

Assessment of dietary intake and its determinants in adult patients on anti-tubercular treatment in Aligarh, India: a cross sectional study

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Abstract

Background and objectives: Adequate nutrition and a good dietary practice play an important role in recovery from tuberculosis (TB). Improper dietary practice and poor nutrition lead to low immunity in the host and thus increase the risk of active TB in addition to relapse and mortality. The objective of the study was to assess the dietary intake and its determinants in patients on anti-tubercular treatment.

Materials and methods: A cross-sectional study was conducted, in four Designated Microscopic Centres under the administration of the District TB Cell of Aligarh district from January 2020 to December 2021. Adult TB patients undergoing treatment between the ages of 18 to 60 years were enrolled. A semi-structured questionnaire was used as a study tool. The 24-hour recall method was used for eliciting dietary intake as it had less recall bias. The sufficient and insufficient dietary cut offs were chosen from the Indian Council for Medical Research (ICMR) nutrient guidelines for TB patients. The data was analyzed by appropriate statistical tests.

Results: A total of 410 TB patients participated in the study. Majority (61.7%) of the patients were unemployed and 46.8% belonged to the lower middle class. Of the total cases, 83.2% patients were consuming energy below the Recommended Dietary Allowance (RDA). The protein intake was sub-optimal in 71%, while 52% were taking fat below RDA. Age, gender, and education of the participants were significantly associated (< 0.05) with their energy and protein intake.

Conclusions: The participants' intake of nutrients was suboptimal compared to RDA. Thus, there is a need to improve the nutritional status of TB patients. Therefore, findings of the study could be utilised to plan programs for improved nutritional care for under privileged TB patients living in rural and urban areas.

Introduction

Tuberculosis (TB) is one of the oldest diseases known to mankind, caused by the bacterium

Mycobacterium tuberculosis [1]. India has approximately 26% of global TB cases and it kills an estimated 480,000 Indians per year or more than

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1,400 per day [2,3]. TB is curable, preventable, and effectively treated with anti-tubercular treatment (ATT) [4]. It has been known that there is a bidirectional link between TB and nutrition. TB can lead to malnutrition, and malnutrition may predispose to TB. Poor dietary intake and nutrition lead to low immunity, increasing susceptibility of the host, and increasing the risk of active TB by six to ten times, besides increasing the risk of relapse and mortality [5,6]. Weight loss among people with active TB can be caused by several factors, including reduced food intake due to loss of appetite, nausea and abdominal pain. It is also been associated with altered metabolism and malabsorption of nutrients and anti-TB drugs. Management of active TB disease needs 20–30% more energy, so diet and nutritional requirements are increased, but TB, as such, decreases appetite, leading to weight loss. Therefore, a good dietary practice and effective treatment improve the outcome of TB [7]. In view of the above, this study aimed to assess dietary practices of adult TB patients on anti-tubercular treatment residing in urban and rural areas.

Materials and methods

This study was a cross-sectional study conducted in Aligarh from January 2020 to December 2021. Four Designated Microscopy Centres (DMCs) under the administration of the District TB Cell of Aligarh district were selected based on geographical contiguity, study feasibility, resources and the case load. Centers were located under the rural and urban TB units (TU). Two centers from each area were selected. The study participants were adult TB patients undergoing treatment between the ages of 18 to 60 years. Those who had comorbidities like hypertension, HIV, diabetes, and condition like pregnancy were excluded from the study. TB cases were enrolled by sequential sampling method from the complete list of registered TB patients of the respective DMCs [8]. A face-to face interview was conducted. A semi-structured questionnaire was used as a study tool. The questions were asked in locally known language, Hindi. A pilot study was conducted to assess the feasibility and appropriateness of the questionnaire and the flow of the interview. Subsequently, required

modifications were made to the questionnaire. Based on the results of the pre-test exercise, the interview schedule was modified according to the responses elicited, and the words used in the questionnaire were modified to make them understandable for the participants. The 24-hour recall method was used for eliciting dietary intake as it had less recall bias. Due care was taken during the dietary history that participants were not on fast or feast in the last twenty-four hours. The sufficient and insufficient dietary cut offs used were based on the Indian Council for Medical Research (ICMR) nutrient guidelines for TB patients. The ICMR assumes that TB patients live a sedentary life due to the debilitating effects of the disease.

Statistical analysis: Data entered in MS Excel and analyzed by IBM SPSS software version 20.0 (IBM Corp). Chi-square and other appropriate tests were used and the value of $p < 0.05$ was taken as significant.

