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Dietary practices of pulmonary tuberculosis patients attending clinic at lodwar county and referral hospital, Turkana County, Kenya

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Abstract
Dietary practices and tuberculosis exacerbate each other such that when dietary intake is poor, the prognosis of TB is poor. TB, on the other hand, depresses the dietary intake by lowering the appetite and thereby influencing the nutritional status. The study aimed to establish the dietary practices of pulmonary tuberculosis patients attending TB clinic at Lodwar County and Referral Hospital, Turkana County, Kenya. The study was an analytical cross-sectional. Purposive sampling was used to select the Lodwar County and Referral Hospital as the location of the study. The study samples (n=242) was chosen using the systematic sampling method. The dietary practices analysis involved a 24-hour recall, food frequency questionnaire, and dietary diversity score. TB clinic at Lodwar County and Referral Hospital, Turkana County, Kenya. Tuberculosis patients aged 25 – 44 aged 25-44 years. The energy intake of TB patients accounted for 85% and 81% the RDA for TB for males and females respectively. Carbohydrate consumed was 86% for males and 83% for females. Protein intake was 39% and 46% of the RDA for males and females respectively. Important micronutrients in TB management including Vitamins A, D, B_1, B_2, B_6, C, zinc, selenium and folate were consumed at levels lower than the RDA. The mean number of meals eaten in a day was 1±0.6. Nearly half of TB patients (49%) had a medium DDS (4-5 food groups) and nearly the same percentage (45%) having a high DDS (≥ 6 food groups). Most of the respondents reported poor dietary practices. Most of the respondents reported poor dietary practices. Counseling on dietary practices should be the key intervention during TB management.

Keywords: nutrition on status, dietary practices, 24-hour recall, food frequency questionnaire, and dietary diversity score

1. Introduction
Tuberculosis (TB) has affected humanity for more than 4,000 years [19]. 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 precipitously burgeoning and plaguing 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 [6]. 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 fever and night; these have negative implications on dietary intake.

Dietary practices (nutrients intake, diversified diets, the number of meals per day) and tuberculosis exacerbate each other, such that, when dietary intake is poor, the prognosis of TB is poor [16]. TB depresses dietary intake by lowering the appetite and thereby influencing the nutritional status [18]. TB drugs tend to induce negative nutrient-drug interaction further depressing the intake [10].

Despite the critical contributions of good nutrition to the treatment and management of T.B, LCRH lacks a fully established nutrition support programme for T.B patients who attend treatment. Moreover, there is no enough information on the dietary practices of TB patients at LCRH. No study in the district hospital or the county has previously targeted dietary practices of TB patients in the region.

Dietary diversity is a fundamental element of the high-quality diet. According to [7], culture, access to food, knowledge of food, disease, and stress are major factors affecting dietary practices. When financial concerns are at play, meals often get skipped. Also, food that is purchased may not provide a nutritionally adequate diet [3]. Inadequate dietary intake may be secondary to symptoms of diseases, including TB, for example, nausea, vomiting, and pain [16].

People who take medications (such as Patients on TB medication) may experience unpleasant side-effects that can ultimately reduce their dietary intake [15]. Shifting from a monotonous diet to one with diverse food choices has been revealed to augment macronutrient and micronutrient among consumers [8]. Lack of income to purchase food, rather than the lack of availability of fresh foods in the market, is the major challenge for vulnerable populations to access diversified diets. Compounding limited dietary diversity is the infinitesimal diversity of food production at the household level. Limited varieties of crops grown, livestock reared, and absence of land reclamation negatively impacts households' ability to put food on the table. More sensitization on farming and higher quality training can build the knowledge, attitudes, and practices among TB patients for the need for a diversified diet.

Dietary diversity in a population at risk of TB has been formidably correlated with higher household socio-economic status (SES) [1]. A higher SES is also associated with a higher micronutrient adequacy as a result of dietary diversity [14].

Consumption of a wide variety of foods is an internationally accepted recommendation for a healthy diet. According to [2], healthy diets have been greatly associated with positive health outcomes such as quick recovery from diseases and reduced incidences of mortality. Low dietary diversity has been associated with specific nutrient deficiencies, an important health indicator, independent of socioeconomic status [12]. Studies have found that consumption of a varied diet leads to a reduced risk of developing a deficiency or excess of any one nutrient and is therefore associated with the dietary nutrient quality [11].

According to the [9], the energy requirement for a tuberculosis patient is approximately 35 – 40 kcal per kg of ideal body weight. Also, protein intake of 1.2 to 1.5g per kg body weight or 15% of total daily energy intake or approximately 70 – 100 per day. Fat should provide 25 – 30% or less of the total energy requirements of an individual. The recommended dietary allowance for energy for TB patients for male and females is approximately 2300 Kcal/day and 2630kcal/day respectively. The protein required in a day is approximately 82g for females and 95g for males based on 1.35 g/IBW for both. Fat in grams is approximated from average required (27.5% of daily Kcal).

