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ORIGINAL ARTICLE

Undernutrition assessment and nutrient intake of people with TB in the Philippines

G.A.A. Lagason,[1] M.T. Gler,[1] J.A.R. Ganaden,[1] K.A. Panganiban,[1] G.H. Castillon,[2] J.P. Cegielski[3]

[1]TB HIV Innovations and Clinical Research Foundation, Cavite, Philippines; [2]De La Salle Medical and Health Sciences Institute, Cavite, Philippines; [3]Department of Epidemiology, Rollins School of Public Health, Emory University, Atlanta, GA, USA.

SUMMARY

BACKGROUND: TB remains a major health concern in the Philippines, with malnutrition worsening patient outcomes. However, limited data on under nutrition and nutrient intake among TB patients hinder effective nutritional care.

METHOD: This cross-sectional study in Cavite, Philippines, assessed nutritional status, dietary intake, and the feasibility of nutritional assessment, counselling, and support (NACS) in outpatient TB clinics. Adult TB patients from six catchment areas participated. Nutritional status was evaluated using the Subjective Global Assessment questionnaire, and dietary intake was recorded through a 72-h asynchronous video nutrient diary via the SureAdhere app. NACS feasibility was assessed based on health care worker adherence to guidelines.

RESULTS: Among 141 participants, 88% were malnourished, with 85% classified as mildly/moderately malnourished and 3% as severely malnourished. Macronutrient deficiencies were common, with protein and fat intake at 56% and 51% of requirements, respectively. NACS delivery was feasible, with all participants completing the assessment and receiving nutritional support.

CONCLUSION: These findings highlight the urgent need for integrating nutritional care into TB management. The successful implementation of NACS in outpatient TB clinics presents an opportunity to enhance patient outcomes and reduce the TB burden in the Philippines.

KEY WORDS: tuberculosis; malnutrition; nutritional assessment; dietary intake; nutritional support; Cavite

In the 2013 Philippines National Nutrition Survey, the prevalence of undernutrition in the general adult population in the Philippines was 41.7%.[1] The TB incidence is 764/100,000, ranking fourth among the 30 high-burden countries.[2] Studies indicate that TB incidence rises with increasing levels of undernutrition in a population,[3] and undernourished individuals with latent TB infection face a higher risk of developing active TB.[4,5] Active TB disease among people who are undernourished may be lethal, and undernutrition may persist even after successful anti-TB treatment without nutritional support.[6,7] The 2013 WHO guidelines on TB management included individualised nutritional assessment and management, including dietary counselling and nutritional interventions for all patients with active TB.[8] The provision of food support during anti-TB treatment is based on evidence that macronutrient supplementation increases treatment adherence, improves weight gain during treatment, and decreases mortality.[9–11] Peru's national TB programme follows WHO guidelines with 80% coverage,[12] offering free treatment, psychological and nutritional counselling, and monthly food baskets during TB treatment.[13] On the Myanmar–Thailand border, TB clinics provide food rations throughout treatment. India supports patients with cash advances for nutrition during TB care.

Nutritional assessment and support are currently not part of the Philippines' National TB Program Guidelines. In 2013, roughly 7 in 10 households did not meet their dietary energy requirement, suggesting chronic undernutrition at the household level.[14] We assessed the nutritional status and nutrient intake of patients with TB in Cavite, a high-TB-incidence area, to inform the development of operationally feasible guidelines for nutritional assessment, counselling, and support (NACS) for patients with TB. We also aimed to determine the feasibility of NACS in TB clinics, including adherence by health care workers (HCWs) to a defined protocol for procurement and distribution of healthy food to patients.

METHODS

We conducted a cross-sectional study on the nutritional status and nutrient intake of patients with TB and the feasibility of NACS provided by HCWs in outpatient TB clinics. The study took place from October 2023 to April 2024 in the six outpatient TB clinic catchment areas in Cavite, a high-TB-incidence province south of Metro Manila, Philippines. With a population of 4,344,829, Cavite reported 24,550 TB cases in 2023 (565 per 100,000).[15] We enrolled patients aged 18 years or older with newly diagnosed

Correspondence to: Glyzelle Anne A. Lagason, TB HIV Innovations and Clinical Research Foundation, MD Congressional Avenue, Salitran III, Dasmariñas, Cavite, Philippines. E-mail: galagason@tbhivicr.org.ph

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bacteriologically confirmed pulmonary TB who were awaiting treatment or had been treated for less than 2 weeks. Exclusion criteria included current participation in a nutritional intervention trial or receiving nutritional support from private or government entities. Our primary outcomes were the proportion of patients with TB who were undernourished, their predominant macronutrient deficiency, and the feasibility of delivering NACS in the outpatient setting.

