

## EVALUATION OF NUTRITIONAL STATUS OF NEW TUBERCULOSIS PATIENTS AT THE EFFIA-NKWANTA REGIONAL HOSPITAL

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*Conflict of Interest: None*

### SUMMARY

**Objective:** To determine the prevalence of malnutrition among pulmonary TB patients prior to starting treatment and assess the impact of socio-economic characteristics on their nutritional status

**Design:** Intervention study

**Setting:** Communicable Diseases Unit, Effia-Nkwanta Regional hospital, Sekondi, Ghana

**Participants:** A total of 570 newly diagnosed adults with pulmonary tuberculosis

**Interventions:** A structured questionnaire was used to collect demographic and socio-economic information, after which basic anthropometric measurements were done at registration and after two months of TB treatment

**Main outcome measures:** Body mass index (BMI) at time of starting treatment and change in BMI after two months of treatment

**Results:** The mean BMI at registration was 18.7 kg/m<sup>2</sup>; 51% were malnourished; 24%, 12% and 15% respectively had mild, moderate and severe malnutrition. Two months after starting treatment, the mean BMI was 19.5 kg/m<sup>2</sup>; 40% were malnourished; 21%, 11% and 8% respectively had mild, moderate and severe malnutrition. Using univariate regression analysis, nutritional status was significantly associated with marital status, income per month, educational level, believe in avoiding certain food types and immediate family size at the time starting TB treatment. Two months after starting treatment, change in BMI was significantly associated with age group, marital status, employment status, educational level and belief in avoiding certain food types.

**Conclusions:** Half of TB patients were malnourished at the time of registration. However, the initiation of treatment resulted in improvement in nutritional status of the patients, with socio-economic factors being important correlates of the observed malnutrition. The findings can be used to advance the argument in support for nutritional supplementation among TB patients in Ghana.

**Key words:** tuberculosis, malnutrition, socio-economic status, Ghana

### INTRODUCTION

Tuberculosis (TB) is a global public health problem, responsible for more than 2 million deaths each year.<sup>1</sup> The association between TB and malnutrition is well recognised; TB can lead to malnutrition and malnutrition may predispose to TB.<sup>2</sup> TB has been found to co-exist with malnutrition among patients at the time of starting treatment in both developed and developing countries.<sup>3-7</sup> TB is also associated with various socio-economic factors and often occurs in populations suffering from poverty, poor housing and economic deprivation and these are also major factors predisposing to poor nutritional status and impaired immune function.<sup>2,8,9</sup>

Nutritional status determines normal health and functioning of all systems in the body, including the immune system which is responsible for host resistance to various infectious diseases.<sup>8</sup> Because cell-mediated immunity is the key host defence against TB, malnutrition is therefore an important risk factor for the development of TB.<sup>8</sup> Furthermore, the reactivation of latent or previously sub-clinical TB infection is also often related to deteriorating nutritional status and this explains the observed increase in the prevalence of TB in association with HIV infection.<sup>8</sup> Thus, the effective management of diseases, including TB, therefore requires detailed evaluation of the nutritional status since this can help prevent or modify many complications of diseases and also help in making projection of the interaction of nutritional status on the clinical course of the disease.<sup>10</sup>

Although the relationship between malnutrition and TB has been recognised long ago, this has not been studied in Ghana. There is also a limited insight into the influence of socio-economic factors on nutritional status of TB patients in Ghana. This study was therefore designed to document the prevalence of malnutrition among newly diagnosed adult pulmonary TB patients at the time of registration and to assess the impact of socio-economic characteristics of patients on the nutritional status at registration and two months after starting TB treatment.

## SUBJECTS AND METHOD

### Study setting

The study was conducted between January 2002 and December 2003 at the Effia-Nkwanta Regional (ENR) hospital, which is located at Sekondi-Takoradi, the capital of the Western Region and the third largest city of Ghana. The ENR hospital has a Unit called the Communicable Diseases Unit (CDU), a 54-bed capacity facility where all TB patients receive treatment.

