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Benefits of Giving Egg White Extract and Moringa Leaves to Improve The Nutritional and Immune Status of TB Patients. A Scoping Review

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ABSTRACT

TB is still a major global health concern, especially in developing nations like Indonesia, which has the third-highest rate of TB cases globally. Mycobacterium tuberculosis infection has a negative effect on the health of the patient as well as causing low serum albumin levels, poor nutritional status, and other blood abnormalities, all of which worsen the general health of those who are infected. Nutritional supplements, particularly egg white and milk containing moringa extract, have the potential to improve nutritional status and speed up TB patients' recuperation. The protein-rich egg white may raise albumin levels, while the nutrient-dense moringa boosts immunity. Furthermore, encouraging treatment adherence and halting the disease's spread require nutritional measures and family support. The purpose of this scoping review is to investigate the possible uses of egg.

Keywords: albumin, egg white extract milk, moringa leaves, nutritional status, tuberculosis

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BACKGROUND

Tuberculosis (TB) remains a significant global health challenge, particularly in developing countries such as Indonesia. Patients with TB not only face the burden of *Mycobacterium tuberculosis* infection but frequently encounter malnutrition, decreased serum albumin levels, and blood abnormalities, further exacerbating their overall condition. Deterioration in nutritional status can be attributed to various factors, including decreased appetite, heightened metabolic demands due to the infection, and the side effects associated with prolonged TB treatment. Therefore, nutritional interventions are critical for improving health outcomes and facilitating recovery in TB patients (Amaliyah, 2023).

According to a recent report from the World Health Organization (WHO), there were approximately 10.6 million reported cases of TB worldwide in 2022, with a mortality rate of 1.6 million. Indonesia ranks third in the global burden of TB, following India and China. In 2023, the Indonesian Ministry of Health documented around 845,000 active TB cases, representing approximately 3.2% of the national population. East Java, a densely populated province, accounted for about 95,000 TB cases in the same year, which constitutes 35% of the national total, thus positioning East Java among the provinces with the highest TB burden in Indonesia.

The factors contributing to the rise in TB cases in Indonesia, particularly in East Java, are multifaceted. The primary factor is the airborne transmission of *Mycobacterium tuberculosis*, especially in densely populated areas with inadequate sanitation. Additionally, high rates of malnutrition, limited access to healthcare services, and non-compliance with TB treatment significantly exacerbate the situation. Individuals from lower socioeconomic backgrounds are particularly vulnerable to TB, as nutritional deficiencies can impair immune function. Furthermore, the emergence of multidrug-resistant TB (MDR-TB) poses additional challenges to effective treatment (Suryaningrum, 2012).

If left untreated, TB can have severe implications for both individual health and socio-economic conditions. The most prominent health impact is the deterioration of nutritional status, resulting from metabolic disruption and decreased nutrient intake. Low serum albumin levels are indicative of protein malnutrition and may impede the healing process. Additionally, blood abnormalities, such as anemia, are common among TB patients, reducing their ability to combat infections. Socially, TB patients often face stigma, leading to isolation, while economically, they suffer from lost productivity due to extended treatment durations (Kiki, 2018).

One potential strategy to enhance the nutritional and health status of TB patients is the implementation of supplementary nutritional interventions, such as egg white extract and Moringa oleifera leaves. The high protein content of egg white may help elevate albumin levels, while Moringa leaves, rich in vitamins, minerals, and antioxidants, can bolster immune recovery. Furthermore, improving dietary balance and closely monitoring TB treatment are essential to mitigate the risk of malnutrition. Empowering families and communities to support TB patients in adhering to treatment and maintaining nutritional intake is also crucial for promoting recovery and preventing further transmission (Setiawan, 2022).

This scoping review aims to explore the administration of egg white and Moringa leaf extract milk, highlighting the prioritization, components utilized, and the development of this treatment approach.

