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RESEARCH ARTICLE

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Dietary Practices of patients with Pulmonary Tuberculosis Attending Clinic at Kericho County Referral Hospital-Kenya

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Abstract

Dietary practice is one of the major factors that influence nutritional status of a pulmonary (PTB) patient. Feeding complications like lack of appetite, vomiting and nausea, increase the chances of an individual not meeting their recommended dietary allowance (RDA) and being undernourished. Poor dietary intake leads to poor prognosis of TB which will in turn affect the nutrition status of the patient. The main aim of this study was to investigate dietary practices among PTB patients attending the TB clinic at Kericho County Referral Hospital (KCRH).

The study adopted a cross-sectional descriptive design. Systematic random sampling was used to select study participants. A structured questionnaire was used to collect data from PTB patients aged 18 years and above (N=175). Data were entered into Microsoft excel 2010 for cleaning and analyzed using SPSS version 24.0 software. Nutri-survey was used to analyze data on 24-hour recall. Ethical approval was sought from Kabarak University Research Ethics Committee (KUREC), research permit were sought from National Commission on Science, Technology & Innovation (NACOSTI) and research authorization was obtained from KCRH. Informed consent was obtained from all study participants before commencement of data collection. Data were handled safely from collection, analysis to storage.

Majority of PTB patients were male, aged between 21-30 years with secondary school education, and had had TB for 1-2 months. Consumption of macronutrients was average despite the relative availability of food sources for most households. Mean carbohydrate, protein and fat intake was 300.2g/day & 279g/day, 75.1g/day & 63.8g/day and 55.6g/day & 51.7g/day for male and female subjects respectively in each category. The mean energy intake was 2001.2 kcal/day and 1860 kcal/day for male and female subjects respectively which is below the RDA for TB patients based on ministry of health (MoH) recommendations. Results showed inadequate intake of micronutrients by study respondents. Most of the participants consumed an average of >4 meals per day. Study participants who had a high DDS (>6) mostly consumed cereals, oils & fats, vegetables as well as milk & milk products.

Most of the participants had a diverse diet but did not meet their energy, macronutrient and micronutrient requirements.

Counselling on good dietary practices should be incorporated as one of the key interventions in management of PTB. Nutrition support should be provided for PTB patients to meet their energy requirements.

KEYWORDS:

Dietary practices, dietary diversity, meal frequency, macronutrient, micronutrient.

I. INTRODUCTION

Mycobacterium tuberculosis is the main causative agent of tuberculosis (TB) disease (centers for disease control and prevention [CDC], 2016a). Commonly, it affects the lungs leading to pulmonary TB, but in severe cases, the mycobacteria can disseminate into other body organs and establish a pathology leading to development of extra-pulmonary TB (McIntosh, 2017). At times, the bacteria may remain dormant within the body or but mostly it's pathognomonic (Banuls et al., 2015). The latter is termed active TB while the former as latent TB. Latent TB infections often become active in immunocompromised patients (World Health Organization [WHO], 2020). Pulmonary TB is the most common and clinically important type, especially in the developing world (Van't Hoog et al., 2011)and to evaluate case detection. Methods: Residents aged 15 years and older, from 40 randomly sampled clusters, provided two sputum samples for microscopy; those with chest radiograph abnormalities or symptoms suggestive of PTB provided one additional sputum sample for culture. Measurements and Main Results: PTB was defined by a culture positive for Mycobacterium tuberculosis or two positive smears. Persons with PTB were offered HIV testing and interviewed on care-seeking behavior. We estimated the population-attributable fraction of HIV on prevalent and notified PTB, the patient diagnostic rate, and case detection rate using provincial TB notification data. Among 20,566 participants, 123 had PTB. TB prevalence was 6.0/1,000 (95% con-fidence interval, 4.6-7.4.

