International Journal of Food Science and Nutrition
ISSN: 2455-4898, Impact Factor: RJIF 5.14
www.foodsciencejournal.com
Volume 2; Issue 1; January 2017; Page No. 119-122

The nutritional status of pulmonary tuberculosis patients aged 25-44 years attending tuberculosis clinic at Lodwar County and Referral Hospital, Turkana County, Kenya

[1] Isaac Nthiga, [2] Dorcus Mbithe, [3] Beatrice Mugendi, [4] Tabitha Wambui

[1] Department of Community Nutrition, Kenya Medical Training College, Kenya
[2, 3] Department of Food Science and Technology, Dedan Kimathi University of Technology, Kenya
[4] Department of Nursing, Kenyatta Methodist University, Kenya

Abstract
Kenya is ranked thirteenth of the twenty two high-burden tuberculosis countries in the world and fifth highest in Africa. The majority of the people affected by TB in Turkana Central District were aged 25 - 44 years, with the peak at 25 - 34 years. No study in the District Hospital or in the County had targeted establishing nutrition status of tuberculosis patients. Nutritional status is a significant risk factor for the development of tuberculosis. Tuberculosis increases the body need for energy, protein and the demand for vitamins and minerals especially vitamins A, B_6 and B_{12} and minerals like iron and zinc and therefore influencing nutrition status. The study aimed to establish the nutrition status of pulmonary tuberculosis patients aged 25 – 44 years attending TB clinic at Lodwar County and Referral Hospital, Turkana County, Kenya. A cross-sectional analytical study design was adopted among 242 TB patients, who were systematically sampled. Purposive sampling was used to select the Lodwar County and Referral Hospital as the location of the study. BMI, MUAC and skin-fold thickness were measured to determine the nutritional status. Data was analyzed using SPSS version 17 and summarized using descriptive statistics such as frequencies, means, and percentages of the study population. Majority of the TB patients were undernourished (50.15%, 59.60% and 61.60%) based on BMI, MUAC and Skinfold thickness respectively. The principal cut-off point used in this study for BMI and MUAC was adopted from WHO 2004 and mean fat percentage interpreted from Lafayette skin fold reference, 2005. There was a high prevalence of under nutrition among the pulmonary tuberculosis patients aged 25 – 44 years attending TB clinic at Lodwar County and Referral Hospital, Turkana County, Kenya.

Keywords: nutrition status, high prevalence of under nutrition, risk factors, BMI, MUAC and skin-fold thickness

1. Introduction
Tuberculosis (TB) has affected humanity for more than 4,000 years [14]. It is a common infectious disease and in most cases fatal. Tuberculosis is viewed in two groupings: active disease or latent infection. Active TB is an ailment whereby the TB bacteria are quickly growing and afflicting various organs of the body whereas latent phase goes undetected most the times. Active TB occurs during the economically productive years (19 - 49 years) of people's lives, compromising the earning capacity [1].

According to Kenya Ministry of Health, 2004, the peak age group affected by TB for both males and females in 2004 in Kenya was 25 - 34 years. Turkana Central District Health Report, April 2011 indicated that the majority of the people affected by TB are aged 25 - 44 years, with the peak at 25 - 34 years. Pulmonary tuberculosis is the most common form, accounting for about 80% of the total cases, and it manifests itself with signs and symptoms such as a chronic cough, pain in the chest, hemoptysis, weight loss, sweats, weakness and fever; these have negative implications on nutrition status.

Nutritional status is one of the critical determinants of resistance to TB infection where those with nutritional deficiency are associated with an impaired immune function and therefore, at a higher risk. Malnutrition enhances the development of active TB and once it develops it makes the nutrition state of the body worse [10].

TB depresses dietary intake by lowering the appetite and thereby influencing the nutritional status [12]. TB drugs tend to induce negative nutrient-drug interaction further depressing the intake and therefore influencing the nutrition status [3].

