Research Paper Home Science

Impact of Nutrition Education on Pulmonary Tuberculosis Patients

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ABSTRACT

Tuberculosis is a common infectious disease caused by various strains of Mycobacterium tuberculosis. One third of the world's population is infected with M. tuberculosis, with new infections occurring in about 1% of the population each year. In 2010, there were an estimated 8.8 million new cases and 1.5 million associated deaths, occurring in developing countries. The rates of tuberculosis in different areas varies across the globe; about 80% of the population in many Asian and African countries are positive in tuberculin tests. More people in the developing world contract tuberculosis because of a poor immune system, and largely due to malnutrition.

Pulmonary tuberculosis has been strongly associated with malnutrition. The objective of the study is to assess and compare the effect of nutrition education with change in the anthropometric measurements and energy, protein intake. The study was planned for the adult patients attending the OPD at Sion Hospital of the Mumbai city. Sample size comprises of total 150 of which 50% subjects were recruited randomly to experimental and control group. Weight, Height, BMI, MUAC, energy and protein intake of each subjects were recorded. Every week all the subjects were provided Nutrition education through one-to-one counseling. The anthropometric measurements were recorded after every three week for both the control group and the experimental subjects. The entire study was planned for six weeks and finally effect of nutritional modification was related with the changes in anthropometric parameters and energy protein intake. The results were statistically evaluated and found significantly related amongst the group

KEYWORDS : Pulmonary Tuberculosis Anthropometric measurement Nutrition education

INTRODUCTION

Tuberculosis (TB) is a bacterial diseases caused by aerobic mycobacterium tuberculosis. (Rubin, 1995)[1]. Like common cold, it spreads through air. The disease was traditionally diagnosed among economically disadvantaged populations. Overcrowded premises, aerosolization with poor ventilation are the major causes of spreading of diseases. Understanding these risk factors provided on insight to develop effective tools to cure or curb relapse of TB.

India is the second most populated country in the world. TB is often associated with severe wasting malnutrition[5] and associated with less in body weight (Chakraborty, 2004)[2]. It causes reduction in appetite altered metabolism leading to decreased energy intake. Nearly, 70% of TB patients are in the age group of 15 to 54 years of age. It does tell enormous socio-economic burden to the Indian country.

In the 21st century pulmonary TB is the most frequent underlying cause for wasting in the world. Studies do demonstrate poor nutrition status among adults with pulmonary tuberculosis. Such patients face double burden of malnutrition. Firstly, energy needs have increased due to inverse of diseases. Secondly, anti TB drugs aggravate the situation by reducing circulating nutrients concentration and by peripheral neuropathy. The association between malnutrition and pulmonary TB is well recognized. The study was undertaken with following aims and objectives.

1. To assess anthropometric profile of patients (Height, Weight, Mid Upper Arm Circumference MUAC).
2. To observe energy and protein intake of the selected subjects.
3. To provide one to one nutrition education related to food intake and sanitation hygiene to each subjects and their family.
4. The results were recorded and evaluated by statistical treatments.

MATERIALS AND METHODS

Study location and Design: The quantitative study was done at Lokmanya Tilak Municipal General Hospital, Sion, Mumbai.

Sampling: Purposive sampling is adopted for the study. Patients registered and attending the Out Patient Department (OPD) for the treatment of tuberculosis were selected.

Sample size: 150 patients were selected**.**

Inclusion criteria: Since it was a purposive sample selection patients with pulmonary TB were selected. Both males and females were selected from the age group 30-60years. Females were non-pregnant and non-lactating.

Exclusion criteria: Patients with HIV and TB endocrine liver, cardiac, pneumonia, influenza were excluded.

The subjects were informed and written consent was taken in English, Marathi and Hindi language prior to data collection

Tools for data collection: Case Record Form (CRF) was taken for all the personal information. Before commencement of the study, anthropometric measurements were recorded by appropriate methods.