Currently, about 1.7 billion people are carriers of *Mycobacterium tuberculosis* and run the risk of developing active infection at one point during their lifetime (CDC, 2020b). In 2019, 10 million people developed tuberculosis. Out of this, 5.6 million were males, 3.2 million were females while 1.2 million were children. An estimated 1.4 million fatalities were reported across the world with 208,000 having HIV/AIDS co-morbidity (WHO, 2020). Africa accounted for 25% of global new TB cases in 2019 representing a 1% rise from 2018. Majority of the cases occurred in the Sub-Saharan region with Kenya being classified as one of the top 7 listed countries with the highest burden (WHO, 2020). According to the Ministry of Health (2020), TB has largely become a major public health concern in Kenya. For instance, a total of 86,504 cases were reported in 2019; out of which 10% were children.

Undernutrition is associated with augmented risk of mortality and relapse in individuals with TB disease (Sahile et al., 2021). Undernutrition diminishes the body's ability to fight back infections (Musuenge et al., 2020). Poor nutrition status may be due to nausea, vomiting, abdominal cramps, lack of appetite and diarrhea among TB patients and can lead to nutrient deficiencies (Feleke et al., 2019). Improving nutrition status of TB patients along with TB treatment scales up the treatment outcomes while reducing the risk of relapse (Muse et al., 2021).

Dietary practices play a critical role in prevention and treatment of TB (Mwendia et al., 2017). Nutrition deficiencies increases the risk and severity of the disease (Appiah et al., 2021). Individuals with feeding complications like nausea, lack of appetite and vomiting are more likely to be undernourished and causes one not to meet their recommended dietary allowance (RDA) (Kanabus, 2019 & Feleke et al., 2019). Tuberculosis drugs causes negative nutrient-drug interactions which further lowers intake (Nthiga et al., 2017a). Furthermore active TB requires increased energy requirements (Gurung et al., 2018)

Mortality & morbidity due to TB has continued to rise across all age groups in Kenya. Whether this is due to ineffective interventions or other extrinsic factors beyond the available interventions need to be investigated. If no deliberate and well-informed efforts are put in place to curb the trend, the future for TB patients can only get bleak. Available evidence supports the nexus between proper dietary practices and improved disease state, prognosis and improved ability of the body to fight off infections. This study, therefore, assessed dietary practices among pulmonary tuberculosis (PTB) patients attending the clinic at Kericho County Referral Hospital (KCRH).

II. METHODS

A cross-sectional descriptive study design was adopted for this investigation. The study was conducted at the TB clinic of KCRH. The Study targeted patients suffering from PTB who were attending the TB clinic at KCRH at the time of study and aged 18 and above.

The study subjects met the following criteria to be included in the study: must be at least 18 years of age; should have received a laboratory diagnosis of TB and; must be attending TB clinic at KCRH. The study subjects were excluded from the study if: they were aged 18 years and above with PTB and critically ill, and those who declined to sign the informed consent form.

Calculation of sample size was done using the formula of Fisher et al. (1991) at a prevalence rate of 50%. A sample size of 384 was attained. The size was further reduced to a finite number of 168 using the formula of (Yamane, 1967) and 10% increment added to cater for non-response; bringing total sample size to 185.

Systematic random sampling was used to select study participants. Every third patient was selected in the population frame for inclusion in the study. Approximately 300 patients visiting the clinic in a month, the total number of patients is divided by the study population.

Semi-structured questionnaires were used to collect data. The questionnaire was pre-tested at the TB clinic of Kapkatet sub-county hospital among 10% of the total sample size. Data obtained during the pretest were used to adjust the questionnaire accordingly. Data collection was conducted through face-face interviews. The questionnaire focused on the demographic and socio-economic characteristics like; age, gender, occupation, level of education, marital status, family size, religion and housing. Dietary practices section focused on food frequency, 24hour recall, and dietary diversity score. Locally available household utensils were used to estimate the amount of food. Data was collected with the help field assistants and in adherence to WHO guidelines on the prevention of COVID-19 transmission (WHO, 2020b).