Ethical consideration: Approval for the study was obtained from the Institutional Ethics Committee, Jawaharlal Nehru Medical College, Aligarh Muslim University, along with the District TB Cell (DTC), Aligarh, for conducting the study. Informed consent was obtained from the participants, and confidentiality was ensured.

Results

A total of 410 TB patients participated in the study. The majority of cases (62.4%) were in the age group of 18–30 years, and the mean age was 31.6 ± 11.8 years. Approximately half (53.4%) of the TB cases were male, and 67.6% of participants were married. The majority of patients (56.3%) were from the Hindu community and 62.4% of the patients were from the general caste and illiterate patients comprised 38% of the study population. Of the total, 42.2% of patients resided in rural areas, whereas those in urban slum areas accounted for 39.5%. Majority (61.7%) of the patients were unemployed, 46.8% had ≤ 5 family members, and the remaining (53.2%) had a family size of >5 members while 64.9% of participants were from nuclear families. The data on socioeconomic class (modified B.G. Prasad) revealed that 46.8% of TB

Table-1: Socio-demographic profile of study population (N=410)

Characteristics	Number (%)	Characteristics	Number (%)
Age in years		Occupation	
(18-30)	256 (62.4)	Professional	1 (0.2)
(31-40)	55 (13.4)	Semi-Professional	14 (3.4)
(41-50)	62 (15.2)	Skilled	4 (1)
(51-60)	37 (9.0)	Semi-skilled	32 (7.8)
Gender		Unskilled	106 (25.9)
Male	219 (53.4)	Unemployed	253 (61.7)
Female	191 (46.6)	Locality/area	
Religion		Rural	173 (42.2)
Hindu	231 (56.3)	Urban	75 (18.3)
Muslim	175 (42.7)	Urban-slum	162 (39.5)
Others	4 (1)	Family size	
Caste		≤5	192 (46.8)
General	256 (62.4)	>5	218(53.2)
OBC	106 (25.9)	Family type	
SC & ST	48 (11.7)	Nuclear	266 (64.9)
Education		Joint	53 (12.9)
Illiterate	158 (38.5)	Third generation	
Primary Level	99 (24.1)	Social class	
High School	81 (19.8)	Class-I	13 (3.2)
Intermediate	34 (8.3)	Class-II	67 (16.3)
Graduate	24 (5.9)	Class-III	91 (22.2)
Postgraduate & above	16 (3.9)	Class-IV	192 (46.8)
Marital status		Class-V	47 (11.5)
Married	277 (67.6)		
Unmarried	133 (32.4)		

Note: SC- Scheduled castes. ST- Scheduled tribes, OBC- Other backward classes

patients belonged to the lower middle (class IV) class as per the modified B.G. Prasad classification, 2019 (Table-1).

Overall, most (83.2%) of TB patients daily energy intake was deficient. Most of the males (88.1%) and 77.5% of the females consumed less energy per day than the recommended RDA. Among all TB patients, the majority (71%) were taking less protein than the required amount. According to the RDA, 78.1% of males' and 62.8% of females' daily protein intake was insufficient. Overall, the majority (52%) of TB patients' fat intake was sub-optimal according to RDA and 65.8% of males and 36.1% of females were consuming less fat less than recommended by the RDA (Table-2).

Total mean energy intake of the TB patients was 1516 ± 332 k cal/day. The mean energy consumption by the male and female TB patients was 1587 ± 347 k cal/day, and 1434 ± 295 k cal/day respectively. Overall mean protein consumption by all TB patients was 45 ± 13 g/day.

In total, mean fat intake was 23 ± 6 g/day. In male and female TB patients, the consumption was 23 ± 6 g/day and 22 ± 6 g/day, respectively (Table-3). It was observed that males' daily energy intake was 75% of the RDA, while the same was 86% for females. Likewise, the protein intake with respect to the recommended RDA by males was 85%, whereas by females it was 93%. The fat intake in males was 92% of the advised RDA; however, in

Table-2: Dietary intake status of the TB patients in comparison to RDA (Sedentary life style, ICMR, NIN Hyderabad, 2020; N=410)

