

**THE EFFECT OF NUTRITIONAL MANAGEMENT IN THE NUTRITIONAL STATUS OF PATIENTS WITH PULMONARY TUBERCULOSIS: A SYSTEMATIC REVIEW LITERATURE****Adi Brando M Sagala*, Etty Rekawati, Astuti Yuni Nursasi**

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*adibrando80@gmail.com**ABSTRACT**

Pulmonary Tuberculosis (TB) incidence and mortality rates in 2021 are higher than in 2020. The main risk factor for TB is malnutrition. Conversely, TB patients with malnutrition will experience obstacles in the healing process. The aim of this study was to review the results of research on the effect of nutritional management on the nutritional status of clients. The study design was a systematic literature review with PRISMA protocol. The literature search was limited to the last 10 years (2013-2023) in six databases, namely: Pubmed, Proquest, Science Direct, Scopus, Sage Journal, Wiley, and supplemented with hand searched in Google Scholar. All literature obtained has been reviewed for quality by each researcher using the Joanna Bridge Institute checklist for critical appraisal, then summarizing evidence, and interpreting the results. The initial search obtained 2688 literatures. The final result was seven literatures in this study. The results of these studies show that nutritional management has a positive effect on the nutritional status of TB patients. The types of nutrition management activities are individual diet, provision of high-calorie and high-protein supplementary foods, nutrition counseling, and supplementation. It was concluded that the intervention of individualized diet preparation had a statistically significant effect on improving nutritional status.

Keywords: dietary recommendations; nutrition management; nutrition status; tuberculosis

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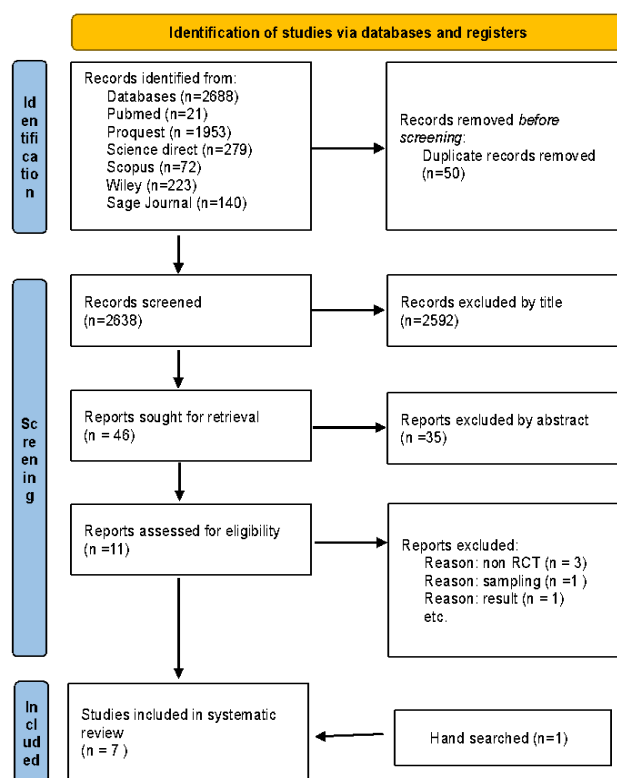
INTRODUCTION

Pulmonary Tuberculosis (TB) patients are estimated to reach 10.6 million people worldwide in 2021. The TB incidence rate increased by 3.6% and the death rate by 1.6 million people compared to 2020. About 45% of TB cases are in the Asian region (WHO, 2022). TB as a public health problem is mostly experienced by vulnerable groups. A study by Költringer et al. (2023) of 116 countries showed that TB incidence rates remain high in countries with low human development indices. This condition is exacerbated by poor access to and quality of health services (Ponnampalli & Birudukota, 2023). One of the risk factors for TB is nutritional status. Malnutrition is a major risk factor for TB disease (WHO, 2022). The risk of developing TB is twice as high in people with a Body Mass Index < 18.5 (Cho et al., 2022) and almost four times as high in people with anemia (Gelaw et al., 2021). Malnutrition and TB influence each other. About half of people with TB suffer from malnutrition (Seid & Ayele, 2020; Wondmienieh et al., 2021). Malnutrition in TB patients is caused by the disease process, drug side effects, social, and economic reactions. It affects the healing process, lung damage, risk of TB complications in other organs, increased transmission, and increased risk of death (Hoyt ID et al., 2019; Niu et al., 2023; Seid & Ayele, 2020).