Data collected were entered into Microsoft excel 2010 for coding and cleaning, and to check for omissions, duplicates, and errors. The data were then entered into the Statistical Package for the Social Sciences (SPSS) version 24.0 software for analysis. Descriptive statistics e.g. percentages, mean and standard deviations was used to analyze data. Data on 24-hour recall was analyzed using Nutri-survey computer package to determine the intake of energy, macronutrients and micronutrients of the study participants. The results were then compared with recommended dietary allowance (RDA) for TB.

Approval to conduct research was sought from the Kabarak University Research Ethics Committee (KUREC) (Reference number: KABU01/KUREC/001/02/05/2021). Research Permit was obtained from the National Commission on Science, Technology & Innovation (NACOSTI) (License number: NACOSTI/P/21/11216) and research authorization was obtained from KCRH. Informed consent was obtained from all study participants before commencement of data collection and confidentiality of subject's information was assured as data were only handled by the lead researcher and stored under a password protected device.

III. RESULTS

A. Demographic and Socio-Economic Characteristics of Study Participants

A total of 175 participants were sampled. Majority (68.0%) of the participants were male. The mean age of study participants was 33 years; 49.7% of the participants were married while 96% were Christians. About 40.6% of the study participants had attained secondary school education. The mean family size was 2.37 ± 1.111 and 31.4% of the households had 3-4 members, 43.4% owned the houses they lived in while; 50.9% were residents of Ainamoi Sub County as presented in Table 3.1.

TABLE 3.1:
Demographic Characteristics of Study Participants

Characteristic	Category	N(175)	
		N	%
Gender	Male	119	68.0
	Female	56	32.0
Age	< 21	19	10.9
	21-30	69	39.4
	31-40	48	27.4
	41-50	24	13.7
	51-60	9	5.1
	≥61	6	3.4
	Mean Age	33.13 ± 11.794	
Marital status	Married	87	49.7
	Single	76	43.4
	Separated/ Divorced	11	6.3
	Widowed	1	0.6
Religion	Christian	168	96.0
	Muslim	1	0.6
	Pagan	6	3.4
Level of education	No formal education	7	4.0
	Primary education	54	30.9
	Secondary education	71	40.6
	Tertiary education	43	24.6
Family size	1-2	45	25.7
	3-4	55	31.4
	5-6	47	26.9
	7-8	21	12.0
	≥9	7	4.0
	Mean family size	2.37 ± 1.111	
Housing	Living with relatives	57	32.6
	Own house	76	43.4
	Rental house	42	24.0

B. Duration of Pulmonary Tuberculosis

Majority (60%) of the study participants had contracted PTB for 1-2 months indicating that 60% most participants were on the intensive phase of medication. A smaller proportion (2%) had had the disease for ≥7 months. About 6.3% (n=11) of the participants had other members within their households who had PTB. Out of the 6.3% (n=11), 81.8% had one other member while 18.2% had at least two other members within their households with PTB as shown in Table 3.2.

TABLE 3.2:
Disease Duration and Household Members with Tb

Characteristic	Category	N(175)	
		N	%
Tb duration (n=175)	1-2 months	105	60
	3-4 months	30	17.1
	5-6 months	35	20
	≥7 months	5	2.9
	Mean	2.70 ±2.273	
Phase of medication	Intensive phase	105	60
	Continuation phase	70	40
Households with TB	No	164	93.7
	Yes	11	6.3
Number household members having TB in the (n=11)	1 person	9	81.8
	≥2persons	2	18.2

C. Dietary Practices of Study Participants

Dietary practices of PTB patients were assessed using a 24-hour recall, food frequency questionnaire, and dietary diversity score. Meal frequency and source of food were also assessed. Findings show that 81.7% had 4-6 meals per day with an average of 4.49 meal frequency (MF). This indicates that the MF for most participants was 4 per day as shown in Table 3.3.

TABLE 3.3:
Meal Frequency per Day of Study Participants

Number of meals	N(175)	%
1-3	32	18.3%
4-6	143	81.7%
Mean	4.49 ± 0.934	

Most (42.9%) of the study participants consumed food from their own farm produce, 30.3% consumed food purchased from the market while; 26.9% consumed food sourced from both farm produce as well as the market as shown in Figure 3.1.