A good multivitamin and mineral supplement or combined formula providing 50% - 150% of the daily recommended allowance is advisable since it is most unlikely that a TB patient will be able to meet the increased requirements for vitamins and minerals from dietary sources alone due to low intake linked to poor appetite [9].

A study by [5] indicates that diet diversity is a good indicator of nutrition security and is associated with reduced risk of morbidity. Therefore, the inclusion of a variety of foods in the diet facilitates adequate nutrients intake. Thus, diet diversification through the promotion of production and consumption of diversified diet can be one of the strategies of mitigating the effect of food insecurity and nutrient deficiencies.

2. Materials and methods

A cross-sectional analytical study design was adopted. Dietary practices and associated risk factors such as demographic, social-economic and health factors were investigated. The study was conducted at 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 dietary practices. 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. For the 24 hour recall, a sub-sample was purposely selected (n = 141) due to the long distances study participants covered and ease of respondents access by road. Then a follow up to their household to determine household measures for actual consumed food was done.

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. Dietary practice assessment was done using a 24-hours recall that helped to determine the dietary intake of the respondents, a seven-day food frequency questionnaire (FFQ) to assess the frequency of consumption of selected foods, to assess the typical food intake over seven days and to determine the dietary diversity score (DDS), as described by [4]. For the 24 hour recall, the respondents were asked to recall all the foods they had eaten the previous day from the time they woke up to the bedtime. A calibrated household measures like plates; cups and spoons were used to estimate the amount of food. A pre-tested food frequency questionnaire with 16 food groups was used to assess the frequency of food intake and availability [4]. The respondents were asked whether they consumed the enlisted foods in different food groups and how frequent they did within the previous seven days. The Dietary Diversity Score was attained by establishing the number of different food groups consumed where the more the number of food groups consumed implied the dietary diversity in both macro and micronutrients.

Data on dietary intake (24-hour recall and FFQ) was analyzed using Nutri-Survey computer package to determine intake of energy macronutrients (carbohydrate, proteins and fats) and micronutrients (Vitamin A, Vitamin E, Vitamin B6, Folate, Vitamin C, Selenium and Zinc) for both males and females. The results were compared with the RDA for males and females to assess the adequacy of their dietary intake.

Approval to conduct research 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 carry out research was obtained from LCRH. A signed consent by respondents was required before administering the questionnaire. Confidentiality was maintained.

3. Results

The information on dietary practices; 24-hour recall, food frequency questionnaire and dietary diversity is presented in this section. The mean energy intake for the study population was 2228 kcal/day for males and 1870 Kcal/day for females. The energy intake of TB patients accounted for 85% and 81% the RDA for TB for males and females respectively. Carbohydrate contributed a lot to the daily caloric intake where males consumed 86% of the RDA for TB patient with females taking (83%) carbohydrate of the recommended dietary intake for TB patients. The study established that protein was not consumed to the recommended dietary allowances for pulmonary tuberculosis patients as much as it is one of the key nutrients that are required for the dietary management of TB. The mean protein intake was 37±22g/day where males and females were found to have consumed 39% and 46% of the RDA for TB patients respectively.

The mean fat intake was 42 g/day and 29 g/day for males and females respectively. Male and females were found to have consumed 53% and 56% of the RDA for TB patients. The study population did consume fiber to almost the thresholds recommended dietary intake for TB patients; males averaged at 87% while females consumed about 90% of TB patients RDA (Table 1).

Table 1: Mean energy and macronutrient composition for the study respondents

Nutrient	Participants intake		*RDA for TB		**Normal RDA		% of TB RDA	
	Male	Female	Male	Female	Male	Female	Male	Female
Energy (kcal)	2228	1870	2630	2300	2275	1987	85	81
Carbohydrates g/day	338	279	391	336	341	298	86	83
Protein g/day	37	38	95	82	63	54	39	46
Fat (g/day)	42	39	80	70	76	66	53	56
Fiber (g/day)	26	27	30	30	30	30	87	90
*RDA values are based on guidelines for management of tuberculosis and leprosy in Kenya, July 2013								