Socioeconomic status is a major indicator of nutritional status [2]. The risk of malnutrition can be divided into disease-related factors, including TB that reduce intake despite the availability of foods and inadequate availability of food, quality or presentation of food, which influence the nutrition status [8].

Wasting is associated with increased mortality in those with active TB. In a study of 1,181 newly diagnosed TB patients in rural Malawi, 57% were underweight (BMI <18.5), including 21% with BMI<16. A BMI 17.0, indicating moderate to severe malnutrition, was associated with a two-fold increased risk of early death [13]. Advanced lung disease was associated with low BMI and fat mass in another Malawian study [10]. Undernutrition contributes to TB morbidity and increased mortality in those with active TB. Thus promoting good nutritional status through imparting knowledge on good dietary practices and economic empowerment can be a strategy to mitigate poor nutritional status.

2. Materials and methods
A cross-sectional analytical study design was adopted. Nutrition status and associated risk factors such as demographic, social-economic and health factors were investigated. The study was conducted at Lodwar County and Referral Hospital (LCRH), which is located in the Central Division, Turkana Central District of Turkana County.

The study targeted pulmonary TB diagnosed patients aged 25-

44 year. High prevalence of tuberculosis was recorded in this group in Turkana County. Pulmonary TB diagnosed patients aged 25 - 44 years who were affected by other chronic diseases were excluded as these would affect their nutritional status.

Calculation of the desired sample size was done using the Cochran (1963) formula as cited by Fisher *et al*. (1998), and a sample size of 240 was attained. Due to the possibilities of non-response, 10% was added to make a sample size of 264**.**

LCRH was purposively selected. Systematic sampling was used to select subjects. 3rd case in the population frame was selected for inclusion in the sample until 242 subjects were attained.

Reconnaissance visits were made to the study area in order to familiarize with the place and to meet the medical officer of health for Turkana County as well as the medical superintendent of Lodwar County and Referral Hospital and other relevant officers on the ground to help mobilize the respondents. The researcher explained the nature of the research to the medical officer of health, medical superintendent and health officers in charge of TB clinic at Lodwar County and Referral Hospital. Three research assistants with nutrition background were trained for three days on the objectives of the study, survey methodology, anthropometric measurements and interviewing techniques. The research team with the assistance of a nurse on duty identified the TB patients aged 25 - 44 years by verifying the age from a national identity card, calendar of event and health records. A face to face interview was conducted and anthropometric measurements taken after seeking consent and assuring the respondent of confidentiality.

Anthropometry measurements (weight, height, MUAC and skin fold) were taken using bathroom scale, Stadiometer, adult MUAC tape and Lafayette skin fold calipers respectively. Anthropometric measurement, weight and height was taken as recommended by WHO (2004). Height was taken while standing on a level ground and barefooted and the measurement was read and recorded in meters to the nearest 0.1 cm. The weight of respondents was taken while they stood on the weighing scale wearing light clothing with no shoes. The measurements were recorded to the nearest 0.1kg.

Mid-upper Arm Circumference (MUAC) measurements were taken at the mid of the left arm, midway between the acromion process of the shoulder and olecranon process of the elbow. The palm was placed on the stomach to relax the arm and keep it at a right angle to the body. The midpoint was then marked, and the circumference taken with the arm falling loosely at the side of the body. The readings were recorded in centimeters to the nearest 0.1cm.