### TB diagnosis and management at the ENR hospital

Cases of TB are diagnosed among patients reporting to the Out-Patient Department (OPD) of the hospital. Individuals who presented with cough lasting for three weeks or more undergo sputum smear microscopy and chest x-ray examinations. Those found to have TB are then referred to the CDU where they are registered and started on anti-TB treatment.

During the intensive phase of treatment, patients who live at communities far away from the CDU are supplied with their drugs and then referred to a health facility near to their normal place of residence for direct observation of treatment (DOT) on daily basis; patients living near the CDU go there every morning for DOT. About 90% of patients are managed daily on this ambulatory basis for the entire intensive phase. However, patients who are severely ill or have other medical complications that will not permit ambulatory treatment are admitted to the CDU for treatment.

The continuation phase of treatment is unsupervised so all patients are seen at the CDU every month on ambulatory basis irrespective of where DOT was received during the intensive phase. This enables review of progress of treatment to be made as well as the supply of medications for the proceeding month. The treatment regimens and outcomes used throughout Ghana are those recommended by the World Health Organization (WHO).<sup>1, 11</sup> Treatment is provided free of charge to all TB patients in Ghana. However, patients who need supplementary drugs like blood tonics, analgesics and cough mixtures are made to pay for these drugs.

### Study population and data collection

The study population consisted of adults age 18 years and above who were newly diagnosed with pulmonary TB and were about to be registered for treatment. Patients were excluded if they fulfil any of the following exclusion criteria: previous history of TB and/or treatment; pregnancy or currently breastfeeding; diabetic mellitus and known HIV positive status or AIDS patients.

At enrolment, a structured questionnaire was used to collect information on basic demographic data, type of pulmonary TB, length of symptoms before diagnosis of TB was made, belief in avoiding certain food types when coughing, income per month and immediate family size. The height (h) of the patients was measured while standing erect 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 intensive phase of treatment (2 months).

### Data analysis

The data was analysed using SPSS 10.1 for Windows (SPSS Inc, Chicago, IL). The heights and weights measured were used to calculate the body mass index ( $BMI = w/h^2$ ) at registration as  $BMI_0$ , and at the end of intensive phase ( $BMI_2$ ). The change in BMI after completing two months of treatment was then computed by subtracting  $BMI_0$  from  $BMI_2$  and used to categorise the patients into two; those patients whose BMI decreased and those with an increase in BMI. A  $BMI \geq 18.5 \text{ kg/m}^2$  was defined as normal, and malnutrition as  $BMI < 18.5 \text{ kg/m}^2$ . Different degrees of malnutrition were also defined as follows: mild malnutrition,  $BMI = 17.0-18.4 \text{ kg/m}^2$ ; moderate malnutrition,  $BMI = 16.0-16.9 \text{ kg/m}^2$ ; severe malnutrition,  $BMI < 16.0 \text{ kg/m}^2$ .<sup>12</sup> In order to determine whether any socio-economic characteristics were associated with malnutrition at registration and two months after starting treatment, P values were calculated using univariate regression analysis. Statistical significance was taken as  $p < 0.05$ .

## RESULTS

### Characteristics of the study population

Six hundred and ten (610) new adult pulmonary TB patients were enrolled during the study period. Of these, 40 (6.6%) were excluded from the analysis because they were not available for their weights to be measured at the end of the intensive phase of treatment for various reasons: 18 defaulted from treatment, 12 died and 10 were transferred out to other treatment centres. Of the 570 patients included in the analysis, 369 (65%) were males and 201 were females. The mean age for all the patients was 39 years; 37 and 41 years for female and male patients respectively ( $p=0.12$ ). Five hundred and seven (89%) were registered as sputum smear positive and 63 (11%) as smear negative pulmonary TB patients.