Nutrients	Gender	Dietary intake	Number (%)
Energy (k cal/day)	Male	Insufficient (<2110)	193 (88.1)
		Sufficient (>2110)	26 (11.9)
	Female	Insufficient (<1660)	148 (77.5)
		Sufficient (>1660)	43 (22.5)
	Total	Insufficient	341 (83.2)
		Sufficient	69 (16.8)
Protein (g/d)	Male	Insufficient (<54)	171 (78.1)
		Sufficient (≥54)	48 (21.9)
	Female	Insufficient (<46)	120 (62.8)
		Sufficient (≥46)	71 (37.2)
	Total	Insufficient	291 (71)
		Sufficient	119 (29)
Fat (g/d)	Male	Insufficient (<25)	144 (65.8)
		Sufficient (≥25)	75 (34.2)
	Female	Insufficient (<20)	69 (36.1)
		Sufficient (≥20)	122 (63.9)
	Total	Insufficient	213 (52)
		Sufficient	197 (48)

females, its consumption was higher than the RDA (Table-3).

A statistically significant (p<0.05) association was found between age and energy intake. As age increased, the energy intake decreased. Gender, marital status, education, and occupation were also significantly associated (p< 0.05) with energy uptake. No significant association (p > 0.05) was found between social-economic class, caste, family size, type of family, and religion with energy intake among participants (Table-4). No significant association was found with calorie intake and that of treatment category, duration of initiation of ATT from illness, phase of medication. Patients with pulmonary TB (PTB) were more vulnerable to an energy-deprived diet against extra-pulmonary TB

(EPTB), as shown in Table-4 (p<0.05). All MDR TB patients were consuming a statistically significant (p <0.05) sub-optimal level of energy (Table- 4).

Association of socio-demographic factors and clinical profile of TB patients with protein intake is shown in Table-5. There was a statistically significant (p<0.05) association of protein intake with age category, gender, and education. Protein intake was significantly (p<0.05) high among TB patients with higher education level compared to those with low education levels. Marital status, religion, caste, family size, family type, employment status, social class, or clinical profile of the patients had no significant (p > 0.05) association with protein intake of TB patients.

Table-3: Nutrients intake and percentage of RDA (Sedentary lifestyle) energy, protein and fat consumption in TB patients (ICMR, NIN Hyderabad, 2020; N=410)

Nutrients	Total	Male		Female		% of RDA	
	Intake	Intake	RDA	Intake	RDA	Male	Female
	Mean±SD	Mean±SD		Mean±SD			
Energy (kcal/day)	1516 ± 332	1587 ± 347	2110	1434 ± 295	1660	75	86
Protein g/day	45 ± 13	46 ± 13	54	43 ±13	46	85	93
Fat g/day	23 ± 6	23 ± 6	25	22 ±6	20	92	110

Table-4: Association of socio-demographic factors and clinical profile with calorie intake of study participants (N=410)

Characteristics	Calorie intake		p value	Characteristics	Calorie intake		p value
	Insufficient N (%)	Sufficient N (%)			Insufficient N (%)	Sufficient N (%)	
Age in years				Occupation			
(18-30)	203 (79.3)	53 (20.7)	$\chi^2=15.99$ P=0.001	Employed	138 (87.9)	19 (12.1)	$\chi^2=4.062$ P= 0.044
(31-40)	43 (78.2)	12 (21.8)		Unemployed	203 (80.2)	50 (19.8)	
(41-50)	61 (98.4)	1 (1.6)		Education			
(51-60)	34 (91.9)	3 (8.1)		Illiterate	136 (87.2)	20 (12.8)	$\chi^2=7.355$ P=0.025
Gender				Primary & HS	151 (83.9)	29 (16.1)	
Male	193 (88.1)	26 (11.9)	$\chi^2=8.25$ P=0.004	Inter & above	54 (73)	20 (27)	
Female	148 (77.5)	43 (22.5)		Type of TB			
Marital status				PTB	227 (87.3)	33 (12.7)	$\chi^2= 8.689$ P=0.003
Married	238(85.9)	39 (14.1)	$\chi^2=4.61$ P=0.03	EPTB	114 (76.0)	36 (24)	
Unmarried	103 (77.4)	30 (22.6)		Treatment category			
Religion				New	173 (82.0)	60 (18)	$\chi^2=1.790$ p=0.181
Hindu	197 (85.3)	34 (14.7)	$\chi^2=2.8$ P=0.25	Prev. treated	68 (88.3)	9 (11.7)	
Muslim	140 (80.0)	35 (20.0)		Type of TB (according to DST result) n=206			
Others	4 (100.0)	0 (0.0)		Non- MDR	165 (86.4)	26 (13.6)	$\chi^2= 7.079$ P=0.029
Cast				MDR-TB	15 (100)	0 (0)	
General	211 (82.4)	45 (17.6)	$\chi^2=0.323$ P=0.851	Duration of initiation of ATT from 1st episode of illness			
OBC	89 (84.0)	17 (16)		≤ 1 month	104 (80.0)	26 (20)	$\chi^2=1.367$ P=0.242
SC & ST	41 (85.4)	7 (14.6)		> 1 month	237 (84.6)	43 (15.4)	
Family size				PHASE OF MEDICATION			
≤ 5	159 (82.8)	33 (17.2)	$\chi^2=0.033$ P=0.856	Intensive phase	148 (87.1)	22 (12.9)	$\chi^2=3.137$ P=0.077
>5	182 (83.5)	36 (16.5)		Contn. phase	193 (80.4)	47 (19.6)	
Family type				Appetite			
Nuclear	219 (82.3)	47 (17.7)	$\chi^2=0.384$ P= 0.825	Decrease	233 (80.1)	58 (19.9)	$\chi^2=6.893$ P=0.009
Joint	45 (84.9)	8 (15.1)		Not decrease	108 (90.8)	11 (9.2)	
3 rd generation	77 (84.6)	14 (15.4)			H/o abdominal pain, nausea, vomiting and diarrhea		
Social class				Yes	95 (87.2)	14 (12.8)	$\chi^2=1.685$ P=0.194
Class-I	12 (92.3)	1 (7.7)	$\chi^2=2.656$ P=0.617	No	246(81.7)	55 (18.3)	
Class-II	54 (80.6)	13 (19.4)		Nutritional counselling received			
Class-III	76 83.5)	15 (16.5)		Yes	183 (83.2)	37 (16.8)	$\chi^2=0.00$ P=0.995
Class-IV	157 (81.8)	35 (18.2)		No	158 (83.2)	32 (16.8)	
Class-V	42 (89.4)	5 (10.6)					