A dietary recall was done by open ended questionnaire along with food contains of different size and shapes.

The subjects were classified on the basis of tuberculosis as per the following criteria.

Sputum positive: A patients with at-least two sample of sputum positive for Acid Fast Bacilli (AFB) by microscopy

Sputum Negative: A patients with three samples of sputum found negative for AFB by microscopy along with X-ray abnormalities were consistent.

Nutrition education:

Nutrition education was provided on the one to one base along with pictorial presentation. Only sputum positive and sputum negative were included for the nutrition education All the selected subjects were requested not to leave or go out of station during the study period. After, counseling patients were told to recall the instructions. For any doubts and queries, telephone no., mobile no., email id was given.

RESULTS AND DISCUSSION:

TB is caused by the bacterium Mycobacterium tuberculosis. According to Symptoms of TB include unexplained weight loss, fatigue, fever, night sweats, chills, loss of appetite, coughing, coughing up blood and chest pain (Frieden et.al., 2003)[3]. Malnutrition and a weak immune system are risk factors for TB. Eating a healthy diet can help prevent and improve malnutrition, strengthen the immune system and prevent unintentional weight loss caused by TB.

Subjects were out-patients with untreated active pulmonary TB attending the Sion hospital which is a general public hospital and the national referral hospital in Mumbai city. Controls and experimental groups of selected patients with pulmonary TB, was matched with cases for sex and age, and selected randomly from nonfamily neighbors of the patients in the smallest administrative unit in Sion hospital. At all outpatient hospitals in the public sectors, patients need to be systematically screened for cough by medical officers. Persons with cough for 2 weeks, or more, with or without other symptoms suggestive of TB, should be promptly identified as pulmonary TB suspects and steps taken to subject them to sputum smear microscopy of acid-fast bacilli, for diagnosis of TB. Using the prescribed form for sputum examination, the medical officer of the hospitals sends the TB suspects for sputum examination to the laboratory of Revised National Tuberculosis Control Program (RNTCP) **d**esignated **m**icroscopy **c**entre (DMC) (Vasantha and. Gopi, 2009)[4]. In the DMC laboratory the patient, receives sputum containers with instructions to provide sputum specimens, which are then sent for sputum examination. The number of specimen required for diagnosis of smear positive pulmonary TB is two, with one of them being a morning sputum specimen.

Total 150 patients attending Sion hospital OPD were selected as subjects for this study. The total selected subjects were divided in two groups randomly as 75 (Male = 55, Female = 20) were assigned to the control and 75 (Male = 44, Female = 35) as experimental group. General information about religion, age, housing, education was collected using pre-define questionnaire. The interpretation of these data with respect to religion indicate that subjects comprises of 30 Hindu (20%), 63 Muslim (42%), Buddhists 42 (28%), and 15 catholic (10%). Percentage distribution of subjects according to religion is shown in figure 1. This data can be related with the eating pattern of subjects which may have effect on nutritional status of the patients.

All the subjects were residing in the Dharavi slum area of Mumbai. Most of the patients were illiterate. The study also endorsed that nearly 85% of patients were below 50years of age. The information also indicates that the subjects were below poverty line and may not have financial condition for adopting healthy food. The slum area is highly congested with non-hygienic environment are responsible for infectious health disorder in the area under study.

The selected subjects were classified based on their sputum test and were informed about the project. The information collected is recorded in the Table 1 which reveals that out of total 75 subjects from experimental group nearly 60% (n=44) were male whereas control group comprises of nearly 70% (n=55) male. Amongst the experimental group, 53% patients were sputum negative comprises of n=28 male and n=12 female subjects. At the same time 46% patients were found sputum positive comprise of n=16 male and n=19 female patients. The proportion of female was little higher. Similarly, the control group has 56% were sputum negative and remaining were sputum positive. The proportion of female patients was lower. The data also reveals that 68 (n=45 male and n=23 female) patients were sputum positive

Anthropometry[3] plays an important role in industrial design, clothing design, ergonomics and architecture where statistical data about the distribution of body dimensions in the population are used to optimize products. Changes in life styles, nutrition and ethnic composition of populations lead to changes in the distribution of body dimensions (FAO, 1994)[5]. Subjects were weighed without shoes using an electronic platform weighing scale and weight recorded to the nearest 0.1 kg; while height was recorded to the nearest 0.1 cm using a microtoise.