Skin fold measurements were taken using a Lafayette skinfold callipers as explained in the Lafayette instrument skinfold caliper (ii) user's manual (2005). The skin fold measurements were taken in three sites for male (chest, abdominal and thigh) and women (thigh, triceps and suprailium).This was done by marking each site carefully with all marks on the right side of the body, and then the fold of skin and underlying subcutaneous adipose tissue was grasped between left thumb and index finger. The side of the fold was roughly parallel and the grasp was about 2.0 cm above the place the measurement was taken, and gently held with the thumb and forefinger placing the jaws of the callipers perpendicular to the length of the fold and measure the skinfold thickness to the nearest 0.1 mm. The actual measurement from the calliper was read about 3 seconds after the calliper tension was released and recorded to the nearest 0.1mm. The researcher checked all questionnaires to ensure completeness and utmost clarity with the help of research assistants. Data was coded, entered, cleaned and analyzed. Anthropometric data were analyzed using SPSS version 17.0 computer package; the indices of interest were BMI, MUAC and skin fold thickness. The WHO cut-off points [11] were used to interpret the nutritional status of the adults for BMI and MUAC while Lafayette Skinfold Manual (2005) was used to interprete the body fat percentage.

Permission was sought from the graduate school of Kenyatta University and approval to carry out the research was granted. Clearance was obtained from Kenyatta University Ethics Review Committee. A research permit was obtained from National Commission for Science, Technology and Innovation and the authority to conduct research was obtained from Lodwar County and referral Hospital). A signed consent by respondents was required before taking the anthropometric measurements. Confidentiality was maintained.

3. Results

3.1 Nutritional status of the study respondents

Nutritional status of TB patients was determined using body mass index (BMI), mid-upper arm circumference (MUAC) and the skin fold thickness.

3.1.1 Classification of nutritional status of tb patients by Body Mass Index

In this study, the highest BMI for male and females were 24.8 and 26.16 respectively, with the minimum BMI being 13.11 for both males and females. The mean BMI was 18±2.3511 and 18±3.1066 for male and female respectively. The study revealed that no males were overweight, but 4% of females were overweight. The study findings showed that about half of males (53.7%) and females (46%) were of normal nutritional status, with mild malnutrition/thinness at 19% and 17% male and female respectively. According to this study (18.2%) of TB patients were severely thin where 13.4% belonged to male gender and 23% of females. In general, about 48.2% of TB patients attending Lodwar TB clinic were found to be underweight. Table 1. Shows the distribution of nutritional status of TB patients by BMI.

Table 1: Classification of nutritional status by BMI

Classification of BMI	Cut off points	Male		Female		Total	
		N = 142	%	N=100	%	N=242	%
Severe thinness	<16.00	19	13.4	23	23	42	18.2
Moderate thinness	16.00 - 16.99	20	14.1	10	10	30	12
Mild thinness	17.00 - 18.49	27	19	17	17	44	18
Normal range	18.50 - 24.99	76	53.7	46	46	122	49.8
Overweight	≥25.00	0	0	4	4	4	2

*The cut-off points were adopted from WHO 2004

3.1.2 Classification of nutritional status by MUAC

The study found out that the lowest MUAC in centimeters obtained for men and women are 12 cm and 13cm respectively, while the maximum was 25.1 in male and 25cm in females. The average MUAC were 18.8301± 2.60 and 19.5405± 2.91 for men and females respectively. 40.5% of TB patients were identified to be of normal nutritional status with the majority (59.5%) being undernourished. Nearly the same percentage was noted for those who were of normal nutritional status, both male (40.8%) and females (40%). Of those undernourished, 31% had moderate acute malnutrition while 28.5% had severe acute malnutrition. More women (31%) than men (26.8%) were found to be severely acutely malnourished as shown in Table 2.

Table 2: Classification of nutritional status by MUAC

Classification by MUAC	Cut-off points for MUAC (cm)	Male		Female		Total	
		N=142	%	N=100	%	N=242	%
Normal	≥ 22.1 (Women), ≥ 23.1 (Men)	58	40.8	40	40	98	40.5
Moderate acute malnutrition	≥ 21.4 to ≤ 22.1 (Women)	46	32.4	29	29	75	31
	≥ 22.4 and≤ 23.1 (Men)						
Severe acute malnutrition	< 21.4 (Women),	38	26.8	31	31	69	28.5
	< 22.4 (Men)						

Source: this table is showing the data from study against the cut-off points adopted from WHO 2004.