METHODS

The methodology employed in this scoping review follows the framework proposed by Arksey and O'Malley (2005), which consists of five stages. This approach aligns with the recommendations of Levac et al. (2010) for the synthesis and analysis of relevant literature

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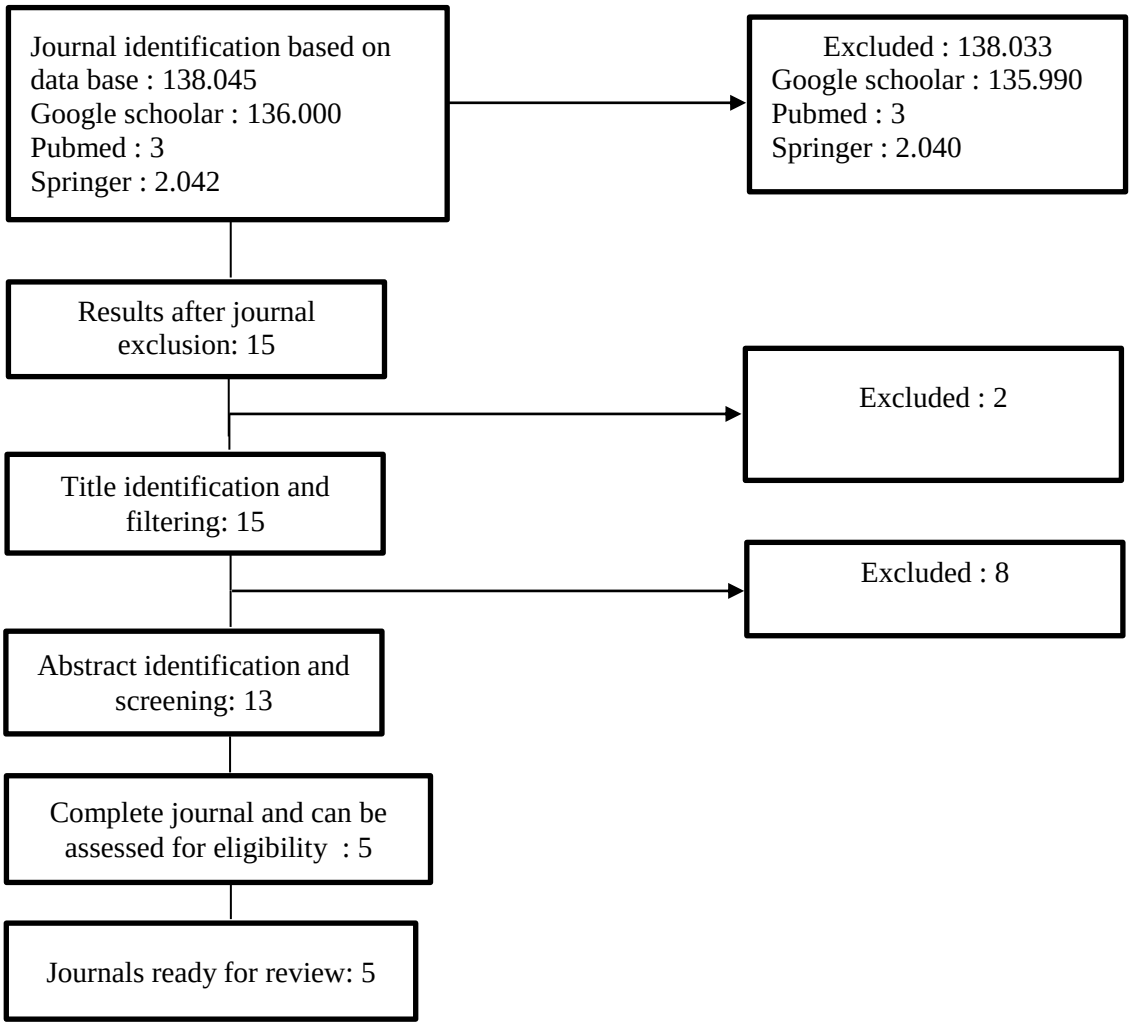
(Levac, D., Colquhoun, H., & O'Brien, 2010). The five stages of the Arksey and O'Malley framework are as follows: (1) identifying research questions; (2) identifying relevant studies; (3) selecting studies; (4) mapping data; and (5) compiling, summarizing, and reporting results. This research adheres to the aforementioned framework, and the methodology is further detailed in accordance with the PRISMA guidelines (Page et al., 2021). The subsequent sections will elaborate on each of the first five steps of the Arksey and O'Malley framework.