Figure 3. 1:
Source of Food for Study Participants

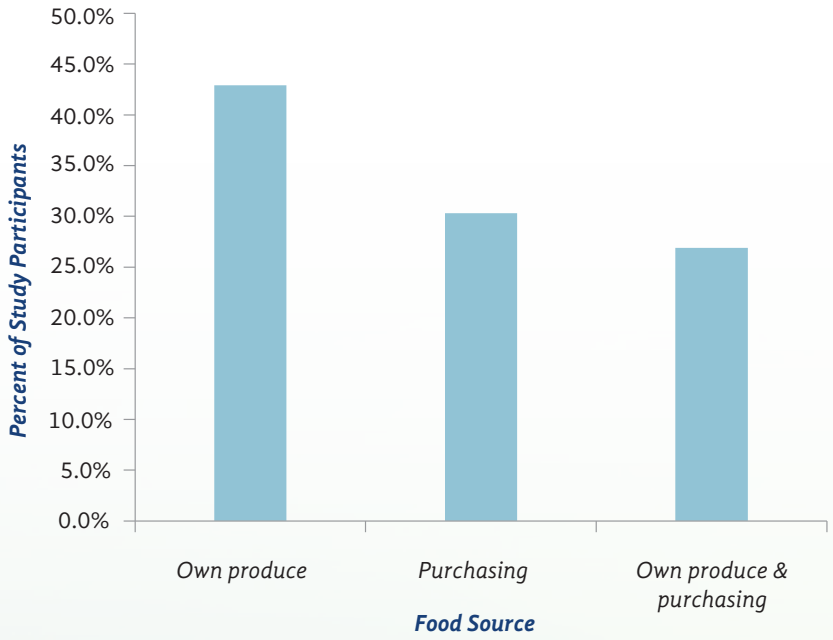

Table 3.4 shows the frequency of consumption of selected food groups by study participants. About 32.6% consumed vegetables twice a week. Interestingly, a similar percentage (27.1%) of participants consumed fruits twice a week and seasonally. Legumes, pulses & nuts, and roots & tubers were consumed seasonally by 26.9% and 31.9% of participants respectively. About 21.2% consumed animal products every day while 32.1% consumed cereals twice a week. Oils & fats, and sugar & honey were consumed daily by 37.1% and 35.8% of participants respectively. See table 3.4 below.

TABLE 3.4:
Food frequency of selected food groups of study participants

	Every day	Twice a week	Once a week	Once a month	Seasonally	Never consumed
	%					
Vegetables	19.5	32.6	16.9	13.1	15.7	2.1
Fruits	7.9 27.1		18.4	13.2	27.1	6.2
Legumes, pulses & nuts	6.2	25.4	12.5	20.7	26.9	8.5
Animal products	21.2	23	15.4	16.8	14.6	8.9
Cereals	25.1	32.1	22.4	13.2	6.4	0.8
Roots & tubers	2	25.9	16	20.7	31.9	3.5
oils & fats	37.1	16.8	13.3	15	8	9.7
Sugar & honey	35.8	17.3	7.4	13	24.4	2.1

The mean dietary diversity score (DDS) was 7.12 ± 1.748 SD. Most (89.1%) of the study participants had a high DDS (≥ 6 food groups). Additionally, 10.3% and 0.6% of participants were in the medium DDS (4-5 food groups) and low DDS (≤ 3 food groups) respectively as shown in table 3.5.

TABLE 3.5
Dietary Diversity Score of PTB Patients

Category	N (175	%
≤3 (low)	1	0.6
4-5 (moderate)	18	10.3
≥6 (high)	156	89.1
Mean	7.12 ± 1.748	

The mean energy intake for male and female subjects was 2001 kcal and 1860 kcal respectively. About 3.4% (6) and 4.6% (8) of males and females respectively met the recommended energy requirements for the day. The mean intake for fats was 58.7±11.9g/day. The results show that the mean intake for fiber intake was 20.0±3.5g/day and 18.6±4.8g/day for males and females respectively. The respondents accounted for: 76% & 81% - energy intake, 83% & 77% - carbohydrates, 79% & 78% - proteins and 70% & 74% - fats the RDA for TB for male and female subjects for each category respectively as shown in Table 3.6.

