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ORIGINAL ARTICLE

SOCIO-DEMOGRAPHIC PROFILE AND BASAL METABOLIC INDEX CHARACTERISTICS OF PATIENTS WITH PULMONARY TUBERCULOSIS AND THEIR TREATMENT OUTCOME IN MEDICAL COLLEGE HOSPITAL, AMRITSAR, INDIA

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ABSTRACT: INTRODUCTION: Tuberculosis is an ancient disease associated with high degree of morbidity and mortality worldwide, more so in developing countries having overwhelming problems of poverty, poor living conditions, illiteracy, malnutrition, drug addiction. **OBJECTIVES:** To evaluate the socio-demographic profile and BMI characteristics of patients with pulmonary tuberculosis and their treatment outcome. **MATERIAL & METHOD:** This prospective study was conducted on 200 new sputum smear positive patients having age >15 years. **OBSERVATIONS & RESULT:** The present study (n= 200) with 121 males and 79 female revealed that 75.8% of males and 87.5% of females were in the age group of 15-45 years, being the most productive years of life. 60.5% cases lived in overcrowded houses with inadequate ventilation (73%), poor lighting (68.5%), majority with lower socio-economic status (72.5%). 66% were from medium to large sized families, 65% joint family while 35% with nuclear families. 57.5% were working & thus were included in income generating activity group. illiteracy was observed in 40% & addiction in 47%. 69.5% of the cases were underweight (BMI < 18.5kg/m2) at initiation of treatment and percentage improved to 62.5% at the end of anti-tubercular treatment. **CONCLUSION:** The study findings emphasise the association of the socio-demographic profile including overcrowding, inadequate ventilation of the dwellings, ill-ventilated kitchens, under-nutrition with poor BMI, poor level of education (illiteracy, ignorance, poor knowledge about the disease), low socio-economic status with poverty contributing as significant risk factors for tuberculosis & its spread in family & community.

KEYWORDS: Tuberculosis, socio-demographic, illiteracy, overcrowding, malnutrition.

INTRODUCTION: Tuberculosis is a disease that has adversely affected the nations since times immemorial and remains the most common cause of death world over, in spite of its being 100% preventable and curable, with people still continue suffering and dying from the disease.[1] India has the highest tuberculosis burden among nations, accounting for about 1/4th of the global incidence. In 2012, World Health Organisation estimated 2.2 million incident cases (176/100,000/year) with prevalence of 2.8 million (230/100,000/year) and mortality rate of 0.27 million cases 22/100,000/year) in India.[2]

Several socio-demographic factors contributing towards the increasing incidence and development of TB are age, gender, socioeconomic status, smoking, alcoholism, drug addiction, living conditions, literacy, family history, overcrowding, poor sanitation, poor ventilation, malnutrition, occupational factors like exposure to silica and those working in proximity to persons suffering from pulmonary tuberculosis, increased stress and strain of life etc.[3]

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The association between TB and malnutrition is well recognised; tuberculosis can lead to malnutrition which in turn may predispose to TB.[4] Both these conditions have been found to coexist among patients at the time of initiating treatment in both developed and developing countries.[5,6] Malnutrition enhances the development of active tuberculosis and active tuberculosis makes malnutrition worse thus creating a vicious cycle. People with BMI below 18.5 have 2-3 times more risk as compared to individuals with normal BMI. Unfortunately very few studies have been designed to examine the relationship between nutrition and the incidence of TB and its severity. May be that randomised controlled trials the gold standard in evidence based medicine can be difficult to carry out in food insecure regions due to ethical considerations.

Poverty, a curse in disguise, plays major role in tuberculosis, the risk of non-adherence to tuberculosis treatment was found to be significantly associated with low socio-economic status. [7] The WHO theme "Stop TB, fight poverty" on the World tuberculosis day 2002, emphasises this important socio-economic factor related to the disease. Poverty results in poor nutrition which renders the immune system more vulnerable to invading organisms like Mycobacterium tuberculosis and forces to overcrowded living conditions which in turn increases the risk of disease transmission in the family.

With paucity of published data and literature on the subject, related to this region, the present study was conducted to know the impact of these indicators on tuberculosis and the treatment outcome.

AIM AND OBJECTIVES: To evaluate the socio-demographic profile and BMI characteristics of patients with pulmonary tuberculosis and their treatment outcome.