Figure 1. Chart PRISMA



Identification of Research Statements

The objective of this scoping review is to synthesize information regarding the prioritization of using egg white extract and moringa leaf extract. The research questions addressed in this review are as follows:

1. What nutritional components can be derived from egg white and moringa leaves?
2. How do these components influence the improvement of nutritional status and albumin levels?
3. What is their effect on immune function?

Identification of Relevant Studies

In this step, a comprehensive search for relevant studies was conducted using specific keywords: "tuberculosis," "egg white extract," "moringa leaves," and "nutritional status." This

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search was performed across multiple databases, including Google Scholar, PubMed, and Springer. Initially, the search focused on studies published in the last five years, followed by an exploration of literature from the previous ten years to ensure a thorough review of relevant research.

Study selection

Exclusion criteria were applied to papers that had at least one of the following indications: 1) published in a language other than English; 2) publications unrelated to the research, such as correspondence, comments, opinions, book reviews, conference abstracts, secondary data analysis, tutorials, concept analyses, or regulatory documents; and and 3). did not focus on egg white extract and moringa

Creating Data Charts

In this stage, create data charts arranged in two tables, namely a study characteristics table grouped by title, author name, year, design, objectives, number of samples and research location.

In addition, it also collects specific data to answer problem questions.

Collecting, Summarizing, and Reporting Results

At this stage, identify, analyze and narrate the problems that will be discussed.

RESULTS

Table 1. Study Characteristics

No.	Title	Author(s) and Year	Research Design	Research Objective	Sample Size	Study Location
1.	Micronutrients in Moringa oleifera and Its Potential for Food Fortification	Yee Kei Kiki Chan, 2018	Comparatif	This study aims to analyze the micronutrient content of Moringa oleifera and evaluate its potential as a food fortification ingredient. It will compare Moringa's micronutrient levels with other foods and explore its use in fortified products, such as broth cubes, to address micronutrient deficiencies and improve nutrition.	The study collected 50 samples of Moringa oleifera leaves and pods from five different locations, with ten samples from each site, to account for nutrient variability due to environmental factors.	The research locations for sample collection include: 1. Nigeria – Agricultural areas in tropical West Africa 2. India – Tamil Nadu, Southern India 3. Philippines – Luzon Province, Southeast Asia 4. Indonesia – East Nusa Tenggara, a Moringa-producing region 5. 5. Honduras – Rural areas in Central America
2.	Clinical Trial of Bee Pollen and Moringa Oleifera Leaves as Supportive Therapy for Liver Function Improvement and Nutritional Status in Pulmonary TB Patients	Marissa Matinahoru, 2022		This study aims to evaluate the effectiveness of bee pollen and Moringa oleifera leaves as supportive therapy for improving liver function and nutritional status in TB patients undergoing Anti-Tuberculosis Medication (OAT). It focuses on whether supplementation can reduce SGOT and SGPT levels	The study included 18 subjects who received Moringa leaf extract capsules (1.8 grams) and 20 subjects in the control group who received a placebo.	The study was conducted in Ambon City, involving outpatient pulmonary TB patients from several community health centers (Puskesmas), including: 1. Puskesmas Rijali 2. Puskesmas Air Besar 3. Puskesmas Waihaong 4. Puskesmas Air Salobar 5. Puskesmas Tawiri 6. Puskesmas Kilang 7. - Puskesmas Nania