TABLE 3.6
Mean Energy and Macronutrient Intake of Study Participants

	Participants intake		RDA for TB patients		Adequacy (%)	
	Male	Female	Male	Female	Male	Female
Energy (kcal)	2001.2±345.3	1860.0±478.0	2630	2300	76	81
Carbohydrates g/day	300.2±51.8	279.0±71.7	391	336	77	83
Proteins g/day	75.1±12.9	63.8±17.9 95		82	79	78
Fat g/day	55.6±9.6	51.7±13.3	80	70	70	74
Fiber g/day	20.0±3.5	18.6±4.8	30	30	67	62

Note. RDA values for TB patients were adopted from Nthiga et al., 2017a. Adequacy (%) = X/RDA * 100%

Most vitamin consumption was moderately lower than the RDA for TB patients (Table 3.7). Vitamin A accounted for 57% and 66% RDA for TB patients for male and female respectively, vitamin D accounted for 67% and 62% RDA for TB patients for male and female respectively, vitamin E consumption accounted 62.5% of the RDA for TB patients for both male and female and vitamin B6 intake was 63% and 69% of RDA for TB patients. Calcium and phosphorus consumption accounted for: 87% and 81% RDA for TB patients for males and females respectively as presented in Table 3.7.

TABLE 3.7
Mean Micronutrient Intake of Study Participants

Nutrient	*Participant intake*		*RDA for TB*		*Adequacy (%)*	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
Vitamin A (Mcg)	430±98.4	413.1±136.2	750	625	57	66
Vitamin D (Mcg)	4.0±0.7	3.7±1.0	6	6	67	62
Vitamin E (mg)	8.2±1.7	5.6± 2.4	13	9	63	62
Vitamin B1(mg)	1.1±0.2	1.1± 0.3	1.5	1.4	73	79
Vitamin B2 (mg)	1.0±0.2	0.9±0.2	1.6	1.4	63	64
Vitamin B6 (mg)	1.0±0.2	1.3±0.3	1.6	1.6	63	69
Folate (Mcg)	390.2±67.3	362.7±93.2	500	500	78	73
Vitamin B3 (mg)	16.0± 2.8	14.9±3.8	20	20	80	75
Vitamin B12 (Mcg)	2.6±0.4	2.4±0.6	3.0	3.0	87	80
Vitamin C (mg)	38.0±6.6	35.3±9.1	56	56	69	63
Potassium (mg)	3109.8±536.6	2890.4±742.8	5875	5875	53	49
Calcium (mg)	1086.6±187.5	1010.0±259.5	1250	1250	87	81
Magnesium (mg)	239.3±41.3	222.5±57.2	325	275	74	92
Phosphorus (mg)	870.1±150.1	808.7±207.8	1000	1000	87	81
Iron (mg)	16.6±2.9	15.4±4.0	36	19	46	81
Selenium (Mcg)	28.6±4.9	26.6±6.8	43	33	67	62
Zinc (mg)	13.0±2.2	12.1±3.1	18	15	72	81

Note. RDA for TB patients according to Kenya National clinical nutrition and dietetics reference manual, February 2013. Adequacy (%) = X/RDA * 100%

IV. DISCUSSION

According to the results as presented in Table 3.1, most of the study participants were male, married, subscribe to the Christian faith, and had a mean age of 33 years. Most of the participants had attained secondary school education while 31.4% of the subjects belonged to households that had three to four members. The Kenya National Bureau of Statistics (KNBS), (2020) household census report documented an average family size of 3.9. In relation to the current results, this may mean that there are fewer households with more than 5 members at the study site.