The World Health Organization implemented nutrition management strategies in the 2030 Tuberculosis End Strategy, including nutrition assessment, counseling, management of acute malnutrition, management of moderate malnutrition, micronutrient supplementation, and contact investigation. Nutritional management is an intervention that can be performed by nurses and is part of the skill intervention. Nurses provide and improve balanced nutritional intakes with activities including: determining nutritional status & needs; identifying preferred foods and allergies; developing dietary recommendations; encouraging family involvement; monitoring weight (Bulechek RN FAAN, 2013). A systematic review of previous literature suggests that oral nutritional support is safe to administer and well tolerated without systemic reactions and has an effect on TB recovery (Grobler et al., 2016; Si et al., 2015). However, previous intervention studies have shown inconsistent results on nutritional status indicators and there are no standardized guidelines for nutritional management interventions. Therefore, the aim of this systematic literature review is to examine the results of research on the effect of nutritional management on the nutritional status of TB clients.

METHOD

The research design was a systematic review of the literature with the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) protocol as depicted in scheme 1 (Page et al., 2021). Researchers conducted the search after applying the research questions with the PICO method (Population/patient, Intervention, Comparison, Outcome). The study population was TB patients who received nutritional management interventions such as: education, counseling, dietary management, and supplementation. The results of the intervention were expressed by indicators of nutritional status. The literature search was limited to the last 10 years (2013-2023) in six databases: Pubmed, Proquest, Science Direct, Scopus, Wiley, and Sage Journal, and added hand searched in Google Scholar. The researcher used the keywords: tuberculosis, recommended dietary, supplement, nutritional status, and recommended dietary. Boolean operators, AND and OR, were used to maximize literature search results.



Scheme 1. PRISMA

Inclusion criteria were: TB patients of all ages; currently following a treatment program; randomized controlled trial (RCT) or quasi-experiment research design; full text literature; English language. Exclusion criteria were: Loss to Follow Up and parenteral nutrition. The quality of the literature was assessed by each researcher. Risk of bias was assessed using the JBI Critical Appraisal for Randomized Controlled Trial (Barker et al., 2023).

RESULTS

The literature obtained from the first search was 2688. All literature was then processed using Endnote X9. The same literature was read one by one and then selected to be removed. After 50 duplicate literatures were removed, the researchers screened the literature until 11 literatures were eligible for full text reading. A total of 6 literatures were excluded due to the risk of bias. Then the researcher added 1 literature through hand searched searches. The final result was 7 systematically reviewed literatures. Information from the seven literatures was then processed into an information extraction table (table 1) which included author data, year, location, design, sample, intervention, results, and conclusions.