				and improve hematological parameters (hemoglobin, erythrocytes, leukocytes, platelets) and Body Mass Index (BMI).		
3.	Effectiveness of Egg White Supplementation on Albumin Levels and IL-6 in Tuberculosis Patients with Hypoalbuminemia	Agus Prastowo, Wiryatun Lestariana, Siti Nurdjanah, Retno Sutomo, 2016	This study employs a single-blind randomized controlled trial design..	This research aims to assess the effectiveness of egg white therapy in increasing albumin levels and reducing IL-6 activation in tuberculosis (TB) patients with hypoalbuminemia.	The study involved 75 patients, with 37 in the treatment group and 38 in the control group.	The research was conducted in a hospital, though the name of the hospital is not specified in the abstract. Detailed location information is usually available in the full study.
4.	Immunonutrition and Hepatoprotective Aspects of Nanoemulsion Moringa Oleifera Syrup as an Adjuvant for Tuberculosis Treatment in Children	Nyoman Budhi Wirananda Setiawan, Agus Indra Yudhistira Diva Putra, Made Indira Dianti Sanjiwani, Agung Wiwiek Indrayani, Ida Ayu Ika Wahyuniari, 2022	Lterator review	This research aims to evaluate the immunonutrition and hepatoprotective effects of Moringa oleifera nanoemulsion syrup in children with tuberculosis. It also seeks to assess its potential as an adjuvant therapy by enhancing immune system activation and reducing the toxic side effects of tuberculosis medications.	This study is a literature review that does not involve direct sampling of human or animal subjects. It compiles data from various relevant scientific articles, selected based on keywords such as "immunonutrition," "tuberculosis in children," "hepatoprotectant," and "Moringa oleifera."	The research was conducted virtually by accessing articles from various online scientific databases. Due to its literature review methodology, no specific physical location was designated for the execution of the study.
5.	Nutritional Benefits and Functions of Moringa oleifera	Salma Sultana, 2020	This study utilizes a quasi-experimental design, (stability (FS).	This research aims to evaluate the nutritional composition and functional properties of dried Moringa oleifera leaves collected from two ecological zones in Bangladesh. Additionally, it seeks to assess the potential of Moringa oleifera leaves as a source of beneficial phytonutrients for human and animal diets.	The sample consisted of Moringa oleifera leaves collected from two different locations. Although a specific number of tested leaves is not mentioned, studies of this nature typically involve collecting 20-30 samples from each site for representative analysis.	The research was conducted in Joypurhat and Mymensingh, two distinct ecological zones in Bangladesh, where the Moringa oleifera leaf samples were collected.

Table 2. Specific Study Data

No.	Article Title	Nutritional Content of Egg White Extract and	Impact on Nutritional Status	Impact on Albumin Levels	Impact on Immunity

		Moringa Oleifera			
1.	Micronutrients in Moringa Oleifera and Its Potential in Food Fortification, Yee Kei Kiki Chan, 2018	1. Moringa oleifera is often recommended for its high micronutrient content compared to other vegetables. 2. A bench-scale cold extrusion process was conducted to explore the feasibility of producing Moringa-enriched bouillon cubes. Nutritional characterization indicated that additional fortifiers are necessary to enhance the nutritional value and stability of these cubes. The flavor of Moringa can be adjusted depending on its application. 3. Several studies have confirmed that Moringa contains sufficiently high levels of micronutrients. 4. Moringa is primarily recognized in the literature as a vegetable rich in protein and iron. 5. This project analyzed proximate composition, mineral content, vitamin content, and protein quality to provide a comprehensive overview of Moringa's nutritional content. Proximate analysis determined the amounts of moisture, crude protein, crude lipid, crude fiber, ash, and carbohydrates in Moringa leaves and whole pods, while crude protein and mineral content were assessed in the skin and flesh of Moringa pods. These values were compared with existing literature. Vitamin content and protein quality were not experimentally measured but evaluated from literature data. 6. Moringa leaves are a protein-rich food source high in lysine or methionine and contain significant levels of cysteine, which can complement essential amino acids. 7. While Moringa has various nutrients, its iron content is comparable	For this project, proximate composition, mineral content, vitamin content, and protein quality were analyzed to provide a comprehensive overview of Moringa's nutritional content. Proximate analysis determined the amounts of moisture, crude protein, crude lipid, crude fiber, ash, and carbohydrates in Moringa leaves and whole pods. Additionally, crude protein and mineral content were assessed in the skin and flesh of Moringa pods. The measured values were compared with existing literature. However, the vitamin content and protein quality of Moringa leaves and fruits were not experimentally measured for this thesis; instead, data from the literature were evaluated.	Moringa leaves are a protein-rich food source, particularly high in lysine, methionine, and cysteine, making them valuable for complementing essential amino acids.	1. Moringa contains various nutrients, with its iron content comparable to that of spinach, while its vitamin A content is lower than that of carrots on a dry basis. 2. One of the benefits of vitamin A is its role in strengthening the immune system by optimizing the production and function of white blood cells, which are essential for combating bacteria and pathogens that cause disease. 3. - Additionally, vitamin A can enhance digestive health, promoting optimal nutrient absorption in the body.