MATERIAL AND METHODS: The present prospective study was conducted on 200 new sputum smear positive patients who were attending the outdoor or admitted in Chest and Tuberculosis Hospital, Government Medical College, Amritsar, India after taking their consent. The study population consisted of patients having age >15 years, new sputum smear positive with pulmonary TB, registered for treatment. Exclusion criteria included extra pulmonary tuberculosis and smear negative pulmonary tuberculosis cases. Institutional ethical committee approval for the study was taken.

A structured questionnaire was used to collect information on basic socio-demographic data like name, age, sex, height, weight, marital status, education, occupation, religion, caste, family type, family size, household environment, socio-economic status, knowledge, attitude, practices and sputum conversion rates. The height (h) of the patients was measured while standing erect against wall without shoes; weight (w) was measured on a digital standing scale with minimal clothing on. The same instruments were used to take the measurements and were calibrated each morning to ensure validity of the results. Both height and weight were recorded to two decimal places. With height assumed to be unchanged, the weights of the patients were measured again at the end of the treatment.

RESULTS: The present study to assess the socio-demographic profile & BMI characteristics in patients of pulmonary tuberculosis & their effect on treatment outcome had sample size of 200 patients with 121(60.5%) males and 79(39.5%) females.

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Age Group (Years)	Male n= 121 No. Col*%	Female n= 79 No. CoI%	Total n= 200 No. CoI%
15 – 29 #Row%	67 (55.4) {57.3}	50 (63.3) {42.7}	117 (58.5) {100.0}
30 – 44 Row%	25 (20.8) {56.8}	19 (23.75) {43.2}	44 (22.0) {100.0}
45 – 59 Row%	20 (16.7) {68.96}	9 (11.25) {31.0}	29 (14.5) {100.0}
>= 60 Row%	9 (7.5) {90}	1 (1.25) {10.0}	10 (5.0) {100.0}
*Col% = Column percentaqge #Row% = Row percentage			

Table 1: Distribution of cases according to sex and age

Taking an a/c of age distribution of cases (Ref. Table 1) 58.5% were in the age group of 15-29 years (Both male & female). Out of 121 males about three-fourth of the cases were less than 45 years i.e. 55.4% in the 15-29 years and 20.8% in the 30-44 years age group; whereas one fourth of the cases were in the >45yrs age groups. Among 79 females, 63.3% were in the age group of 15-29 years, 23.75% were in the age group of 30-44 years while only 12.5% were in the higher age group.

Parameter		No. of cases n = 200	Percent-age
Place of Residence	Native	170	85
	Migrant	30	15
Marital Status	Married	105	52.5
	Single	92	46
	Widow/Widower	3	1.5
Religion	Hindu	89	44.5
	Sikh	93	46.5
	Others	18	9.0
Caste	Upper caste	30	15
	Artisan caste	25	12.5
	Lower caste	145	72.5
Family type	Nuclear	70	35
	Joint	130	65
Family size*	Large	39	19.5
	Medium	93	46.5
	Small	68	34.0

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Education		Above Matric/Matric	48	24
		Below Matric	72	36
		No Schooling	80	40
Occupation	IGA**	Cultivator/Businessman	7	3.5
		Service	23	11.5
		Labourer	60	30
		Working female	25	12.5
	Non IGA	Housewife	55	27.5
		Student	17	8.5
		Nonworking	13	6.5
*According to the number of persons in the household: >8: large, 5-8: medium and 1-4: small** IGA-Income generating activity				

Table 2: Distribution of cases according to the socio-demographic profile

Table 2 illustrates distribution of cases according to their socio-demographic profile. Out of the total 200 cases, 85.0% were natives while 15.0% migrant. More than half i.e. 52.5% were married, 46.0% unmarried and 1.5% bereaved (Widow/widower). 44.5% were Hindus and 46.5% Sikhs, 9% belonged to other religions. 72.5% belonged to lower caste. It was observed that 65% of them belonged to joint families and 46.5% had medium sized families having 5-8 members in the household. 36% of the cases were below matric whereas 40% were illiterate. There were only 24% cases who were matric or above matric. Income Generating Activity (IGA) group comprised of labourers (30%), service men (11.5%), working females (12.5%) and cultivators/businessmen (3.5%). Non IGA group comprised of housewives (27.5%), students (8.5%) and non-working subjects (6.5%).