3.1.3 Classification of nutritional status by Skin Fold Thickness

Classification of nutritional status was done using skin-fold thickness. Men's total skin-fold from the chest, abdominal and thighs were obtained while women's total skin-fold from thighs, triceps and suprailium. The Mean of total skin-fold for male and female were 17.87 ± 4.64 % and 24.00 ± 7.29 % respectively. The study also found out that the maximum of total skin-fold for males was 35.15 mm while that for females was 44.00 mm. Males recorded the lowest total skin-fold measurement (9.6 mm) compared to females who had 11.95 mm as the lowest measure. The total skinfold measurement were used to establish the percentage fat of the study respondents where mean fat percentage for male and female were 5.76 ±2.53 and 10.41 ±4.29 respectively. Based on skin fold thickness, 18.1% males and 20% females were severely malnourished while 50.1% male and 35% female being moderately malnourished.

3.1.4 Comparison of the Nutritional Status of Different Anthropometric Indicators

Tuberculosis patients found to be undernourished based on Body Mass Index (BMI < 18.5 kg/m^2) was 48%, which was less than the one found using Mid Upper Circumference (MUAC; males ≤ 23.1cm & females ≤ 22.1cm) at 59.5% and 61.6% from percentage body fat (% body fat; males ≤ 10% & and females 20%) established from the skin fold thickness. Generally 57% of the TB patients were undernourished.

4. Discussion

4.1 Nutritional status of TB patients

Determination of nutritional status of TB patients is important to identify those at risk, improve their nutritional statuses and prevent any complications associated with malnutrition. Malnutrition could occur in different forms and degrees that could be over-nourished or under-nourished. As mentioned earlier, nutritional status in this study was measured by use of BMI, MUAC and skinfold thickness. The findings showed that about half of males and females were mild and severely undernourished. These findings agree with another study done in Tanzania [5] in which it was found that patients with a co-infection of TB and HIV had a lower BMI than those suffering from HIV/AIDSs only. The study further highlighted that undernutrition enhances susceptibility to TB infection and even exacerbates it. In another study by Zachariah (2002), the results indicated that malnutrition has an association with severe pulmonary manifestations of TB disease and poorer outcomes after TB therapy.

Just like in BMI, MUAC and skinfold thickness pointed out that a significant portion of the population were undernourished. MUAC as indicators of nutrition showed that the majority of TB patients were undernourished. The study agrees with two other studies done in India and Malawi among TB patients. In Ethiopia, study done by Meressa, *et al*. (2015) found out that the majority of TB patients were malnourished. As for Malawian, 78% were malnourished [10]. Skinfold thickness measures amount of fat under the skin. Patients with lower than the mean averages in the study were considered undernourished. Nutritional status by skinfold concurred with those of BMI and MUAC in that majority of TB patients were undernourished at the time of the study.

It is accepted that malnutrition is a risk factor for TB [1]. This research found out that a good number of study participants were undernourished which might have contributed to the severity of the TB infection in the study population. Inadequate dietary intake is due to patients' inability to access adequate nutritious food thus causing malnutrition.

[8] found out that the risk of malnutrition can be divided into disease-related factors, including TB that reduce intake despite the availability of foods and inadequate availability of food, quality or presentation of food which reduces intake and therefore affecting the nutrition status of the patients. This research found that the respondents' Majority of were undernourished and this could be related to the TB disease itself.

5. Conclusions

There was a high prevalence of under nutrition among the pulmonary tuberculosis patients aged 25 – 44 years attending TB clinic at Lodwar County and Referral Hospital, Turkana County, Kenya.

6. Acknowledgement

I want to thank the Almighty God in whom, and through whom all the work that went into this thesis was made possible. I wish to acknowledge Kenyatta University staff especially the teaching and non-teaching staff in the Department of Food, Nutrition and Dietetics for a good learning environment. I am very much grateful to my supervisors Dr. Dorcus Mbithe and Prof. Beatrice Mugendi for their inspirational instruction and

guidance that enhanced the quality of this thesis. Sincere gratitude to all the Institution Based Students of April 2011 class of Kenyatta University, Food Nutrition Department for their encouragement and support throughout my study.