**RDA values adopted from WHO/Trufts University, 2002, Lidikwe *et al*., 2001 and FAO/WHO/UNV

Micronutrients are of great importance in the management of TB, especially those that boost the immunity (e.g. Vitamins A and E, and selenium) as well as those that their demand is increased by intake of TB treatment drugs (vitamin D, B3, B6, B12, folate, calcium and magnesium). Both men and women consumed relatively lower than the normal RDAs of selected vitamins (vitamin A, E, D, B3, B6, B12, and folate) (Table 2). For example, for vitamin A, the consumption of TB males and female was 54% and 66% of the RDA for TB respectively. As for vitamin D, both males and females met 80% of their daily requirements. Vitamin E intake for both males and females were 55% and 75% of the recommended dietary intake of Vitamin E. Most of the minerals were consumed below the recommended dietary allowances for tuberculosis patients. In potassium and calcium consumption, both males (31%) and females (32%) did not meet their RDAs. Magnesium and phosphorous, consumption were more than RDAs for TB patients. The magnesium RDAs for males and females are 260 mg/day and 220 mg/day respectively. However, data from the 24-hour recall showed that the average daily consumption was more than that; males (119%) and females (156%). The average consumption of Phosphorous among male participants was 820 mg and that of females was 857 mg; comparing to the Phosphorus RDAs for TB, they met their RDAs by103 % (males) and 107% (females). For Iron, Selenium and Zinc, which are also vital in maintaining in maintaining body immunity, the consumption was below the RDA as shown in Table 2.

Table 2: Mean micronutrient composition for the study respondents

	Participants Intake		*Normal RDA		** RDA for TB		% of TB RDA	
Nutrient	Male	Female	Male	Female	Male	Female	Male	Female
Vit A*(µg)	324	329	600	500	750	625	43	53
Vitamin D (µg)	4	4	5	5	6	6	64	64
Vit.E* (mg)	5	6	10	7.5	13	9	40	64
Vit B1 (mg)	1	1	1.2	1.1	1.5	1.4	67	73
Vit B2 (mg)	1	1	1.3	1.1	1.6	1.4	62	73
Vit. B 6* (mg)	1	1	1.3	1.3	1.6	1.6	62	62
Folate*(µg)	128	134	400	400	500	500	26	27
Vit B3 (mg)	14	13	16	16	20	20	70	65
Vit. B12 (µg)	1.5	1.6	2.4	2.4	3.0	3.0	50	53
Vit C* (mg)	24	26	45	45	56	56	43	46
Potassium (mg)	1438	1497	4700	4700	5875	5875	24	25
Calcium (mg)	166	149	1000	1000	1250	1250	13	12
Magnesium (mg)	310	344	260	220	325	275	95	125
Phosphorus (mg)	820	857	800	800	1000	1000	82	86
Iron (mg)	9	9	29	15	36	19	25	48
Selenium (ug)*	19	18	34	26	43	33	45	55
Zinc*(mg)	9	9	14	12	18	15	51	60

*RDA values adopted from WHO/Trufts University, 2002, Lidikwe *et al*., 2001 and FAO/WHO/UNV

**Micronutrients of concern in TB management according to Kenya National clinical nutrition and dietetics reference manual, February 2013.

The mean DDS was 5.1 SD + 1.1 ranging from 3 to 8 for the IDDS. A small percentage (6%) of the study participant had a low dietary diversity score (≤ 3 food groups) [4]. About half of TB patients (49%) had a medium DDS (4-5 food groups) and nearly the same percentage (45%) having a high DDS (≥ 6 food groups). Most of the study participants were found to have a medium intake of macro and micronutrients since they had a medium DDS (4-5 food groups) compared to those who had a high DDS (≥ 6 food groups). The highest consumed food groups of the study participants were cereals (100%), oils and fats (83%) other vegetables (81%), dark green vegetables (81%), Milk and milk products (77%) and Flesh meats (63%) (Figure 1).

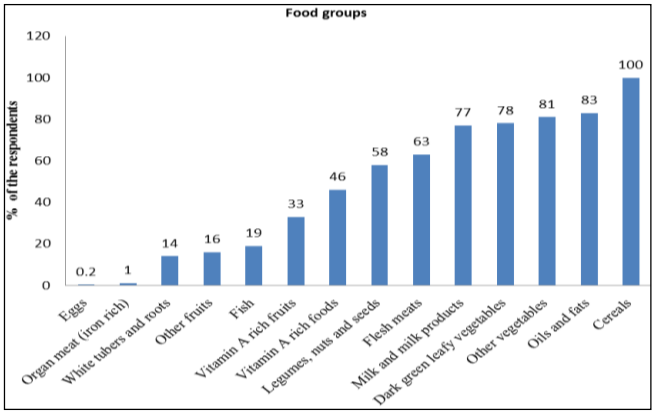

Fig 1: Dietary Diversity of study participants

Food groups were based on guidelines for measuring household and individual dietary diversity (FAO, 2011)

Most of the TB patients both female (68%) and male (54.2%) experienced poor appetite with an average of 61.1% during the time of study. Availability of resources was another most determining factor in food choice. Money availability determined what one would eat, regardless of its nutritional value. It was noted that the main source of food for both male (78.5%) and female (71.5) was from purchases, followed by donations or gift (male 18.8%, female 25.2%). Little food was obtained from own production by males 2.7% and females 3.3%.