Table 1.
7 systematically reviewed literatures

No	Author	Year	Location	Title	Design	Respondent	Intervention	Result	Conclusion
1	Liyun He . Guoming Zhang . Meng Wei . Yanjun Zhao . Weixing Chen . Qiaojun Peng . Guiyun Meng	2019	Xinjiang, China	<i>Effect of Individualized Dietary Intervention on Oxidative Stress in Patients with Type 2 Diabetes Complicated by Tuberculosis in Xinjiang, China</i>	RCT	Patients with Type 2 Diabetes Mellitus (T2DM) complicated by Pulmonary Tuberculosis. The total sample of 164 people was divided into control group (n = 82) and intervention group (n = 82).	- Intervention period 3 months - Health education on T2DM and TBP 1x/week - Individualized dietary recommendations: Standard T2DM diet with adjustments to blood sugar monitoring results. TBP dietary recommendations with 10% more total calories than T2DM dietary guidelines; carbohydrates 55-65% & fat 20-25% of total calories; vegetables 300-500 g/day; fruit 100-200 g/day; calcium >800	- Significant increase in albumin, haemoglobin, total lymphocyte count, BMI (Body Mass Index), superoxide dismutase levels (p<0.05) - Significant decrease in fasting blood sugar levels, blood sugar levels 2 hours after fasting, and HbA1C (p<0.05) - The proportion of sputum positive in the intervention group was lower than the control group.	Combination of educational interventions and individual dietary recommendations improves nutritional status and oxidative stress in patients with T2DM-TB

No	Author	Year	Location	Title	Design	Respondent	Intervention	Result	Conclusion
2	Ajay Kumar Singh, Ankita Siddhanta, Latashree Goswami	2020	India	<i>Improving tuberculosis treatment success rate through nutrition supplementation and counselling: Findings from a pilot intervention in India</i>	Quasi Experiment al	Patients with active TB aged > 15 years. Total sample size of 519 people divided into intervention group (n=282) and control group (n=237).	mg/day. - Intervention period 6 months - Monthly feeding of cereal with carbohydrate content of 1089 calories and protein content of 41 g/day - Nutrition counseling	- Weight gain in the intervention group was 6-10 kg at the end of the 6th month. While in the control group the maximum was 4 kg. - There was a significant difference in weight gain. - Almost 90% of respondents in the control group experienced an increase in body weight of 10%. While 55% of control group respondents experienced an increase of 4-8%. - The TB treatment success rate in the intervention group was 95%, compared to 83.5% in the control group.	Regular supplementation and nutrition counseling improves body mass index and TB treatment success rate
3	Isa Ma'rufi, Khaidar Ali, Sigit Kusuma Jati, Anik Sukmawati, Kurnia Ardiansyah, dan Farida Wahyu	2019	Indonesia	<i>Improvement of Nutritional Status among Tuberculosis Patients by Channa striata</i>	RCT pre-post test	Patients with active TB who have recently started standardized treatment. The 200	- Intervention period 1 month - Channa striata extract supplementation. The	- Increased BMI in both groups. - The change in BMI in the	Channa striata extract increased BMI faster. Intervention group

No	Author	Year	Location	Title	Design	Respondent	Intervention	Result	Conclusion
	Ningtyias			<i>Supplementat ion: A True Experimental Study in Indonesia</i>		respondents were divided into intervention (n=103) and control (n=97) groups. Exclusion criteria: MDR- TB, HIV/AIDS, DM, and loss to follow up.	supplement consisted of: 90% Channa striata extract; the remaining 10% consisted of 12.5% albumin and 6.6% bioflavono ids. - Supplement s were given 3x/day	interventi on group was faster than the control group. - There was no significan t difference in BMI between the two groups (p<0.05). - There were fewer complai nts of nausea in the interventi on group (p<0.05).	respondents reported fewer complaints of nausea.
4	Uyanga Batbold, Dmytro O Butov, Galyna A Kutsyna, Narantsetseg Damdinpurev, Elena A Grinishina, Otgonbayar Mijiddorj, Mikola E Kovolev, Khaliunaa Baasanjav, Tatyana S Butova, Munkhburam Sandagdorj, Ochirbat Batbold, Ariungerel Tseveendorj, Erkhemtsetseg Chunt, Svetlana I Zaitzeva, Hanna L Stepanenko, Natalia I Makeeva, Igor V Mospan, Volodymyr S Pylypchuk, John L Rowe, Peter Nyasulu, Vichai Jirathitikal, Allen I Bain14, Marina G Tarakanovskaya & Aldar S Bourinbaiar	2016	Mongolia and Ukraina	<i>Double- blind, placebo- controlled, 1:1 randomized Phase III clinical trial of Immunoxel honey lozenges as an adjunct immunothera py in 269 patients with pulmonary</i>	RCT	TB patients categorized as DS-TB, MDR- TB, XDR-TB and TB-HIV. Total 269 respondents were divided into intervention group (n=137) and control group (n=132).	- Intervention for 1 month - The intervention group received Immunoxel sublingual supplement 1x/day. Imm unoxel is a formula of honey and immunomo dulatory herbs. - The intervention group received Immunoxel sublingual supplement 1x/day. Immunoxel contains honey and immunomo dulatory herbs. - Control group received placebo	- Interventi on group responde nts showed higher sputum negative results (65.9%) than the control group (25.2%.) after 1 month of interventi on. - The control group gained more weight (mean 2 kg) than the placebo group (mean 0.6 kg). - Decrease d TB inflamm ation indicators in the interventi on group - Decrease in TB	Immunoxel supplements are affordable, safe, effective, fast-acting, and commercial ly available to complement TB therapy.