**Nutritional status and socio-economic characteristics at registration**

The mean BMI at registration for all patients was 18.7 kg/m<sup>2</sup>; for males it was 18.8 kg/m<sup>2</sup> and 18.6 kg/m<sup>2</sup> for

females (p=0.58). Two hundred and ninety one patients (51%) were malnourished at the time of registration; 138 (24%) having mild malnutrition, 69 (12%) moderate malnutrition and 84 (15%) severe malnutrition.

**Table 1** Socio-economic characteristics and nutritional status of tuberculosis patients at the time of registration for treatment at the ENR hospital

Variables	Normal		Malnutrition		p-value Univariate
	N	(%)	N	(%)	
All patients	279	49	291	51	
Sputum smear type					
Positive	243	48	264	52	0.168
Negative	36	57	27	43	
Sex					
Male	189	51	180	49	0.141
Female	90	45	111	55	
Age group (Years)					
≤35	114	45	138	56	0.115
>35	165	52	153	48	
Marital status					
Single	75	44	96	56	0.022
Married	153	55	126	45	
Divorced/ Widowed	51	42	69	58	
Employment status					
Working	210	52	198	48	0.056
Not working	69	43	93	57	
Income/month (cedis)*					
<100 000 (≈US\$10.5)	129	43	171	57	0.003
>100 000 (≈US\$10.5)	150	56	120	44	
Educational level					
No formal education	78	51	75	49	0.001
Basic education	144	44	186	56	
Post basic	57	66	30	34	
Duration of symptoms (months)					
≤ 3	180	50	177	50	0.362
> 3	99	46	114	54	
Belief in food prohibition					
Yes	81	43	108	57	0.04
No	198	52	183	48	
Immediate family size					
≤ 4	153	53	135	47	0.04
> 4	126	45	156	55	

NB: Decimals of percentages are rounded to the nearest whole number;

\*Exchange rate at the time of writing: \$1 US = 9,500 cedis;

ENR= Effia-Nkwanta Regional

At the time of registration, nutritional status was significantly associated with marital status, income per month, educational level, believe in avoiding certain food types when coughing and immediate family size. It was however, not different with respect to sputum smear type, sex, age group, employment status and duration of symptoms before reporting to the hospital (Table 1).

#### **Change in BMI two months after starting treatment and socio-economic characteristics**

Two months after institution of chemotherapy, there was a gradual improvement in nutritional status. The mean BMI for all patients rose to 19.5 kg/m<sup>2</sup>, a change of 4.3%. For males, the mean BMI rose to 19.5 kg/m<sup>2</sup> and 19.4 kg/m<sup>2</sup> for females, representing changes of 3.7 % and 4.3% respectively (p=0.71).

Two hundred and twenty eight patients (40%) were malnourished; 117 (21%) had mild malnutrition, 63 (11%) moderate malnutrition and 48 (8%) severe mal-

nutrition. Proportion of malnutrition at the time of registration and two months after starting treatment is shown in the Figure.

**Table 2** Socio-economic characteristics and change in body mass index (BMI) of tuberculosis patients 2 months after starting treatment at the ENR hospital

Variables	Increase in BMI		Decrease in BMI		p-value Univariate
	N	(%)	N	(%)	
All patients	426	75	144	25	
Sputum smear type					
Positive	384	76	123	24	0.11
Negative	42	67	21	33	
Sex					
Male	270	73	99	27	0.24
Female	156	78	45	22	
Age group (Years)					
≤35	210	83	42	17	0.01
>35	216	68	102	32	
Marital status					
Single	138	81	33	19	0.07
Married	198	71	81	29	
Divorced/ Widowed	90	75	30	25	
Employment status					
Working	285	70	123	30	0.01
Not working	141	87	21	13	
Income per month (cedis)*					
<100 000 (≈US\$10.5)	237	79	63	21	0.01
>100 000 (≈US\$10.5)	189	70	81	30	
Educational level					
No formal education	123	80	30	20	0.01
Basic education	231	70	99	30	
Post basic	72	83	15	17	
Duration of symptoms (months)					
≤ 3	264	74	93	26	0.58
> 3	162	76	51	24	
Belief in food prohibition					
Yes	156	83	33	17	0.01
No	270	91	111	9	
Immediate family size					
≤ 4	210	73	78	27	0.31
> 4	216	77	66	23	