Biceps, triceps, suprailiac and subscapular skin-folds on the left side of the body were measured to the nearest 0.2 mm three times at each site using a skin-fold caliper. Body Mass Index (BMI) was calculated as body weight divided by height squared (kg/m^2) (Tverdal, 1985)[6]. Subjects were regarded as being malnourished if BMI < 18.5 kg/m^2. Mid-Upper Arm Circumference (MUAC) was measured with a flexible steel tape. The mean technical error, expressed as a standard deviation (SD = $d^2/2n$, where d is the difference between paired measurements and *n* is the number of subjects.

The mean BMI in all patients was 20% lower than in controls ($P <$ 0.001), and the mean proportion of fat in all patients (17.7%) was lower than in controls (21.9%) ($P<0.05$). The number of patients with BMI < 18.5 kg/m^2 (66%) was more than six fold that of the healthy controls (10%) ($P < 0.001$). The mean body weight, BMI, skin-fold thickness, mid-upper arm circumference, proportion of fat, fat mass and fat free mass in male patients were significantly lower than in male controls, whereas all of these variables except biceps and suprailiac skin-fold thickness were significantly different between female patients and controls. Serum albumin concentration was 10% lower in TB patients than in controls. All patients in the study had a baseline BMI, i.e. weight (kg)/height (meter)^2 performed. The BMI value is a crude measure of nutritional status of the patients. BMI was used as a baseline comparison between cirrhotic patients and the local healthy population. Although no definitive recommendation can be made regarding which anthropometric indices are the most appropriate for the TB patients. Weight-for-height could be used for healthy subjects and body mass index could be used for TB patients.

The anthropometric assessment indicates that nutritional status was significantly lower in patients with active pulmonary TB compared with healthy controls. TB patients had significantly lower BMI, skin-fold thickness and serum albumin concentration than healthy controls. Energy and nutrient intake tended to be lower in TB patients than in controls, but the differences were not significant. Two 24-h recalls are not sufficient to determine whether patients have a lower energy intake than controls. Because the number of subjects and number of days required to obtain significant differences are much higher, On the other hand, patients and controls may have similar food habits and food intakes because their socioeconomic background and living conditions are similar. The infectious disease like TB may lead to impaired absorption and increased rates of metabolism. TB is probably associated with more severe malnutrition than other chronic illnesses.

After classification subjects of both the groups were examined with respect to their anthropometric measurements before and after the start of nutrition education program (WHO, 2003)[7]**.** The mean and standard deviation (SD) observations are summarized in the Table 2 to 5. The observations are reported separately for the subjects of experimental group who were sputum positive and sputum negative.

Statistical treatment was applied to these data and values are used to support interpretation of the result. Mean and standard deviation (SD) data are also used for reporting normally distributed data. An independent sample *t* test was used to assess the differences between patients and controls for normally distributed parameters. For all statistical analyses and a *P*-value < 0.05 was considered significant.

