be easily confused with other childhood diseases (Jaganath & Mupere, 2012) (2). Tuberculosis also affects children in a very severe way and accounts for a lot of morbidity and mortality more so in the developing world. Socio-economic factors which include poverty, malnutrition, crowded housing, and restricted access to health care make the children in Pakistan vulnerable to TB since the country is one of the TB-endemic countries in the world (World Health Organization, 2016) (3). Nevertheless, the application of DOTS approach and other TB prevention measures, childhood TB still poses a major concern in Pakistan (Mahmood et al. , 2011) (4). Measures of control against TB include the BCG vaccination in view of the fact that they afford significant protection against serious manifestations of TB in children. But the coverage and effectiveness of BCG vaccination differ and it has not been as conclusive in preventing pulmonary TB, the most widespread form of the disease (Trunz et al. , 2006) (5). However, children who live with TB patients especially those who share a house with the infected adults are more prone to the infection (6 Marais et al. , 2004). This brings out the need for contact tracing and management in TB control programmes (Dodd et al. , 2016) (7). The purpose of this research is to determine and discuss the risk factors of childhood TB in Nowshera of Pakistan. It is therefore important to have knowledge on these factors with a view of directing interventions towards the right course

for best results for the affected children. Descriptive in design, this study will look at the functions of socio-economic status, nutritional status, household characteristics and BCG vaccination in the epidemiology of childhood TB. The study will add to the literature and help in the formulation of public health interventions focused on tackling TB in children.

Materials and Methods

This study was a cross-sectional descriptive survey conducted at Paeds ward and Biochemistry Department of Nowshera Medical College / Qazi Hussain Ahmed Medical Complex Nowshera during 1st January 2023 to 31st August, 2023. In total, 130 patients diagnosed with pediatric diseases were enrolled, and convenience sampling was applied. The objective of the study was to review the antecedent research in order to determine the socio-economic and environmental risk factors linked with childhood TB. The data collection was done with the help of structured questionnaires that were filled in by the guardians of the children.

Data Collection

The information was obtained in the course of a structured interview based on the questionnaire that included questions related to demographic characteristics, socio-economic status, nutritional status, household conditions, and medical history including BCG vaccination and contact with TB patients.

Statistical Analysis

The gathered data were analyzed by using the SPSS version 24. 0. Regarding the descriptive analysis, continuous data were shown in Mean±SD, and categorical data were presented in number and percentage. The Chi-square test was used to determine the relationship between variables; the level of significance applied was $P \leq 0.05$.

Results

The study was carried on 130 children aged 0-15 years, 65 male and 65 female. As for social background, 69.2% of the patients came from lower class families, and 66.9% of the patients were from rural areas. The participants' BMI scores fell between <18 and >25 indicating that the nutritional status of the participants was diverse. However, it is worth mentioning that BCG vaccination was given to 56.2% of the children with TB, but 43.8% had not been vaccinated. Also, 43.8% reported previous contact with an adult TB patient while 56.2% of the respondents had no such contact. Therefore, these findings point towards the fact that socio-economic factors and incidences of direct contact with TB patients are major drivers of childhood TB in this region. The patients were of various SES which was classified into lower, middle and upper as depicted in the figure 1. **The patients were of various SES which was classified into lower, middle and upper as depicted in the figure 1.**

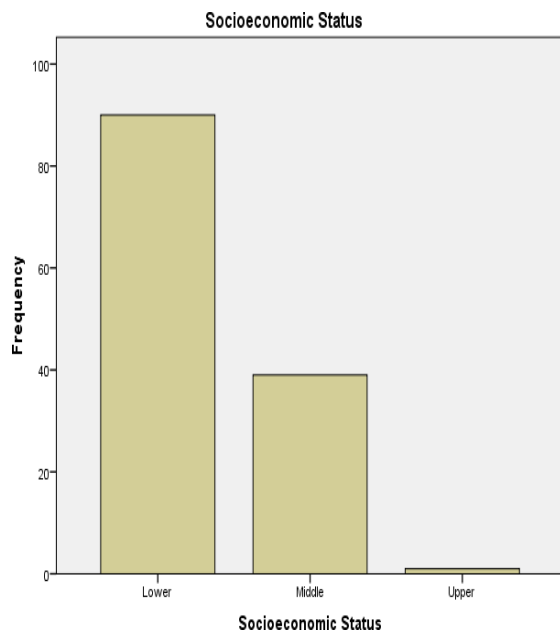


Figure 1: Socioeconomic status

As shown in figure 1, 69.2% of the sample belonged to a lower socioeconomic status, 20% to middle and only 0.8% to upper class.

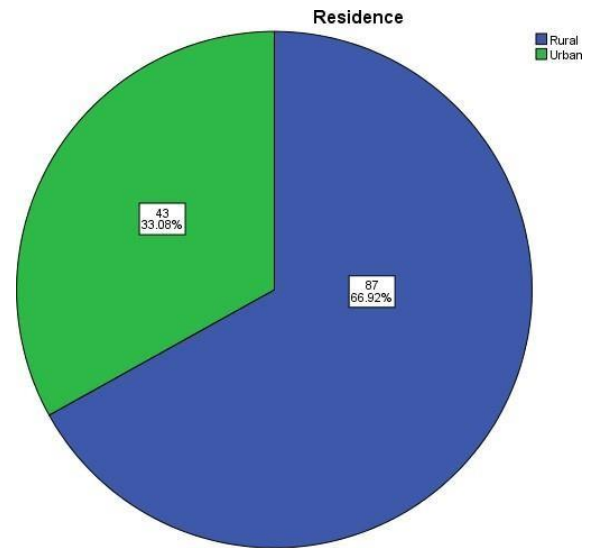


Figure 2: Residence

Figure 2 shows the residence distribution of the included population. 66.9% resided in the rural areas while 33.1% lived in the urban areas.