		to that of spinach, and its vitamin A content is lower than that of carrots on a dry basis. 8. Vitamin A offers additional benefits for the immune system, enhancing immune function by optimizing the production and function of white blood cells, which are crucial in combating bacteria and pathogens. 9. Furthermore, vitamin A supports digestive health by facilitating optimal nutrient absorption in the body.			
2.	Clinical Trial of Bee Pollen and Moringa Oleifera Leaves as Supportive Therapy for Improving Liver Function and Nutritional Status in Pulmonary Tuberculosis Patients. Marissa Matinahoru, 2022	1. Important Micronutrients in Bee Pollen and Moringa Leaves Micronutrients that contribute to liver function include vitamin E and B complex vitamins, along with essential nutrients for general nutrition, such as protein and iron. 2. Bioactive Compounds Both bee pollen and Moringa leaves contain antioxidant and anti-inflammatory compounds that may provide additional health benefits.	The administration of bee pollen and Moringa leaf extract can improve liver function, hematological parameters, and BMI in tuberculosis patients receiving anti-tuberculosis treatment (ATT). However, the results are not significantly different from those of patients who did not receive the supplemental therapy.	No research was conducted.	The administration of bee pollen and Moringa leaf extract can improve liver function, hematological parameters, and BMI in tuberculosis patients receiving anti-tuberculosis treatment (ATT). However, the differences in outcomes are not statistically significant compared to patients who did not receive the supplemental therapy.
3.	Effectiveness of Egg White Supplementation on Increasing Albumin Levels and IL-6 in Tuberculosis Patients with Hypoalbuminemia. Agus Prastowo, Wiryatun Lestariana, Siti Nurdjanah, Retno Sutomo, 2016	1. Egg whites are a high biological value protein (100), indicating that all protein from egg whites can be absorbed by the body. They have the highest ratio of retained nitrogen to consumed nitrogen among food proteins, with a Net Protein Utilization of 94. 2. The protein content of egg whites increases with each gram of egg weight. They contain 95% albumin, primarily in the form of ovoalbumin (54%), ovomucoid (11%), lysozyme (11.5%), ovomucin (1.5%), avidin (0.05%), and ovoglobulin (0.5%). Ovalbumin is the type of albumin that is most easily absorbed by the intestines compared to other	No research was conducted.	1. Bivariate analysis results indicated a significant difference in the mean increase of albumin levels between the treatment group and the control group, with a p-value of 0.001 ($p<0.05$). 2. Egg whites are effective in increasing albumin levels and inhibiting IL-6 reactivation in tuberculosis patients. 3. Therefore, egg whites can be incorporated into therapy to enhance serum albumin levels and reduce inflammation in tuberculosis patients with hypoalbuminemia.	No research was conducted.