Undernutrition was diagnosed based on the European Society of Clinical Nutrition and Metabolism (ESPEN) definition – a state resulting from inadequate nutrition intake or uptake, leading to altered body composition (decreased fat-free mass) and body cell mass leading to diminished physical and mental function and impaired clinical outcome from the disease.[16] Malnutrition, as per the ESPEN conceptual definition, includes nutritional intake/uptake (Domain A), body composition (Domain B), and physical and cognitive function (Domain C).[16–18] BMI was not used as a tool for nutritional assessment, as it only captures weight relative to height, which represents just one domain (body composition) of undernutrition. Malnutrition can occur in individuals with normal or higher BMI due to the loss of fat-free mass, affecting both overweight and obese patients.[16]

Subjective Global Assessment (SGA), a comprehensive assessment of nutritional status developed by Detsky, was used to assess nutritional status, covering all three domains of undernutrition.[19] The SGA, a 7-point scale, was administered once within the first 2 weeks of TB treatment. Scores range from 1 to <3 (severe undernutrition), 3 to <6 (mild to moderate undernutrition), and 6 to 7 (normal nutrition). A subset of 30 participants – representing well-nourished, moderately undernourished, and severely undernourished individuals – were selected for dietary intake assessment. These participants underwent a 72-h non-consecutive video-observed dietary intake assessment using the SureAdhere app.[20] Participants recorded videos of their 24-h dietary intake over a 72-h period, with at least a 1 day interval between recordings during the first 2 weeks of the intensive phase of TB treatment. Participants recorded short videos of each meal in a day before and after eating, describing and estimating its contents. To improve portion accuracy, they used measuring spoons, cups, and a portable scale. Participants sent three to four videos per day, and video recordings were reviewed asynchronously on the Everwell web platform. The energy and macronutrient intakes were calculated using the Philippine food composition table.[21] For processed food items, nutrient information was obtained from package labels. The average daily intake of each macronutrient was compared to the mean of the required daily intake: 55% carbohydrates, 27.5% fat, and 22.5% protein.[22]

Videos in the SureAdhere application were automatically encrypted and transferred to the Everwell platform, where they were compiled and securely stored along with participant metadata. Data storage and security were managed through Microsoft Azure's cloud infrastructure, providing encryption and ongoing risk management. Once videos are uploaded, they are automatically deleted in the participants' phones.

To test the feasibility of NACS in outpatient TB clinics, a subset of 30 participants, distinct from the other groups, were identified. HCWs received training on nutritional assessment, counselling, and support per the WHO's 2013 guidelines.[8] HCW adherence was measured using a standardised checklist covering all essential NACS steps (anthropometric measurements, routine laboratory tests, medical history, dietary evaluation, referral to nutritionists, and distribution of nutritional support). For nutritional support, vendors near clinics provided food packs (~1,200 kcal, 56 g protein) for 2 weeks based on the RATIONS intervention trial.[10] Clinic nurses distributed QR-coded food vouchers linked to participant details (name, address, and ID number). Upon arrival at the store, vendors scanned the codes, triggering SMS notifications to clinic nurses. Nurses marked the checklist as 'completed' once all tasks were finished for each participant, and adherence was calculated as the percentage of fully completed checklists. NACS completion was defined as completed delivery of all six structured components.

In assessing the nutritional status of patients with TB, we calculated a target sample size of at least 141 participants based on a 10.2% malnutrition rate in the Philippines, a 95% confidence level, and 5% significance level. The two subsets were each set at $n = 30$, based on the central limit theorem, which suggests that sample means approximate normality with a sample size of 30 or more, regardless of population's distribution. Statistical analyses included frequencies, percentages, and means (± std. dev.), stratified by SGA score, to assess nutritional status and NACS feasibility. ANOVA and paired *t* tests were used to evaluate dietary intake. Analyses were conducted with SPSS ver 26.0, with P values < 0.05 considered significant. This study was reviewed and approved by the Makati Medical Center Institutional Review Board. All participants gave informed consent for participation in the study.