Dietary Practices of Study Participants

Good dietary practices play a vital role in influencing an individual disease state and prognosis. Adequate diet has been shown to be an integral domain in the well-being of TB patients (Kanabus,

2019)"abstract":"Nutrition & TB - Malnutrition, under nutrition, assessment For a long time it has been known that there is a link between TB & nutrition. There is a two way link between TB & malnutrition. TB makes malnutrition worse, and malnutrition makes TB worse. TB makes under nutrition worse TB makes under nutrition worse Malnutrition is often considered to refer to people having an insufficient intake of food. But it strictly refers to people having either under nutrition or equally people who have too much food, that is people who are obese. So in the context of TB it is usual to refer to under nutrition, which is people getting insufficient nutrients from their food. Most individuals with active TB experience weight loss. Weight loss among people with TB can be caused by several factors, including reduced food intake due to loss of appetite, nausea and abdominal pain. Equally under nutrition weakens the body's ability to fight disease. So under nutrition increases the likelihood that latent TB will develop into active TB disease. Although there is a clear link between active TB and under nutrition, in no way does malnutrition or under nutrition cause TB on its own. TB is only ever caused by TB bacteria. Food insecurity and malnutrition in people who are in close contact of a patient with active TB, increases their risk of developing TB. A person with TB should aim to have three meals and three snacks each day to increase the amount of food they eat. There is more about food & TB. TB and Under Nutrition There is increasing evidence that under nutrition in patients with active TB is associated with an increased frequency and severity of disease and indeed a two to four fold increase in mortality. There is also a five fold risk of drug induced liver damage. A less than ideal weight gain during TB treatment also increases the risk of long term relapse even after initial cure. Under nutrition has also been associated with malabsorption of key anti TB drugs. So TB and under nutrition can cause a vicious cycle of worsening disease and under nutrition. Under nutrition is linked to a number of serious outcomes related to TB disease which include: Disease: Increased severity & higher mortality Treatment: Increased adverse effects (liver toxicity. Results of this study have shown that most of the respondents had inadequate dietary intake as presented in tables 3.4, 3.6 and 3.7. This might influence the subject's treatment outcomes and prognosis as well as impact the progression of any underlying comorbidities. Research has shown that energy requirements for TB patients are often increased due to the infection itself (Nutrition Information Centre of University of Stellenbosch (NICUS), 2005); and this, therefore, underscores the need for adequate dietary intake as a compensatory intervention.

According to WHO (2013), the recommended macronutrient distribution range entails; 15–30% proteins, 25–35% fats, and 45–65% carbohydrates. Results in table 3.6 have shown that there was average consumption of macronutrients. This trend might be due to the relatively adequate availability of food sources for most households since Kericho County is generally food rich (Soko Directory Team, 2015).

According to the results presented in table 3.6, the mean energy intake for sampled subjects was 2001.2 kcal/day and 1860 kcal/day for male and female subjects respectively. This rate is generally below the RDA for TB patients (i.e., 2630 kcal/day and 2300 kcal/day for males and females respectively) according to (MoH, 2010). A study conducted in Lodwar by Nthiga et al. (2017a) reported a mean energy intake of 2228 kcal/day for males and 1870 kcal/day for female subjects which was below the RDA for TB patients. Furthermore, a study conducted in China reported a mean energy intake of 1655.0 kcal/day and 1360.3 kcal/day for male and female subjects respectively. These findings were significantly lower than the daily recommended energy intake [DRIs] (Ren et al., 2019)300 adult TB patients were surveyed in two impoverished counties in China. Nutrient intakes were evaluated through two consecutive 24-h dietary recalls and compared with the Chinese Dietary Reference Intakes (DRIs - 2250 kcal/day for males and 1800 kcal/day for females). Another study conducted at the Myanmar -Thailand border, reported a mean energy intake of 2065 kcal/ and 2325kcal/day for male and female subjects respectively (Damji et al., 2022). These results were slightly above the RDA for Thailand according to Ivanovitch et al (2014). The findings for the various studies defined above

seem to correlate with the availability and adequacy of food sources. For instance, Kericho County - Kenya and Myanmar - Thailand border are generally food stable regions. The source of the food for the former is direct farm production while that of the latter is the possible availability of consistent food aids as well as partial production from the farm respectively. Comparatively, food production in Turkana County – Kenya is generally poor while food sources in Lingyun & Lin Counties - China are relatively diminished.