Paired Sample Test before and after data of the experimental group

Parameters		t	df	Sig. (2-tailed)
Pair 1	Weight (Kg)	-8.756	74	.000
Pair 2	BMI	-8.607	74	.000
Pair 3	MUAC (cm)	-6.599	74	.000

Paired Samples Test of control group for anthropometric data of before and after values

Parameter		t	df	Sig. (2-tailed)
Pair 1	Weight (Kg)	-2.336	74	.022
Pair 2	BMI	-2.446	74	.017
Pair 3	MUAC (cm)	-2.299	74	.024

Malnutrition is a commonest sign and symptom of the disease hence, diet plays a vital role in fighting TB (Onwubaliti, 1988)[8]. Malnutrition is observed frequently in patients with pulmonary tuberculosis (TB), but their nutritional status, especially of micronutrients, is still poorly documented. Nutrient-dense food options loaded with essential vitamins, minerals and nutrients are considered best for tuberculosis patients. Deficiency of nutrients, especially protein ceases body's ability to combat infection.

Diet for patients with tuberculosis should be simple, digestible and well-prepared. Meals for the patients should be tempting, as loss of appetite one of the symptom of the malady. In this manner, patients

get encouraged to eat. Tuberculosis (TB), airborne infectious disease affecting lungs, is preventable to an extent by wise selection of eating options. Eating healthy creates a shield for infected by strengthening his immune system against tuberculosis complications.

During the study patients were provided with nutritional education (WHO, 2003)[7]. The patients were informed about the malnourishment and their ill effects. Also the impact of healthy diet and food resources were explained with the diagram and motivated them for the healthy and hygienic life style.

The objective of this study was to investigate the nutritional status of patients with active TB compared with that of control group, In a case-control study, **33** out-patients aged 15–55yr were not provided with the nutrition education. Only patients with clinical and radiographic abnormalities were separately provided with the diet plan and necessary precautions for the TB. The patients were also informed about the advantage of miconutrients in addition to healthy food consumption. Various inexpensive food resources were shortlisted and identified and suggested in their daily diet. The baseline energy and protein inputs were collected and summarized in Table 6. The data was also collected after providing the nutritional education to the experimental group and observations are tabulated in Table 7. All the results were interpreted using paired t-test.

Paired Sample Test for energy and protein intake in experimental and control group of before and after values (N=75)

No.	Parameter	Experimental group			Control Group		
		t	Df	Sig. 2-tailed	t	Df	Sig. 2-tailed
Pair 1	Energy (Kcal)	-9.639	74	.000	-2.315	74	.023
Pair 2	Proteins (mg)	-17.401	74	.000	-3.937	74	.000

The nutritional status of patients with active pulmonary TB was poor for all the patients (Rao and Gopalan, 1996)[9]. To prevent TB, diet rich in fruits and vegetables that strengthens immune system (Chandra and Kumari, 1994)[10] is advised so that free radicals do not have in impact on rest of the body. Usually, high protein and high energy diet is prescribed for patients with tuberculosis. 6-meal pattern is also recommended for many patients due to poor appetite.

Balanced diet can fight TB and prevent protein and nutrient deficiencies that occur with the disease. A nutritious diet adheres to federal dietary guidelines and includes 2 cups of fruit, 2 ½ cups of vegetables, 3 oz. of whole grain, 3 cups of low-fat milk or an equivalent amount of dairy products, like cheese or yogurt, and lean proteins like chicken, lean ground beef, fish, seafood, soy, beans, nuts and legumes. Fat should be limited to 20 to 35 percent of total calories and less than 300mg of cholesterol and 2,300mg of sodium should be consumed on a daily basis. Other nutrient-packed foods include whole grains, low-fat dairy products and lean proteins. Vitamins that are particularly important for a healthy immune system include vitamins A, C, E and D. Vitamins A, C and E are antioxidants that protect the body by destroying harmful oxygen molecules called free radicals (Chandra, 1988)[11].

Free radicals are known to destroy cells and tissues and contribute to chronic diseases. Dietary supplement, vitamin D plays a role in regulating the immune system. Individuals who are unable to consume enough vitamins through a healthy diet may benefit from taking vitamin or multivitamin supplements. Good food that meets the recommended daily allowances of macro and micronutrients are imperative in preventing and treating tuberculosis. TB patients have lowered appetite and nausea both of which make getting them to eat a difficult task for the caregiver. Hence, the diet of a tuberculosis patient must consist of nutrient-dense foods that provide: The t-test for equality means of both group at baseline are reported in Table 8.