RESULTS

We enrolled 141 patients with active TB over 6 months. Sixty-nine percent were males with an average age of 44.1 ± 15.8 years. Majority of patients (41%) were enrolled from clinics around our base site in Dasmarinas City. The mean SGA score for all patients was 4.96 ± 0.97 (Table 1), with 85% classified

Table 1. Demographics and SGA score of patients with TB assessed for nutrition status in the Philippines, October 2022 to April 2023 (N = 141).

	Overall, n (%)	Well-nourished, n (%)	Mild/moderately malnourished, n (%)	Severely malnourished, n (%)
All subjects	141 (100%)	17 (12%)	120 (85%)	4 (3%)
SGA score[A]	4.96 ± 0.87	6.31 ± 0.28	4.84 ± 0.67	2.78 ± 0.12
Age[B]	44 ± 15.6	39 ± 15.66	44 ± 15.63	52 ± 16.63
Male sex	97 (69)	14 (14)	82 (85)	1 (1)
Bacoor City	8 (6%)	0	7 (88%)	1 (13%)
Dasmarinas City	58 (41%)	6 (10%)	52 (90%)	0
General Mariano Alvarez	54 (38%)	10 (19%)	43 (80%)	1 (2%)
Imus	6 (4%)	0	5 (83%)	1 (17%)
Tagaytay City	5 (4%)	1 (20%)	4 (80%)	0
Trece Martires City	10 (7%)	0	9 (90%)	1 (10%)

SGA = Subjective Global Assessment.
[A]Data are presented as mean ± sd. [B]Data are presented as median ± sd.

as mildly/moderately malnourished, 3% as severely malnourished, and 12% as well-nourished.

The average intake of macronutrients showed significant differences ($P < 0.001$) (Table 2). Carbohydrate intake (1,978 ± 59.99 kcal, 134% of the requirement) significantly exceeded the required daily intake (1,480 kcal). Protein intake (337 kcal ± 25.72, 56% of the requirement) and fat intake (376 kcal ± 45.42, 51% of the requirement) were both significantly below the required daily intake of 605 kcal and 740 kcal, respectively (both $P < 0.001$). Carbohydrate intake exceeded requirements across all nutritional status groups: 1,994 kcal (135%) in the well-nourished, 2,011 kcal (136%) in the mildly/moderately malnourished, and 1,703 kcal (115%) in the severely malnourished. Protein intake remained below requirements across all groups, with the well-nourished and mildly/moderately malnourished consuming 342 kcal (57%) and 345 kcal (57%), respectively, and the severely malnourished consumed 264 kcal (44%). Fat intake was also below requirements, with the severely malnourished consuming the highest proportion (458 kcal, 62%), followed by the mildly/moderately malnourished (371 kcal, 50%) and well-nourished (342 kcal, 46%). Despite these differences, carbohydrate ($P = 0.83$), protein ($P = 0.49$), and fat ($P = 0.68$) did not significantly differ across groups. Lastly, all participants (100%) completed the NACS intervention. HCWs demonstrated 100% adherence to the NACS checklist completion rate.

DISCUSSION

In a high-TB-incidence area of the Philippines, 88% of newly diagnosed TB patients in semi-urban clinics were malnourished. SGA scores showed that 85% had mild to moderate malnutrition and 3% were severely malnourished. Fat and protein intake was below recommended levels, while carbohydrate intake was excessive. SGA tool assessed weight change, eating capacity, symptoms, living ability, disease risks, and malnutrition factors. Similar studies in Vietnam and Taiwan reported lower malnutrition rates among patients with TB at 58% and 81%, respectively.[23,24]

The analysis of daily nutritional intake highlighted an imbalance among patients with TB in the Philippines, with excessive carbohydrate consumption and insufficient protein and fat intake. This aligns with national dietary trends, as rice is the staple source of carbohydrates in a regular Filipino meal. A 2023 Pulse Asia survey found that 83% of families prioritised rice over other food,[25] and the National Nutrition Survey in 2023 showed that 95% of Filipinos consume four cups of rice daily. A 2013 Food and Nutrition Research Institute (FNRI) survey showed that 69% of Filipinos failed to meet dietary energy requirements, with an average daily intake of 855 g, mainly rice, fish, and vegetables.[14] Both the 2018 Expanded National Nutrition Survey and the NACS Study confirmed carbohydrate overconsumption above the recommended 55% of total calories, with NACS reporting 1,978 kcal and the National Survey 288 g (1,152 kcal).