Additionally, the mean intake of macronutrients among the study subjects was above average but below the RDA for TB patients (MoH, 2010). The mean Carbohydrate means intake was 300.2g/day and 279g/day for males and females respectively. Further, the mean intake for protein and fat was 75.1g/day & 63.8g/day and 55.6g/day & 51.7g/day for male and female subjects in each category respectively. A cross sectional study conducted in Lodwar – Kenya reported that intake of carbohydrates contributed a lot to energy requirements as compared to proteins and fats represented as follows: 338g/day & 279g/day, 37g/day & 32g/day, and 42g/day & 29 g/day for male and female subjects in each category respectively (Nthiga, et al., 2017a). Another cross-sectional study conducted in Lingyun & Lin Counties - China reported means of: 212.1g/day & 154.8g/day, 44.6g/day & 35.9g/day, and 73g/day & 68.9g/day for male and female subjects in carbohydrate, protein and fat categories respectively (Ren et al., 2019)300 adult TB patients were surveyed in two impoverished counties in China. Nutrient intakes were evaluated through two consecutive 24-h dietary recalls and compared with the Chinese Dietary Reference Intakes (DRIs. A case-control study conducted in Georgia – USA reported a high mean intake of macronutrients (carbohydrates 462g/day, protein 134g/day, and fat 99g/day) among TB subjects, this high intake of macronutrients reported might be attributed to the tool (Georgia-specific nutrient tool) used to collect data on dietary intake for the participants (Frediani et al., 2016). The average dietary intake of macronutrients (carbohydrates, proteins, and fats) might have contributed to inadequate energy intake per day for the study participants and this will lead to inadequate intake of micronutrients which will have an impact on the immune system of an individual and treatment outcomes.

Micronutrients (vitamins and minerals) are vital nutrients that boost the immune system (cell-mediated) of an individual, increasing the ability to fight infections and thus improving the outcomes of TB treatment (Andrade & Garcia-perdomo, 2020). Some of the micronutrients have important roles in metabolic pathways, cellular function, and immune function e.g. vitamins A, C, D, E, B6, and folic acid, and the minerals zinc, copper, selenium, and iron (WHO, 2013). Inadequate intake of fat will affect the absorption of fat-soluble vitamins (vitamins A, D, E &K) and the method and length of cooking will determine the level of vitamins in food one will consume. According to the results presented in Table 3.7, there was an inadequate intake of micronutrients by study respondents thus this may predispose them to micronutrient deficiencies. This may be attributed to an average intake of food rich in these micronutrients e.g. fruits and vegetables as recorded in food frequency and DDS. Similarly Damji et al. (2022) found that micronutrient intake was generally low among study participants and attributed it to a lack of dietary diversity.

The number of meals consumed in a day determines the amount of food consumed over the same period. Individuals with tuberculosis are encouraged to consume at least 3 meals and 3 snacks per day to increase the quantity of food intake (WHO, 2013). According to the results in Table 3.3, most of the participants consumed an average of >4 meals per day. These findings show a slight variation from those of other studies conducted locally, regionally, and internationally. For instance, findings of a study done in Nyeri County, Kenya reported that participants consumed 3 (81%) meals per day (Mwendia et al., 2017). Furthermore, a study conducted in northwest Ethiopia documented that most of the participants consumed ≤3 (78.5%) meals per day (Endalkachew et al., 2022). Another study utilizing subjects with similar demographics as in the current one and conducted in the eastern region

of Ethiopia, reported that most of the participants consumed 3 (70.6%) meals per day (Muse et al., 2021). This trend seems to place participants in the current study in an advantage position in terms of the number of meals consumed per day. Kericho County is largely food rich as compared to the regions profiled. The amount of food intake may have a positive nexus on the nutrition status of the subjects studied. Adequate intake of requisite calories quenches the augmented energy requirements among participants due to TB. This in turn may facilitate up-regulation of resident immune responses and ultimately improve disease prognosis.