Note: Note: SC- Scheduled Castes. ST- Scheduled Tribes; OBC- Other Backward Classes; HS - High school; Inter – Intermediate; PTB - Pulmonary TB; EPTB - Extra pulmonary TB; Prev – Previously; MDR - Multidrug-resistant; Contn – Continuation

Table-5: Association of socio-demographic factors and clinical profile of TB patients with protein intake (N=410)

Characteristics	Protein intake		p value	Characteristics	Protein intake		p value
	Insufficient N (%)	Sufficient N (%)			Insufficient N (%)	Sufficient N (%)	
Age in years				Occupation			
(18-30)	170 (66.4)	86 (33.6)	$\chi^2=8.342$ P=0.039	Employed	116 (73.9)	41 (26.1)	$\chi^2=1.046$
(31-40)	40 (72.7)	15 (27.3)		Unemployed	175 (69.2)	78 (30.8)	P= 0.307
(41-50)	51 (82.3)	11 (17.7)		Education			
(51-60)	30 (81.1)	7 (18.9)		Illiterate	120 (76.9)	36 (23.1)	$\chi^2=6.473$
Gender				Primary & HS	151 (83.9)	29 (16.1)	P=0.039
Male	171 (78.1)	48 (21.9)	$\chi^2=11.525$ P=0.001	Inter & above	45 (60.8)	29 (39.2)	
Female	120 (71.0)	71 (29.0)		Type of TB			
Marital status				PTB	190 (73.1)	70 (26.9)	$\chi^2= 1.523$
Married	204 (73.6)	73 (26.4)	$\chi^2=2.956$ P=0.086	EPTB	101 (67.3)	49 (32.7)	P=0.217
Unmarried	87 (65.4)	46 (34.6)		Treatment category			
Religion				New	239 (71.8)	94 (28.2)	$\chi^2=0.546$
Hindu	164 (71.0)	67 (29.0)	$\chi^2=0.033$ P=0.984	Prev. treated	52 (67.5)	25 (32.5)	p=0.46
Muslim	124 (70.9)	51 (29.1)		Type of TB (according to DST result) n=206			
Others	3 (71.0)	1 (29.0)		DST	136 (71.2)	55 (28.8)	$\chi^2= 0.06$
Cast				MDR	11 (73.3)	4 (26.7)	P=0.97
General	185 (72.3)	71 (27.7)	$\chi^2=1.839$ P=0.399	Duration of initiation of ATT from 1st episode of illness			
OBC	70 (66.0)	36 (34.0)		≤ 1month	90 (69.2)	40 (30.8)	$\chi^2=0.281$
SC & ST	36 (75.0)	12 (25.0)		> 1 month	201 (71.8)	119 (28.2)	P=0.596
Family size				PHASE OF MEDICATION			
≤5	134 (69.8)	58 (30.2)	$\chi^2=0.246$ P=0.62	Intensive phase	118 (69.4)	52 (30.6)	$\chi^2=0.345$
>5	157 (72.0)	61 (28.0)		Contn. phase	173 (72.1)	67 (27.9)	P=0.557
Family type				Appetite			
Nuclear	189 (71.1)	77 (28.9)	$\chi^2=0.033$ P= 0.984	Decrease	207 (71.4)	84 (28.6)	$\chi^2=0.012$
Joint	38 (71.7)	15 (28.3)		Not decrease	84 (70.6)	35 (29.4)	P=0.516
3 rd generation	64 (70.3)	27 (29.7)		H/o abdominal pain, nausea, vomiting and diarrhea			
Social class				Yes	80 (73.4)	29 (26.6)	$\chi^2=0.422$
Class-I	11 (84.6)	2 (15.4)	$\chi^2=1.795$ p=0.773	No	211 (70.1)	90 (29.9)	P=0.516
Class-II	48 (71.6)	19 (28.4)		Nutritional counselling received			
Class-III	64 (70.3)	27 (29.7)		Yes	149 (67.7)	71 (32.3)	$\chi^2=2.432$
Class-IV	137 (71.4)	55 (28.6)		No	149 (67.7)	71 (32.3)	P=0.119
Class-V	31 (66.0)	16 (34.0)					