Though nutritional knowledge was found to be a determining factor in food choice, the study participants were found to be incapable of choosing their food according to what they had been advised, due to lack of enough resources. "We are advised to eat foods rich in energy, protein and micronutrients but if you don't have enough money to buy these foods like the liver or meat, green vegetables you will end up buying cabbage and maize flour that are cheap and require simple methods of preparation (boiling and braising)" (Lodwar discussant February, 2014).

The number of feeds and how regular the feeds are consumed in a day can affect the nutritional status of an individual. In this study, a high percentage of both females (89%) and males (85%) said they did not regularly eat during the day. On average 1+-1.0 meal was consumed in a day. A discussion with a health worker confirmed that most of the families consumed one or two meals in a day. "Because there is rarely crop production in the community, the main source of food for TB patients is purchases and with limited resources in the community, most of them take one or two meals in a day" (Lodwar discussant February 2014).

The study established that main cooking methods for the study participants are boiling (54%), steaming (28%) and frying (18%).

4. Discussion

A good dietary practice plays a crucial role in influencing recovery from TB. Dietary intake is a modifiable risk factor important in the effort to prevent the onset and the management of TB [6]. The respondents in this study did not consume a nutritionally adequate diet as was evidenced in the analysis of a 24- hour recall, contrasting the requirements for tuberculosis as stated in the study. This might have influenced the onset and recovery period of tuberculosis and other diseases affecting the study respondents.

According to [17], the energy needs of TB patients increases due to the illness itself. An increase in energy need for TB requires additional macro-nutrients to meet the nutritional requirements. However, TB patients in this study consumed energy lower than their RDAs. This is mainly related to their low appetite and limited resources. Amongst the macronutrients; carbohydrates was consumed more than the others (proteins and fats) even though its consumption was below the RDA for TB patients and therefore contributing to the low energy intake in a day for study respondents.

According to the [9] protein intake of 1.2 to 1.5g per kg body weight or 15% of total daily energy intake or approximately 70 – 100g per day is recommended. However, the current study participants did not meet even half of their daily protein requirements. This is associated with low intake of protein rich foods like milk and milk products, legumes, meat, eggs among others.

Fats/oils, which contribute to the energy requirement and transportation of fat soluble vitamins (e.g. Vitamin A) was consumed below half of the RDA. Low consumption of fat/oils posed the risk of inadequate energy intake and low utilization of essential fat-soluble vitamins, especially vitamin A that is important in strengthening body immunity. Such intake translates to poor nutritional status and lowered immunity.

Data from the 24-hour recall and food frequency questionnaire indicated that most of the micronutrients were consumed in low amounts. Low intake of micronutrients posed a risk to their deficiencies, including lowered immunity and therefore, frequent illnesses as was witnessed by some study participants. Low intake of the micronutrients could be associated to low intake of foods rich in the respective micronutrients like green leafy vegetables, fruits and whole grains.

Data collected from food frequency questionnaires was analysed to calculate the dietary diversity score of individual study respondents [4]. The dietary diversity of study participants revealed that some TB patients did not consume a varied di*et al*though the majority had medium to high varying foods. Of the reasons stated by study participants, appetite was seen to be one of the factors that affected the dietary diversity. The study confirmed a close association between TB and appetite. The findings of this study were similar to that of [13], in Tanzania. Loss of appetite is known to be caused by two factors; the effects of the disease itself as well as the side effects of medication. Mycobacterium bacteria and drugs are known to depress the production and activity of the appetite-regulatory hormones.

Arimond, M., & Ruel, M.T. (2004) in their research found out that dietary diversity in the population at risk of a disease has been strongly associated with higher household socioeconomic status. When financial concerns are present, meals are often skipped and food that is purchased may not provide a nutritionally adequate diet [3]. These studies concur with the current study because minimal varieties of foods were selected in different food groups by the participants. For example, only four types of fruits were consumed by the respondents (mangoes, bananas, oranges and avocado), and only beans were selected from the legumes' group. Selection of these foods was influenced by availability in the market and economic status of the study participants. In addition most of the study participants consumed one meal in a day indicating the respondents' adaptive mechanism to food insecurity.

5. Conclusion

Tuberculosis patients attending LCRH practiced poor dietary practices. Patients consumed undiversified diet, few number of meals in a day and low percentages of nutrients in relation to the RDA for the TB patients. Counseling on good nutrition practices should be the key intervention during TB management.

6. References

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