		types.			
4.	Aspects of Immunonutrition and Hepatoprotective Properties of Moringa Oleifera Nanoemulsion Syrup as an Adjunct to Tuberculosis Treatment in Children with Tuberculosis. Nyoman Budhi Wirananda Setiawan, Agus Indra Yudhistira Diva Putra, Made Indira Dianti Sanjiwani, Agung Wiwiek Indrayani, Ida Ayu Ika Wahyuniari, 2022	1. Moringa oleifera leaf nanoemulsion syrup contains various macronutrients, including plant protein, as well as micronutrients such as vitamins, minerals, and trace elements that are associated with immunomodulatory effects against intracellular pathogens like Mycobacterium tuberculosis. 2. The nanoemulsion syrup of Moringa oleifera leaves also includes various minerals, one of which is calcium.	No research was conducted.	No research was conducted.	1. Moringa oleifera has the potential to act as an immunomodulator due to its prebiotic content. 2. Prebiotics are food products rich in fiber that serve as a food source for the normal bacterial flora in the intestines. 3. The nanoemulsion syrup of Moringa oleifera leaves also contains various vitamins, including vitamins A, B6, C, and E. Vitamin A enhances cellular immune responses and lymphoproliferative responses. 4. Vitamin B6 increases the activity of natural killer (NK) cells and lymphocytes.
5.	Nutritional Benefits and Functions of Moringa Oleifera, Salma Sultana, 2020	1. This study demonstrates the nutritional and functional content of Moringa leaves. 2. Moringa leaves have a low fat content, ranging from 4.03% to 9.51%. 3. They also have a higher content of polyunsaturated fatty acids (PUFA).	Moringa leaf powder is rich in carbohydrates and has a high caloric value that contributes to caloric needs.	Moringa leaves have variable protein content, ranging from 16%, 22.42%, 23.27%, to 27.4-40%.	Moringa is rich in vitamins, including water-soluble vitamins. It is high in vitamin C, which enhances iron absorption in the body.

A scoping review of several studies related to Moringa oleifera (Moringa leaf) showed great potential as a micronutrient source and adjuvant agent in the therapy of various diseases. A study by Yee Kei Kiki Chan (2018) highlighted the nutritional content of Moringa leaves as comparable to spinach in terms of iron and slightly lower than carrots in terms of vitamin A. Even so, moringa remains a potential natural fortificant candidate for areas with micronutrient deficiencies, mainly due to its availability. The study also found that moringa could be fortified into bouillon cubes through a cold extrusion process, although additional fortificants may be needed to improve the nutritional value and stability of the product.

Marissa Matinahoru (2022) reported the results of a clinical trial using moringa leaf extract and bee pollen as supportive therapy in tuberculosis (TB) patients. The study was conducted at several health centres in Ambon involving 72 subjects who were divided into three groups: bee pollen, moringa leaf extract, and placebo. Although the therapy showed improvement in the liver condition, haematology, and body mass index (BMI) of TB patients receiving OAT (anti-TB drugs), the comparison between the treatment and control groups showed no significant difference. This is likely due to the administration of multivitamins to all subjects, which affected the final results.

Agus Prastowo et al. (2016) focused on the use of egg white as a supplement to increase albumin levels in TB patients with hypoalbuminemia. Results showed that egg white was able to significantly increase albumin levels, with clear differences between the

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treatment and control groups. Egg white also demonstrated the ability to suppress IL-6 reactivation, which is important in the control of inflammation in TB patients. This study highlights the effectiveness of protein supplementation in helping to improve nutritional status in TB patients.

The study by Nyoman Budhi Wirananda Setiawan et al. (2022) investigated moringa leaf syrup nanoemulsion as an immunonutrition agent and hepatoprotectant in children with TB. The study results showed that moringa leaf nanoemulsion can improve immune function and protect the liver through mechanisms involving immune cell activation and inhibition of cytochrome p450 enzyme action. The nanoemulsion form is also thought to be more effective for administration to children, but further research is needed to validate these findings at the preclinical and clinical levels.