Table 2. Observed daily nutritional intake of carbohydrates, protein, and fat compared to required daily intake levels for patients with TB in the Philippines, October 2022 to April 2023 (n = 30).

					Nutritional status						
					Well-nourished, n = 4		Mildly/mod mal., n = 23		Severely mal., n = 3		
	Ave. daily intake Mean (%)	Req. daily intake Mean (%)	SE	*P* value	Mean (%)	SE	Mean (%)	SE	Mean (%)	SE	*P* value
Carbohydrates intake (kcal)	1,978 (134%)	1,480 (100%)	59.99	<0.001	1,994 (135%)	334.16	2,011 (136%)	174.03	1,703 (115%)	400.93	0.826
Protein intake (kcal)	337 (56%)	605 (100%)	25.72	<0.001	342 (57%)	34.37	345 (57%)	22.42	264 (44%)	98.77	0.492
Fat intake (kcal)[A]	376 (51%)	740 (100%)	45.42	<0.001	342 (46%)	64.35	371 (50%)	38.14	458 (62%)	341.42	0.678

Values are expressed as mean ± SE.
[A]Kruskal–Wallis *H* test.

Protein and fat intake were insufficient in both studies, though NACS Study reported higher levels (337 kcal protein, 376 kcal fat) than the National Survey (55 g/220 kcal protein, 29 g/261 kcal fat) nutritional assessments and nutrient intake in routine programmes. These findings highlight a persistent trend of carbohydrate-heavy diets with inadequate protein and fat consumption, more pronounced in the National Survey.[26]

Our data show that the diet of patients with TB in the Philippines consists of energy-dense but nutrient-poor diets. Protein deficiency impairs cell-mediated immunity, the critical host defence against TB,[27] while malnutrition-related hypoalbuminaemia and anaemia further impair host responses. Our findings are consistent with earlier studies of the baseline nutritional status of patients with TB in China.[28–32] Insufficient fat intake, particularly among the well-nourished and mildly/moderately malnourished participants, further highlights the need for balanced dietary interventions, as fats are essential for energy balance and the fat-soluble vitamin absorption. The 100% completion rate for the NACS survey and food pack distribution confirms the feasibility of implementing nutritional support in Philippine health care settings.

Our study is the first to evaluate the nutritional status and nutrient intake of patients with TB in the Philippines and to pilot the feasibility of food support delivery through food packs in outpatient TB clinics. We used innovative tools, such as the SureAdhere video app and measuring instruments, to accurately document meal composition and reduce recall bias.

Based on our findings, we recommend that the Philippine National TB Program integrate routine nutritional assessment and support into TB care pathways. Using standardised checklists as part of routine TB workflows, supported by occasional supervisory reviews, short refresher trainings, and simple digital tracking, can help keep nutritional assessment and support consistent across clinics. The feasibility of delivering nutritional support through local vendors and HCWs – demonstrated by the 100% completion rate in our study – highlights the potential scalable, clinic-based NACS implementation. Despite the small sample size, our findings on nutrient intake and dietary composition align with recent FNRI surveys on Filipino dietary patterns.[26,33]

However, our study has limitations. It was conducted in a large semi-urban province, limiting the generalisability to rural areas. The study solely focused on adults, so the nutritional status of children and adolescents with TB may differ. Key factors such as income level, education, and food availability, which could influence disparities in nutritional status, were not captured. Small sample sizes also restricted comparisons between subgroups according to nutritional status. Additionally, the lack of treatment outcome data limits our ability to assess the impact of malnutrition on TB treatment outcomes.

Ethical statement

This study was reviewed and approved by the Makati Medical Center Institutional Review Board, and all procedures were conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants.

CONCLUSION

Our study highlights the high prevalence of undernutrition and poor protein and fat intake among adults with TB in the Philippines. We demonstrated the feasibility of implementing nutritional assessment, counselling, and food support in outpatient TB clinics using structured protocols and local vendor partnerships. These findings provide evidence to support the integration of nutrition-focused strategies into the National TB Program.

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Conflicts of interest: none declared.

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