Socio-economic status*	**No. of cases n= 200**	**Percentage**
High	23	11.5
Upper middle	32	16.0
Lower middle	68	34.0
Low	77	38.5
According to Modified Udai Pareekh Scale		

Table 3: Distribution of cases according to Socio-economic status

A perusal of Table-3 shows that more than half of the cases were belonging to lower middle class (34.0%) and low class (38.5%). 16.0% were from upper middle class and only 11.5% were from high socio-economic status.

(a) Type of house	**No. of cases N= 200**	**Percentage**
Pucca	62	31.0
Mixed	73	36.5
Kucha	65	32.5

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(b) Kitchen	N= 200	
In room	55	27.5
Separate with exhaust	30	15.0
Separate without exhaust	37	18.5
Open	78	39.0
(c) Fuel used	N= 200	
LPG stove	75	37.5
Kerosene stove	57	28.5
Cow dung/wood	68	34.0
(d)Overcrowding*	N= 200	
Present	121	60.5
Absent	79	39.5
(e)Ventilation	N= 200	
Inadequate	146	73.0
Adequate	54	27.0
(f)Lighting	N= 200	
Inadequate	137	68.5
Adequate	63	31.5
According to number of persons per room		

Table 4: Distribution of cases according to household environment

Table-4 depicts that 31% of cases resided in pucca houses. Out of the total 200 cases, 33.5% had separate kitchen in their houses and 37.5% used LPG stove for cooking. Smoke vent/exhaust was provided in only 15% cases having separate kitchen. In 27.5% of the cases kitchen was present in the living room itself. Overcrowding was present in 60.5% of the cases and both ventilation and lighting were inadequate in the houses of 73% and 68.5% cases respectively.

Grades	**In the beginning n= 200 No. %**	**At the end of treatment n = 179* No. %**
Severe underweight	68 (34.0)	44 (24.6)
Moderate underweight	23 (11.5)	29 (16.2)
Mild underweight	48 (24.0)	39 (21.8)
Normal	58 (29.0)	62 (34.6)
Pre- obese	3 (1.5)	5 (2.8)
*Excluding drop outs		

Table 5: Distribution of cases according to BMI in the beginning and at the end of treatment

As summarized in Table-5, it was observed that at the start of treatment 69.5% patients were underweight, among which 34% were severely underweight having BMI < 16 kg/m2, 29.0% cases were having normal BMI while only 1.5% cases were pre-obese. At the end of treatment 62.5% of the

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cases were still underweight, 34.6% having normal BMI and 2.8% arrived in the pre-obese category. In 21 cases which included subjects who died, lost to follow up, transferred out or migrated out of area without information weight measurement could not be recorded at the end of treatment.

Determining variables	No. of cases n= 200*	
	Yes (%)	No (%)
Infectious nature of the disease	104 (52.0)	96 (48.0)
Curable	169 (84.5)	31 (15.5)
Life threatening without treatment	167 (83.5)	33 (16.5)
Awareness about the duration of treatment	125 (62.5)	75 (37.5)
Awareness about the effects of irregular and incomplete treatment	141 (70.5)	59 (29.5)
Awareness about the availability of free ATT at the govt. hospital	93 (46.5)	107 (53.5)
Importance of taking treatment under observation	107 (53.5)	93 (46.5)

Table 6: Distribution of cases according to knowledge about the disease

As is evident from the Table- 6, 84.5% of the cases knew that the disease is curable and 83.5% knew that it will be life threatening without treatment. 52% of the cases were aware of the infectious nature of the disease and 62.5% had knowledge about the duration of treatment. 53.5% cases were unaware about the availability of free supply of ATT at the government hospitals. Only 53.5% of the cases knew the importance of taking treatment directly under observation.

NOTE: Each question was given a score of 1. By using likert's scale, knowledge was categorized into poor knowledge (score <3), fair knowledge (score 3-5) and good knowledge (score > 5).

Outcome*	No. of cases n= 200	Percentage
Cured	165	82.5
Treatment completed	6	3.0
Failure	10	5.0
Loss to follow up	8	4.0
Transferred out	5	2.5
Died	6	3.0

*For statistical analysis, outcomes were divided in two categories: Favourable Outcome (F.O.): include cured and treatment completed Unfavourable Outcome (U.O.) – include failure, loss to follow up, transferred out and died.