I also acknowledge all those who participated in data collection, data analysis and in any way that improved and enhanced the quality of this thesis. My appreciation goes to the Lodwar County and Referal Hospital Management Team and specifically the Medical Superintendent for allowing me to carry out the study at the hospital. I wish to recognize the hospital staff in the department of nutrition for the assistance and introduction at the TB clinic. I also wish to recognize my research assistants, Esther Mbogo, John Lokwomi and Emma Muthoni for their availability and dedication during the entire period of data collection. Great thanks to all the respondents who agreed to participate in the study.

Finally, I am very grateful to my family members and friends for their prayers, moral and financial support.

7. References

1. Frieden T, Sterling T, Munsiff S, Watt C, Dye C. Tuberculosis. The Lancet, 2003; 362(9387):887-899.
2. Keding G, Krawinkel M. Food diversity from plough to plate: Linking Agro biodiversity, dietary diversity and micronutrient supply. Sight and Life Magazine, 2008, 3, 23-27.
3. Kim HR, Hwang SS, Kim HJ, Lee SM, Yoo CG, Kim YW, *et al*. Impact of extensive drug resistance on treatment outcomes in non-HIV-infected patients with multidrug-resistant tuberculosis. Clinical Infectious Diseases. 2007; *45*(10):1290-1295.
4. Lafayette Instruments Compony. (2005). Lafayette Skinfold Caliper *Ii User's Manual.* USA: Lafayette.
5. Maro I, Lahey T, MacKenzie T, Mtei L, Bakari M, Matee, M, *et al*. Low BMI and falling BMI predict HIV-associated tuberculosis: a prospective study in Tanzania. The international journal of tuberculosis and lung disease: the official journal of the International Union against Tuberculosis and Lung Disease. 2010 1; 4(11), 1447.
6. Meressa D, Hurtado M, Andrew D, Diro E, Abato K. Achieving high treatment success for multidrug-resistant TB in Africa: initiation and scale-up of MDR TB care in Ethiopia—an observational cohort study, 2015.
7. Ministry of Health: National Leprosy and Tuberculosis Program Kenya. Annual report. Kenya: Ministry of Health, 2004.
8. Shepherd A. Risk factors, causes and physiology of malnutrition. De Montfort University, Leicester. 2009
9. Turkana Central District. Turkana Central District Health Report. Kenya: Ministry of Health, 2011.
10. Van Lettow M, Kumwenda JJ, Harries AD. Malnutrition and the severity of lung disease in adults with pulmonary tuberculosis in Malawi. Int J Tuberc. Int J Tuberc, 2004.
11. WHO. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. The Lancet. 2004, 157-163.
12. World Health Organization. *Global Tuberculosis report 2009.* Geneva: World Health Organization. WHO/HTM/TB. 2009, 303-411.
13. Zachariah R, Spielmann P, Harries D, Salaniponi M. Moderate to severe malnutrition in patients with tuberculosis is a risk factor associated with early death. Trans R Soc Trop Med Hyg. 2002; 96(3):291-4.
14. Zaman K. 2010. Tuberculosis: a global health problem. Journal of health, population and nutrition, 111-113, Bligh & Dyer, and modified Bligh & Dyer extraction methods. Journal of food composition and analysis. 2001; 14(1):93-100.
15. Baker AS, Smith RL. Preparation of solutions for atomic absorption analyses of iron, manganese, zinc, and copper in plant tissue. Journal of agricultural and food chemistry. 1974; 22(1):103-107.
16. Buskirk ER, Mendez J. Energy: caloric requirements, In Nutrition and the Adult. Springer US, 1980, 49-95.