It is well known that malnutrition is a strong risk factor for becoming unwell with TB that TB is itself a risk factor for malnutrition and that malnourished patients with TB (BMI less than 18.5) are at an increased risk of death even with appropriate antibiotic therapy. Malnutrition increases risk of TB and TB worsens malnutrition Recovering from malnutrition requires TB treatment and adequate nutrition for rebuilding tissues and replenishing deficient MN stores Poverty and food insecurity are associated with poor dietary quality and quantity, as well as reduced treatment access, initiation and adherence Lowering treatment costs and providing income transfer can support treatment and mitigate impact of TB on patient and household members Most high burden countries provide food and nutrition support (Menzies, 2011)[12]. Knowledge about the association between malnutrition and TB is prevalent in some cultures, and may reduce diagnostic delay and improve adherence to treatment. Nutritional assessment was based on the: anthropometry and body mass. All measurements were taken by the same single investigator, to avoid any inter-observer variation.

Dietary Recommendations for Tuberculosis Patients

1. Tuberculosis patients should abstain from drinking alcohol due to the reason that medications like Isoniazid, Pyrazinamide and Rifampin along with alcohol tends to damage liver.
   Oily and spicy food should be entirely avoided so that complications shouldn't increase
3. Choosing health options carefully for managing weight or possibly gaining healthy weight.
4. Tuberculosis patients must include plenty of fruits and vegetables in their everyday regimen for an apt caloric intake. Mix bag of starchy vegetables, citrus fruits, dark green leafy vegetables and legumes are the healthy foods for tuberculosis patients.
5. Whole grains should also be a part of diet plan for tuberculosis, which ascertains weight management and improves immune system.
6. Milk and dairy products are other essential components of TB diet, but these should be low in fat content or fat-free.
7. Bitter gourd also renders several benefits to tuberculosis patients.

SUMMARY AND CONCLUSION

The study has demonstrated the presence of malnutrition amongst pulmonary tuberculosis patients at the base line of study. The positive effects of nutrition counseling on pulmonary tuberculosis patients were found to be highly significant in the experimental group at the end of the study compared to control group.

The finding can therefore be used to make important recommendations such as advancing the arguments in support of the counseling with nutrition education amongst all pulmonary tuberculosis under the Directly Observed Treatment DOTS[4] of RNCTP since such programs has been shown to accelerates the recovery of the patients in terms of anthropometric measurements. Therefore nutritional status may be an important prognostic factor that has been largely overlooked by medical community. Early and aggressive attention to improving patients nutritional status may be an important intervention to ensure survival. Recognition of potential benefits of nutritional support and therapeutic drug monitoring offers other avenues that the dietician can modify and it may reduce mortality associated with pulmonary tuberculosis.[12]

In conclusion, this study shows that the nutritional status of patients with active pulmonary TB was poor compared with healthy controls. Further studies are required to establish the mechanistic role of essential vitamins deficiency in defense against TB patients.

ACKNOWLEDGEMENT

The authors wish to express their deep sense of gratitude to Ms. Neha Kothari, student of Dr. B.M. Nanavati college of Home Science, Matunga, Mumbai 400 019

Table No. 1 Sputum test wise distribution of subjects

Test	Experimental Group		Control group		Total	
	Male	Female	Male	Female	Male	Female
Sputum Negative	28	12	26	16	54	28
Sputum Positive	16	19	29	04	45	23
Total	44 (58.7%)	31 (41.3%)	55 (73.3%)	20 (26.7%)	99 (66.0%)	51 (34.0%)

Table 2. Mean and SD for the anthropometric data of Experimental and Control group before and after the nutrition education (N=75)