Table 7: Distribution showing the treatment outcome of New smear positive cases under study

Table 7 illustrates that among the total 200 cases under study, 82.5% were cured and 3.0% completed treatment. Failure rate was 5.0%, 4.0% cases lost to follow up, 2.5% transferred out and 3% died during the treatment.

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DISCUSSION: Tuberculosis, detected as far back as 10,000 BC, continues to haunt us even as we have well stepped into the 21st century AD, with enormous impact on human sufferings. In the present study total of 200 cases comprising of 121 males (60.5%) and 79 females (39.5%) were studied.

The disease affects the people in their most productive years of life, 75.8% of males and 87.5% females were in the age group of 15-45 years. Treatment success was more in the younger age group i.e. 15-29 age group with poor outcome in advanced age group. Male preponderance with male to female ratio of 1.5:1 was seen. The findings in the present study are consistent with the study of Pakasi et al (2009) in Indonesia reflecting that among 121 TB patients, 56.3% were males and 43.7% were females.[8] The finding probably reflects the 'male-dominance' character of our society and also that being the bread-earner, male is made to report the health facility earlier than female counterpart in the family.

Regarding socio-demographic profile of the cases, it was observed that majority of the cases were natives (85.0%); married (52.5%), single (46%), widowed (1.5%), whereas a multi-centric study by Lienhardt et al (2005) in three countries of West Africa showed that out of the total cases, 48% were married and 44% were single and 7% were widowed or divorced. The small difference could be due to multi-centric nature of the study.[9]

The present study shows that almost three fourth of the cases (72.5%) belonged to lower caste. Similar findings were reported by Mohrana et al (2009) in their study at a tertiary level heath facility in Orissa that majority of cases belonged to backward caste/SC/ST.[10]

The present study shows that 66% of the cases were from medium to large sized families. Similar findings were reported by Muniyandi et al (2005) in their study at Tamil Nadu that out of 467 TB cases registered, 65% had family size 4+.[11]

The present study shows that 40% of the cases were illiterate. The similar literacy rates were reported by Muniyandi et al (2006) in their study showing that out of the total TB patients registered under government health facility, 37% were illiterate.[12]

In this study, it was observed that more than half among the males i.e. 50.0% were labourers and more than half among females i.e. 68.75% were housewives.

A study on risk factors of TB by Hill et al (2006) in Gambia reported that the risk of TB decreases in those in a professional occupation.[13]

Most of the cases in this study were from lower middle (34.0%) and low (38.5%) socio-economic status. The review of studies at the Tuberculosis Research Centre, Chennai showed that 64% of TB patients registered under RNTCP were poor and had low Standard of Living Index (SLI), 32% had medium standard of living and 4% had high standard of living.[12]

Regarding the household environment of the cases, it was observed that 31% resided in pucca houses. Less than half had separate kitchen in their houses and used LPG stove for cooking. Smoke vent/exhaust was present in only 15% of the cases having separate kitchen in their house. 60.5% cases lived in overcrowded houses. Inadequate ventilation and inadequate lighting were present in 73% and 68.5% of the cases respectively. It is usually seen that poor housing quality including overcrowding and inadequate ventilation & presence of smoke contribute to poor respiratory health in general & have been implicated in the increased transmission of TB. Housing conditions are used as socio-economic indicators of health and well-being.[14] Poor housing quality and overcrowding are associated with poverty, specific ethnic groups and increased susceptibility to disease.[15] Crowding, poor air quality within homes as a result of inadequate ventilation, and the presence of mold and

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smoke contribute to poor respiratory health in general and have been implicated in the spread and/or outcome of tuberculosis (TB).[16] Aerosolised droplet nuclei spread from cough or sneeze of an individual with active respiratory tuberculosis, laided with mycobacterium tuberculosis bacilli is the known mode of spread of pulmonary tuberculosis, responsible for early and fast spread of disease in such poor overcrowded, ill-ventilated housing conditions. The effect of these conditions on the treatment outcome is significant.