The dietary diversity score (DDS) measures nutrient adequacy and diversity of an individual diet (Food and Agriculture Organization, 2011). DDS is known as a vital constituent of diet quality as it measures the number of food groups consumed over some time (Gómez et al., 2020)an important component of diet quality, is associated with an increased probability of adequate micronutrient intake. Women of childbearing age (WCA An adequate and well-balanced diet is crucial in the sustenance of the ideal physiological landscape of subjects. According to the results presented in figure 3.1 and table 3.5, study participants who had a high DDS (>6) mostly consumed cereals, oils & fats, vegetables as well as milk & milk products. A study conducted by Nthiga et al. (2017a) in Lodwar reported a medium DDS (4-5 food groups) with the most consumed food groups being cereals (100%), oils and fats (83%) other vegetables (81%), dark green vegetables (81%), and milk & milk products (77%). Muse et al. (2021) conducted a study in East Ethiopia and reported that 38.2% of study participants practiced dietary diversity while; 61.8% did not practice any dietary diversity. However, dietary classification scales (low, medium, and high) were not immediately apparent in the said study. On the other hand, a cross-sectional facility-based study conducted in Northern Ethiopia reported a mean DDS of 7.559 with 52.2% of subjects reporting that they consumed a diversified diet while; 47.8% practiced the reverse (Brhane et al., 2021)thereby increasing the likelihood that latent TB will develop into active disease. This may result due to illness that impairs nutrient intake and metabolism or results from inadequate intake of macronutrients, micronutrients, or both. This study aimed to assess undernutrition and associated factors among adult patients on directly observed therapy — short course (DOTS. Another study conducted in Ethiopia and utilizing subjects with similar demographics as those in the current study reported that 53.1% of participants had high DDS of ≥6 food groups (Endalkachew et al., 2021). A case-control study conducted in Ethiopia reported a mean DDS of 3.56 with >80% of the subjects scoring averagely low DDS (4.5 out of 9 food groups) for both treatment and control groups (Keflie et al., 2018). Comparatively, therefore, results for subjects in the current study demonstrate a contrastingly superior DDS. This trend can be credited to the fact that most of the subjects studied are residents of Kericho County which is technically a “food basket” for Kenya. Such high DDS correlates with better disease outcomes and ultimately scales down mortality rates among subjects.

V. CONCLUSION

Based on the interpretation of the results obtained and the ensued discussion herein, the following conclusions suffice:

i. Consumption of macronutrients was average despite the relatively adequate availability of food sources for most households. Mean carbohydrate, protein and fat intake was 300.2g/day & 279g/day, 75.1g/day & 63.8g/day and 55.6g/day & 51.7g/day for male and female subjects in each category respectively.

ii. The mean energy intake was 2001.2 kcal/day and 1860 kcal/day for male and female subjects respectively which is generally below the RDA for TB patients (i.e., 2630 kcal/day and 2300 kcal/day for males and females respectively) according to MoH.

iii. There was an inadequate intake of micronutrients by study respondents.

iv. Most of the participants consumed an average of >4 meals per day which is above WHO recommendations.

v. Study participants had a high DDS (>6) mostly consumed cereals, oils & fats, vegetables as well as milk & milk products.

VI. RECOMMENDATIONS

In reference to the conclusions above, the following recommendations are made:

i. Sensitizations programs to increase macronutrient and micronutrient intake should be formulated seeing that food is readily available in Kericho.

ii. Pulmonary tuberculosis patients should increase their energy intake to above the minimum recommended threshold by MoH(2630kcals for males and 2300kcals for females)

iii. Counselling on good dietary practices should be incorporated as one of the key intervention in management of PTB

iv. Nutrition support should be provided for PTB patients to help in meeting their energy requirements

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CONFLICT OF INTEREST

Authors declare no conflict of interest

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