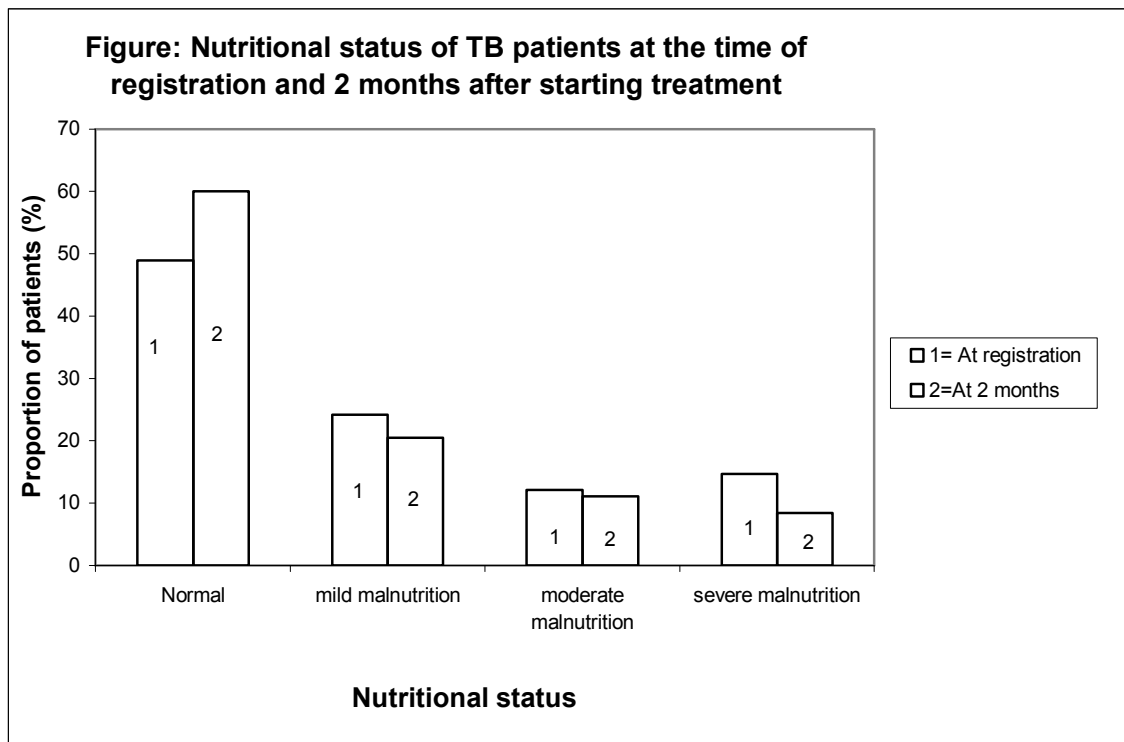
NB: Decimals of percentages are rounded to the nearest whole number

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By the end of the intensive phase of treatment (2 months), there was an increase in BMI of 426 (75%) patients and decrease in 144 (25%). Of the 426 patients who recorded increase in BMI, 198 (46%) had an increase of 0.01-0.99 kg/m<sup>2</sup>; 150 (35%) had 1.0-1.99 kg/m<sup>2</sup>; 54 (13%) had 2.0-2.99 kg/m<sup>2</sup>; 24 (6%) had >3

kg/m<sup>2</sup>. Change in BMI was significantly associated with marital status, age group, employment status, educational level, income per month and belief in avoiding certain food types when coughing (Table 2).