Note: Note: SC- Scheduled Castes. ST- Scheduled Tribes; OBC- Other Backward Classes; HS - High school; Inter – Intermediate; PTB - Pulmonary TB; EPTB - Extra pulmonary TB; Prev – Previously; MDR - Multidrug-resistant; Contn – Continuation

Discussion

This study has demonstrated that the energy intake of 83.2% of the TB patients was below the RDA. The protein intake was sub-optimal in around three-fourths of the participants, while half of the patients were taking fats below RDA. Similar results

were observed in a study in West Bengal, where 86.7% of the subjects were deficient in energy while 36.3% were deficient in fat intake [9]. Similar findings were also reported from Brazil, where most (85%) of subjects were deficient in energy, protein, and micro-nutrient intake as a daily

requirement [10]. The nutrition survey of NNMB stated that 50 to 70 percent of the Indian population consume insufficient protein, fat and energy [11]. A study conducted in Karachi, Pakistan, found that mean energy intake of TB patients was 1321.77 ± 506.19 k cal/day [12]. The difference with our study might be due to a different setting and a large number of participants from urban slums, whose dwellers are largely from lower socioeconomic backgrounds. Moreover, slightly higher energy consumption might be attributed to various social security and nutrition support programmes like the Nikshay Poshan Yojana (NPY) to TB patients in India. Strikingly similar results to our observation were reported by a survey report by Central Tuberculosis Division, MoHFW, India [7]. In concordance with our results, another study reported 19% less consumption of total energy with respect to RDA in TB patients [13]. Similar to our findings, a study from Kenya reported that male and female TB patients respectively consumed 85% and 81% of the RDA of energy [6]. Also, mean protein intake was 37 g/day and 38 g/day by males and females respectively, while fat consumption by men and women TB patients was 53% and 56% of the RDA respectively. These results also corroborate the findings in our study. A study conducted in Peru revealed that the mean calorie intake was 600 k cal/day among TB patients [14]. Another study in Nepal found that occupation was significantly associated with energy intake [15]. However in our study, no significant association was observed with energy intake and age, gender, and education. The present study also found no significant association with calorie intake and treatment category, duration of initiation of ATT from illness and phase of medication. However, it was observed that patients with PTB were more vulnerable to energy insufficiency than those having EPTB ($p = 0.003$). Study from Nepal also reported similar results except that they reported no significant association between type of TB (PTB and EPTB) and energy intake [15].

The present study was an interview-based cross-sectional study, thus subjected to recall bias. Also temporality could not be ascertained as it was a cross-sectional study. The 24-hour recall method was used to assess dietary intake, which had its own limitations. The findings of the study emphasize the need to increase awareness

regarding the role of diet in TB prevention and treatment and also to address other social determinants of TB. Emphasis should be given on health education and dietary counselling by health personnel to TB patients and their care givers.

Author's contribution

All authors contributed equally

Conflicts of interest

Nil

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