Table 1: Number of people sharing a room

Persons Living per Room	Frequency	Percent
>2	42	32.3
3-5	72	55.4
>5	16	12.3
Total	130	100.0

Table 1 represents the living conditions of the patients included in this study. As for their living conditions, 32.3% had less than 2 people living in each room, 55.4% from 3 to 5 and 12.3% had more than 5 people in one room.

no previous history of contact with another case of tuberculosis.

Table 2: Cross-ventilation of house

Cross Ventilation	Frequency	Percent
Yes	78	60.0
No	52	40.0
Total	130	100.0

Table 2 shows the cross-ventilation of the houses of the patients. As can be seen in this table, cross-ventilation was present in 60% of houses and absent in 40 percent.

Table 3: History of contact with adult TB

Patient

History of Contact with Tuberculosis Case	Frequency	Percent
Yes	57	43.8
No	73	56.2
Total	130	100.0

Table 3 shows the history of contact with adult TB patients. 43.8% patients a prior history of exposure to TB patients while 56.2% had no such prior exposure.

Table 4: Relationship with the adult TB

Relation with Case	Frequency	Percent
No exposure	73	56.2
Parent	21	16.2
Sibling	19	14.6
Others	17	13.1
Total	130	100.0

Table 4 shows the relationship of the patient with adult TB patient. It says that 43.8% patients had a history of contact with another adult patient of tuberculosis; among these 16.2% were either of the parent, 14.6% a sibling and 13.1% were others. Conversely, 56.2 percent had had

Table 5: Body Mass Index

BMI	Frequency	Percent
<18	58	44.6
18-25	62	47.7
>25	10	7.7
Total	130	100.0

Table 5 shows the body mass index range of the patients. As evident from this table, 44.6% patients had a BMI <18 while only 7.7% patients had a BMI >25. The majority of patients (47.7%) had a BMI in the normal range.

Table 6: Physical signs of Anaemia

Physical Signs of Anemia	Yes	No
Pallor	77 (59.2%)	53 (40.8%)
Koilonychia	30 (23.1%)	100 (76.9%)
Shortness of Breath	97 (74.6%)	33 (25.4%)

Table 6 shows the physical signs of anaemia

including Pallor, Koilonychia and Shortness of breath. Pallor was reported in 59.2% cases, koilonychias in 23.1% and shortness of breath in 74.6% cases.

Table 7: Time since diagnosis

Time Since Diagnosis	Frequency	Percent
< 6 months	123	94.6
> 6 months	7	5.4
Total	130	100.0

Table 7 shows the time since the diagnosis of the patients. Time since TB infection diagnosis was less than 6 months in 94.6% patients.

Table 8: Treatment status

Time Treatment Taken for	Frequency	Percent
Complete course	5	3.8
Incomplete course	5	3.8
Treatment in progress	117	90.0
Treatment not started yet	3	2.3
Total	130	100.0

Discussion

Tuberculosis in children is still a major concern in the world and especially in the developing nations of the world including Pakistan. The results of this study also point to several significant risk factors for childhood TB as has been identified in other studies. Socio-economic status, household conditions, and contact with TB patients were significantly more highlighted, which brings out the fact that these factors are interrelated and play an important role in transmission and infection in children with TB. Among the discovered trends in the research study, a considerable discovery was that children from lower socio-economic classes stand at higher chance of developing TB. Assuming the entire population of the affected children, 69.2% of them were determined to come from a low class background. This is in concordance with other researches that show that poverty is a key predictor of Tuberculosis because of such factors as malnutrition, population density and inadequate medical facilities (8). Constipation as highlighted in the study by the different BMI classification is a key issue as it weakens the immune system thus exposing children to TB (9). This concurs with Jaganath and Mupere (2012) where they pointed out that malnutrition and TB were significantly related in children (10). The survey also showed that majority of the children, 66.9 percent, lived in rural areas where health facilities are also scarce. This finding supports the claim that rural people are more vulnerable

to TB because most of them cannot afford to access quality health facilities, their socio-economic status is lower and most of them are malnourished (11). Further, the living standards that involved congested houses and lack of proper ventilation were the major causes of TB spread. These environmental factors foster the infection of *Mycobacterium tuberculosis* particularly in a home where there is an infected person (12). In particular, it was established that 43.8% of the children with TB reported a past history of contact with an adult smear-positive pulmonary TB patient at home, which supports the concept of contact tracing and management in TB control. This finding is in agreement with other workers who have also established that household contact is the primary determinant of childhood TB (6). Marais et al. (2004) noted that children in homes with TB infected adults are likely to develop the disease because they are exposed for long (13). The study also focused the effects of BCG vaccination where 43.8% of the infected children had no record of BCG vaccination. The BCG vaccine is also understood to offer substantial protection against the severe types of TB in children; however, it provides a less certain protection against pulmonary TB (14). Trunz et al. (2006) also endorse BCG vaccination in the prevention of severe TB manifestations (15). In addition, the study's findings show that childhood TB is a complex disease that depends on a range of socio-economic factors, environmental conditions, nutritional status, and history of immunization. Tuberculosis control measures must therefore encompass all these factors as a way of management. It is necessary to pay attention to the improvement of socio-economic status, better nutrition, living conditions, and the provision of a wide range of vaccinations.

Conclusion

The results of this study can be discussed in reference to the current literature on risk factors of childhood TB. From the socio-economic

status, contact with the TB patients, and BCG vaccination factors indicate that TB control requires a multi-faceted approach in tackling the disease. Further research should be done to study these relationships in a longitudinal manner and to assess the effectiveness of the specific interventions in children in decreasing the TB rate.

Authors Contribution

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