Measurements	Experimental group		Control group	
	Before	After	Before	After
Weight (Kg)	39.75±6.90	41.45±7.14	39.24±5.91	39.53±5.58
Height (mt)	1.53±.076	1.53±.076	1.56±.072	1.56±.072
BMI	16.79±2.14	17.51±2.18	16.10±2.12	16.23±2.023
MUAC (cm)	22.21±1.79	22.46±1.722	21.53±1.57	22.15±1.44

Table 3. Mean and SD of anthropometric data of Sputum Positive (N=35) and Sputum Negative (N=40) experimental group patients at baseline and after

Measurements	Sputum Positive		Sputum Negative	
	Before	After	Before	After
Weight (Kg)	39.65±7.120	41.34±7.120	39.83±6.79	41.50±7.23
Height (mt)	1.53±.066	1.53±.066	1.53±.083	1.53±.083
BMI	16.75±2.016	17.48±2.056	16.84±2.26	17.52±2.32
MUAC (cm)	22.18±1.81	22.49±1.73	22.23±1.77	22.44±1.73

Table 4. Mean and SD of anthropometric values of sputum positive (N=33) and Sputum Negative (N=42) control group patients at baseline and after:

Measurements	Sputum Positive		Sputum Negative	
	Before	After	Before	After
Weight (Kg)	40.00±6.2	40.42±5.59	38.64±5.66	38.83±5.445
Height (mt)	1.58±.074	1.58±.074	1.54±.065	1.54±.065
BMI	15.90±2.16	16.09±2.094	16.26±2.072	16.34±1.98
MUAC (cm)	21.41±1.60	22.10±1.383	21.63±1.55	22.19±1.50

Table 5.Mean and SD for the anthropometric data of Male (N=55) and Female (N=20) of control group at baseline and after

Measurements	Experimental group		Control group	
	Mean and SD		Mean and SD	
	Males	Females	Males	Females
Weight (Kg)	39.72±6.23	37.90±4.83	39.98±5.90	38.30 ±4.22
Height (mt)	1.58±0.063	1.48±.031	1.58±0.1	1.48±.031
BMI	15.72±2.078	17.13±1.871	15.84±2.032	17.32 ±1.59
MUAC (cms)	21.28±1.62	22.23±1.22	22.10±1.53	22.27±1.20

Table 6. Mean and SD of energy and protein intake by experimental group at baseline (N=75)

Parameter	Experimental group		Control group	
	Before	After	Before	After
Energy (Kcal)	1225.68±174.15	1410.71±150.45	1296.81 ±174.45	1360.13] ±161.96
Protein (gm)	36.43±4.71	53.1±7.38	33.93±4.33	35.25±4.61

Table 7 Mean and SD of energy and protein intake of Males (N=44) and Females (N=31) of experimental and Control group at baseline and after nutrition education:

Parameters	Experimental group				Control group			
	Males	Males	Females	Females	Males	Males	Females	Females
	Before	After	Before	After	Before	After	Before	After
Energy (Kcal)	1240 .91 ±161.88	1405 .34 ±159.52	1405 .34 ±159.52	1418.32 ±138.77	1288. 05 ±175.31	1358.53 ±158.50	1320.90 ±174.22	1364 .55 ±175.32
Protein (gm)	36. 80 ±4.073	52.72 ±8.025	52.72 ±8.025	53.62 ±6.47	34.30 ±4.38	35.91 ±4.73	32.918 ±4.13	33.44 ±3.79

Table 8. t-test for equality means of both groups at baseline (N=150)

Parameters	Before		After	
	t	Sig. 2-tailed	t	Sig. 2-tailed
Weight Kg	0.483	.630	1.817	.071
Height mt	-2.139	.034	-2.139	.034
BMI	2.010	.046	3.690	.000
MUAC cms	2.463	.015	1.208	.229
Energy KCal	-2.499	.014	1.981	.049
Proteins gm	3.378	.001	17.750	.000

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