## DISCUSSION

This study has demonstrated that half of newly diagnosed adult TB patients were malnourished at the time of starting treatment, with more than a quarter having moderate to severe malnutrition. The observed malnutrition among TB patients at the time of registration has been reported in other studies in both developing and developed countries.<sup>3-7,13,14</sup> The degree of nutritional impairment found in this study is the same as in other developing countries,<sup>3,7</sup> but more severe than that found in the UK.<sup>4</sup> In contrast to what was found in other studies,<sup>3,7,14,15</sup> male patients had a slightly higher BMI than female patients at the time of starting treatment.

The institution of chemotherapy was associated with gradual improvement in nutritional status. By the end of the intensive phase of treatment (2 months), 60% of the patients had normal nutritional status, with less than a fifth having moderate to severe malnutrition. Improvement in nutritional status with commencement of treatment has been demonstrated in other studies.<sup>5,7</sup>

The association between tuberculosis and poor socioeconomic factors and poverty has been demonstrated.<sup>9,15-17</sup> People with low socioeconomic status tend to live in crowded conditions that are conducive for increased transmission of the tubercle bacilli, resulting thus in a generally higher incidence of disease among such people. Poverty may also be a barrier in accessing health care services, and this prolongs the period of infectiousness of the tuberculosis patient, further increasing

the risk of infection among the contacts of such a patient. Moreover, extreme poverty results in malnutrition, which is another risk factor for developing TB.<sup>18</sup> This inter-relationship may explain why socioeconomic indicators such as education level, income per month, and immediate family size were found to be significantly associated with malnutrition among TB patients at the time of registration for treatment.

What is responsible for the observed change in BMI among patients less than 35 years, income of greater than 100,000 cedis per month, post basic education and do not believe in avoiding certain food types when sick (Table 2)? The immune system of the young is generally stronger than the aged meaning the ability of the young to withstand and to recover from the stress of sickness is better than the aged. Also the kinds of food types eaten coupled with the varied choices available may also determine the amount of nutrients and energy that can be derived from the food. This may explain why with institution of treatment, patients aged less than 35 years, with post-basic education and higher income and do not believe that certain food types should be avoided when you have TB gained more weight compared to their counterparts.

In spite of the findings of this study, there are limitations that need to be pointed out. The first is the inability to determine the proportion of patients with dual HIV/TB infection, making it difficult to assess the impact of HIV infection (which is known to contribute to

malnutrition among TB patients), on the nutritional status of the patients. Although a study conducted among hospitalised TB patients in Kumasi found HIV prevalence rate of 23.2%,<sup>19</sup> which is far lower than those found in studies conducted elsewhere,<sup>3 6 15 20</sup> it is important to investigate the extent to which HIV infection contributes to malnutrition among TB patients in Ghana in another study. Another limitation is the exclusion of 40 patients, who were recruited as part of the study but were lost to follow-up from the analysis. However, when the analysis was done with the inclusion of such patients no differences were seen in the proportion of malnutrition at the time of starting treatment. The third limitation is the difficulty in ascertaining whether it was malnutrition that led to the development of TB or TB led to malnutrition. A prospective cohort study may be needed to answer this question.

In conclusion, this study has demonstrated the presence of malnutrition among TB patients at the time of starting treatment. It has also shown that socio-economic factors contribute to malnutrition among TB patients. The findings can therefore be used to make important recommendations such as advancing the argument in support for nutritional supplementation, particularly vitamin A and Zinc among TB patients in Ghana since such exercise has been shown to accelerate patient recovery on TB treatment and also served as a strong incentive for patients to adhere to treatment<sup>16 21 22</sup>. Furthermore, because it has been estimated that improved socioeconomic conditions ultimately lead to a sustained 4% to 6% annual drop in infection risk<sup>18</sup>, the pursuance of policies to improve socioeconomic status of the population, together with chemotherapy could potentially help in the eradication of TB.

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