No	Author	Year	Location	Title	Design	Respondent	Intervention	Result	Conclusion
								treatment side effect reactions in the intervention group	
5	Rakesh Lodha, Aparna Mukherjee, Varinder Singh, Sarman Singh, Henrik Friis, Daniel Faurholt-Jepsen, Shinjini Bhatnagar, Savita Saini, Sushil K Kabra, Harleen MS Grewal, and the Delhi Pediatric TB Study Group	2014	India	<i>Effect of micronutrient supplementation on treatment outcomes in children with intrathoracic tuberculosis: A randomized controlled trial</i>	RCT	Children aged 6 months to 15 years (n=403)	- Intervention for 1 month - Supplementation in syrup form containing one of 3 ingredients: zinc; micronutrients & zinc; micronutrients without zinc.	- The intervention group experienced faster height growth than the control group - There was no significant difference between the intervention group taking the supplement versus the placebo group	Micronutrient supplementation had no effect on increasing body weight and lung clearance based on X-ray examination. Possibility of micronutrients affecting height gain in children.
6	Nurpudji Astuti Taslim, Haerani Rasyid, Mellyana Kusuma Atmanegara, Sigit Angriawan, Rezky Amelia	2020	Indonesia	<i>Effect of chocolate soybean drink on nutritional status, gamma interferon, vitamin D, and calcium in newly lung tuberculosis patients</i>	Quasi-experimental pre-post group	The 34 respondents were divided into intervention group (n=17) and control group (n=17).	- Intervention for 1 month - Giving chocolate soybean drink 100 grams/day and nutrition education. Nutritional content of chocolate soybean drink: 523 kcal energy and 40.71 grams protein. - The control group only received education	- Significant changes in the nutritional status of intervention group respondents, viz: weight, BMI, IFN levels but not significant increase in arm circumference. - Nutritional status in the control group improved compared to before the nutrition education intervention. - Improvement in appetite in both groups	Chocolate soybean drink can improve BMI, vitamin D, calcium levels, and IFN levels.

No	Author	Year	Location	Title	Design	Respondent	Intervention	Result	Conclusion
7	Noelle A. Benzekri, Jacques F. Sambou, Ibrahima Tito Tamba, Jean Philippe Diatta, Ibrahima Sall, Ousseynou Cisse, Makhtar Thiam, Gaetan Bassene, Ndeye Maguette Badji, Khadim Faye, Fatima Sall, Jean Jacques Malomar, Moussa Seydi, Geoffrey S. Gottlieb	2023	Senegal	<i>Nutrition support for HIV-TB co-infected adults in Senegal, West Africa: A randomized pilot implementation study</i>	<i>Cluster-Randomised Controlled Trial</i>	TB patients aged \geq years. The 26 respondents were divided into those receiving basket meals (n=14) and those receiving Ready-to-Use Therapeutic Food (n=12).	Food with a calorie content of 1200 kcal and 52 grams of protein per day and micronutrient supplements.	- Weight gain of 4-6 kg in 54.8% of patients - Weight gain at month 2 after intervention was about 5% of baseline. - Reduction in mortality associated with increased weight at month 2 of intervention.	Nutritional support is needed for TB patients in areas with a high prevalence of malnutrition.