In the present study it was observed that addictions were observed in 94(47%) cases out of which 28.8% were alcoholic, 12% smokers, 6% had the habit of tobacco chewing and 13.2% were drug abusers among them intravenous, oral in the form of 'bhuki', 'smack', 'marizuana', 'heroin', capsules. A study in Orissa reported that 58.7% of the patients had addiction to any form of tobacco, smoking was present in 26.3% of male patients and alcohol was noted among 22.4% of the study population.[10]

Regarding knowledge about the disease, it was observed that 81.5% of the cases were had fair/good knowledge about the disease. There was significant difference in the adherence to treatment resulting in favourable outcome in those having fair/good knowledge (81.5%) as compared to those having poor knowledge (18.5%). A study done by Fatiregun et al (2009) in Nigeria showed that patients with a poor knowledge of tuberculosis had a higher risk of having a poor treatment outcome compared to those with a good knowledge.[17]

Tuberculosis is the disease with the social stigma attached to it. In the present study almost two-third i.e. 64% of the cases did not disclose their illness to others because of fear of social boycott. It was seen that only 35.5% of the cases sought treatment from the government hospital on appearance of symptoms. Attitude of the family members was supportive in 90.5% of the cases. Jaggarjama et al (2009) carried out a comparative study in two time periods in 1997 and 2005 in both rural and urban areas in Chennai city. The study showed that reasons for initiating TB treatment with private practitioners in pre and post RNTCP periods were convenience, personal care, motivated by others, confidentiality and known doctor.[18]

The treatment outcome of the NSP cases under study were noted as per RNTCP guidelines. These are: cured (82.5%), treatment completed (3.0%), failure (5.0%), loss to follow up (4.0%), transferred out (2.5%) and died (3%). The favourable outcome (cured + treatment completed) was observed in 85.5% of the cases and unfavourable outcome (failure + loss to follow up + transferred out + died) in 14.5% of the cases. Cure rate was very close to the recommended target of 85%. Treatment completed, defaulted, transferred out and death rates were within the RNTCP norms of <3%, <5%, <3% and <4% respectively. But failure rate of 5.0% was slightly more (expected is <4%).

The findings are in accordance with the study conducted by Chennaveerappa et al (2011) at Hassan, Karnataka showing that among 58 NSP patients treatment 49 patients (84%) got cured, 4(6%) patients died, 3(5%) patients were defaulters and 2 patients were treatment failures.[19]

The association between TB and malnutrition is well recognized. As cell-mediated immunity is the key host defence against TB. It is opined that malnutrition can cause significant impairment of several important mechanism of immune protection including cell mediated immunity, phagocytic function, antibody concentration and cytokine production, thus presenting as important risk factor for development of tuberculosis. In the present study, it was seen that at the time of registration 69.5% of the cases were underweight (BMI <18.5kg/m2) and the percentage dropped down to 62.5% at the end of treatment.

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A review of studies by WHO, Stop TB Department, Geneva, Switzerland showed a log-linear inverse relationship between TB incidence and BMI. In other words, across all these studies TB incidence increased exponentially as BMI decreased.[20] In the present study also, it was observed that 69.5% of the cases registered were having low BMI of < 18.5.

There is a significant change in mean BMI in cured cases from 18.48±2.87 in the beginning to 18.99±2.91 at the end of treatment (p = <0.000) showing significant weight gain in cured cases. The change in the mean BMI of the failure cases before and after the treatment was significant (p = 0.000).

In a study conducted by Vasantha et al (2009) in Tiruvallur district, Tamil Nadu, India, it was observed that the average gain in weight was 3.22kg among smear positive cases registered under DOTS. It was concluded that there is an association between gain in weight with DOT and cure of the patients.[21]

CONCLUSIONS: The study findings underline the association of the socio-demographic profile of the patients with tuberculosis. Overcrowding, inadequate ventilation of the dwellings, ill-ventilated kitchens with increased smoke exposure from the cow dung & wood bio-fuel conglomerating to poor housing quality contribute as risk factors, as was seen in majority of patients. Under-nutrition with poor BMI associated with poor level of education (Illiteracy, ignorance, poor knowledge about the disease), low socio-economic status with poverty are other equally significant contributing risk factors for the spread of disease in the patient, family and thus in the community, being an infection spreading by aerosolized droplet nuclei. As corollary to the preposition, the corrective measures to be undertaken shall include imparting adequate nutrition, spread of education, awareness and information among the masses; with knowledge about healthy adequate ventilation in the dwellings without much added cost burdens.

It can be safely inferred that presence of these indices as risk factors play a pivotal role to guide and consider the diagnosis of tuberculosis in chest symptomatics, with a high index of suspicion and effective treatment thereof. For better understanding of the disease, so as to be able to diagnose and cure it still more efficiently, such scientific knowledge and practical experience can be further updated by conducting even larger sample size studies.

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