All literature used an interventional research design (RCT/quasi-experiment) with a control group or without a control group. Studies were conducted in India (n=2), Indonesia (n=2), China (n=1), Mongolia & Ukraine (n=1), Senegal (n=1). The study sample was 34-2800 people and aged >6 months. Interventions were conducted in hospital and community settings for 1-6 months; patients with drug-sensitive TB, MDR-TB, XDR-TB; TB-HIV complications and T2DM-TB. Nutritional status was assessed by BMI, arm circumference, and blood chemistry (Haemoglobin and albumin).

The supplementation intervention was obtained from 4 research literatures. Research by Batbold et al., (2017) with Immunoxel supplementation intervention for 1 month had a significant effect on changing sputum results to negative ($p < 0.0001$); a significant increase in BMI in the intervention group (20.21 ± 2.2 to 20.77 ± 2.3 ; $p = 0.04$) compared to the control group (20.06 ± 2.2 to 20.13 ± 3 ; $p = 0.92$); a significant increase in Haemoglobin (Hb) in the intervention group (20.21 ± 2.2 to 20.77 ± 2.3 ; $p = 0.04$) compared to the control group (20.06 ± 2.2 to 20.13 ± 3 ; $p = 0.92$). The results of this study are supported by research by Benzekri et al., (2019) that micronutrient supplementation affects the increase in Hb levels from 10.2 to 12.8; median body weight increased by 5 kg; median BMI increased from 17, to 19.3. The increase in BMI also occurred after giving Channa Striata extract for 1 month in a study by Ma'Rufi et al., (2020). Different results in the study of Zinc micronutrient supplementation by Lodha et al., (2014). There was no significant difference in weight-for-age z-score at month 6 in the intervention group [0.76 (0.67, 0.85); 95% CI] compared to the control group [0.76 (0.68, 0.85); 95% CI]. There are 2 research literatures on supplement intervention and nutrition counseling. Providing cereal food with a carbohydrate content of 1089 calories and protein 41 g / day and nutritional counseling 1x / month for 6 months by Singh et al., (2021). The results showed an increase in body weight and BMI in both groups. Another study by Taslim et al., (2020) also stated the same results where there was a significant difference in weight gain in the intervention group. Finally, the individualized dietary recommendation intervention in a study by He et al., (2019) also showed improvements in nutritional status

indicators and BMI ($p < 0.05$).

DISCUSSION

A review of the literature shows that nutrition management has a positive effect on nutritional status indicators. However, the results of all studies were inconsistent. The types of interventions in the research literature were: supplementation, nutrition counseling, individual diet preparation, and combination of supplementation with nutrition counseling. Micronutrient and macronutrient supplementation interventions showed different BMI outcomes. Four studies described 1 month of supplementation. The proportion of weight gain was greatest in Immunoxel supplementation (Batbold et al., 2017). While other studies reported no significant difference between intervention and control groups (Lodha et al., 2014; Ma'Rufi et al., 2020) and only 54.8% of respondents experienced increase in body weight (Benzekri et al., 2019). The difference in research results is due to differences in the composition of nutrients in supplements and the influence of anti-tuberculosis drugs on the recovery process. This condition is supported by research by Lolong et al., (2023) which found that most TB patients reported a reduction in physical complaints during the treatment process. This result is consistent with a study by Tadesse et al., (2023) that intensive phase TB treatment is associated with undernutrition status. Other supporting evidence is a decrease in inflammatory indicators in the intervention group in the first month of treatment (Batbold et al., 2017). Demographic characteristics of research respondents also affect differences in BMI results. The age of respondents in the study by Lodha et al., (2014) was in the range of 6 months -15 years. While other research respondents were aged > 18 years. This condition can be caused by faster growth patterns of height and weight in children until puberty. Other studies have shown that relative body weight in infancy, childhood and adolescence is associated with body composition in adulthood (Poveda et al., 2023). Thus, the increase in body weight in the study by Bhargava et al., (2023) of only 5% in month may be due to the area where respondents live in severe food insecurity. These results are in line with research by which the high undernutrition status of TB patients in developing countries is described (Dargie et al., 2016).

The combined intervention of nutritional counseling and supplements in two studies showed significant weight differences in the intervention group (Singh et al., 2021; Taslim et al., 2020). The additional amount of calories provided was 523-1089 kcal and protein ± 40 g / day. Both studies showed the same significant changes in BMI even though there were differences in the intervention periods of 1 and 6 months. The control group in the study also showed an increase in body weight after one month (Taslim et al., 2020). This positive change was because the control group also received nutrition counseling for one month. Research by (Afifi et al., (2023) also supports this condition. The results showed that nutrition counseling for clients with Multiple Sclerosis for 3 months can improve diet, nutrient intake, and BMI. Nutrition counseling is defined as the process of providing information and advice on improving nutrition. In the initial stage of counseling, a thorough assessment is conducted to obtain information about the condition of nutritional status, nutritional needs, and obstacles to fulfillment. Often, the fulfillment of these needs is caused by the client's psychosocial conditions, such as: motivation, lack of information, physical complaints due to illness, and limited information (Koshimoto et al., 2023). Thus, counseling increases nutritional intake by involving patients to choose foods that are preferred and according to the needs of the TB treatment period. An increase in the appetite for nutritional counseling was also shown in a study by (Taslim et al., 2020). These results are also supported by a systematic review of the literature on cancer patients which states that nutritional counseling can improve food intake, BMI, quality of life, and treatment tolerance (Leis et al., 2023).

Only 1 study conducted an individualized diet preparation intervention. Research by He et al., (2019) showed that individualized dietary recommendations for 3 months had a significant effect on improving nutritional indicators. Although the respondents of this study also had metabolic disorders of Type 2 Diabetes Mellitus (T2DM), the addition of calories > 10% can still maintain normal blood sugar levels, fasting blood sugar, and 2-hour blood sugar. The addition of calories is done gradually according to the results of blood sugar measurements. Thus, dietary recommendations do not change the HbA1C target as a golden standard (Wei et al., 2014). However, this study has not presented data on the influence of other factors such as activity, stress levels, and T2DM treatment. The results of this study can still be criticized considering that some TB patients experience an increase in blood sugar while taking TB drugs (Williams et al., 2022). Individual dietary recommendations can also improve healthy eating patterns. Healthy eating behavior begins with providing education about a healthy diet. Furthermore, individuals can choose and determine the type and amount of food consumed. Research by Liu et al., (2024) on the utilization of mobile phone applications in providing healthy menu choices shows an influence on daily food consumption. Furthermore, this education will also improve eating patterns, knowledge of nutrition, and BMI (Koshimoto et al., 2023).

Limitations of this literature review: the risk of bias from one study with a sample size of only 26 people with purposive sampling technique. In addition, there were differences in the level of malnutrition of respondents before the intervention.

CONCLUSION

A systematic review of the literature shows that nutrition management has a positive effect on the nutritional status of TB patients. The intervention of individualized dietary recommendations has a statistically significant effect on nutritional status indicators. Other interventions such as oral supplements, high-calorie and high-protein foods, and counseling can be provided as support. Further research is needed on the effectiveness of these supporting interventions with an RCT research design. Individualized diet planning as a key nursing intervention to improve the nutritional status of patients with TB.

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