Finally, Salma Sultana's (2020) research emphasises the importance of Moringa oleifera as a nutritional source rich in protein, vitamin C, and minerals such as calcium and potassium. Proximate analyses showed that Moringa leaves from different ecological zones in Bangladesh vary in nutrient content, but are generally rich in important phytonutrients. In addition, moringa leaves have promising functional properties in terms of water absorption capacity, foaming capacity, and foam stability, making it a nutritious food ingredient for human and animal consumption.

DISCUSSION

Based on the results of this scoping review, Moringa oleifera or kelor leaves show great potential as a source of nutrition and supportive therapy agent, especially in the management of diseases such as tuberculosis. Various studies indicate that moringa leaves are rich in protein, vitamins, and minerals, making them a potential fortifying candidate in areas with nutritional deficiencies. In addition, the application of moringa leaves in supplement form, either in extract or nanoemulsion, has immunonutrition and hepatoprotective effects that can support standard therapy, although the results sometimes do not show significant differences compared to controls, possibly due to the administration of multivitamins to all subjects. The potential of moringa leaves in improving health, especially in increasing albumin levels and supporting liver function, is also strengthened by its role in inhibiting IL-6 reactivation. However, further research is needed to ensure its effectiveness in optimal form and dosage, especially in patients with chronic conditions such as TB.

What nutritional components can be derived from egg white and moringa leaves?

Egg whites and moringa leaves both contain nutrients that are beneficial for health. Egg whites are a high-quality source of protein with all essential amino acids, low in fat, and contain vitamin B2 and minerals like selenium, which support the immune system. Meanwhile, moringa leaves are rich in plant-based protein, vitamins C and A, as well as various minerals such as calcium, iron, potassium, and magnesium, which are important for bone health, eye health, and muscle function. Moringa leaves also contain antioxidants and fiber, which are good for digestion. The combination of both can provide a complete range of nutrients to support overall health (Priharwanti, 2024).

How do these components influence the improvement of nutritional status and albumin levels?

The nutritional combination of egg whites and moringa leaves can significantly contribute to improving nutritional status and albumin levels in the body. The high-quality protein found in egg whites, complete with all essential amino acids, helps repair and build body tissues while supporting the production of albumin, a vital protein produced by the liver. Moringa leaves, with their plant-based protein, along with essential vitamins and minerals such as iron and calcium, support metabolism and the optimal absorption of nutrients, which are crucial for improving nutritional status. Additionally, the antioxidants in

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moringa leaves protect body cells from damage and enhance liver health, which plays a key role in albumin production. The fiber and nutrients in both ingredients improve the digestive system, making protein and other nutrient absorption more efficient, ultimately boosting overall nutritional status and albumin levels (Batubara, 2023).

What is their effect on immune function?

The combination of egg whites and moringa leaves can have a positive impact on immune function. The high-quality protein found in egg whites supports cell regeneration and the formation of antibodies, which are essential for a strong immune system. Selenium in egg whites also acts as an antioxidant, protecting body cells from oxidative damage and strengthening the body's resistance to infections. On the other hand, moringa leaves are rich in vitamin C, which is known to enhance the production of white blood cells and bolster the body's immune response. The antioxidants in moringa leaves, such as flavonoids and polyphenols, help combat free radicals that can weaken the immune system. With this nutritional combination, the body receives optimal support to maintain health and resilience against diseases (Ahsan, 2020).

CONCLUSION

In conclusion, Moringa oleifera or kelor leaves have significant potential as a source of nutrition and supportive therapy agent, especially in the management of diseases such as tuberculosis. Its rich nutritional content, including protein, vitamins, and minerals, makes it a promising natural ingredient for food fortification in areas with malnutrition. The use of moringa leaf extracts and nanoemulsion forms has shown benefits in improving immune status, liver function, and nutritional status in patients, although clinical outcomes were not always significant compared to controls, possibly due to confounding factors such as multivitamin administration. Further research is needed to optimize the form, dosage, and application of moringa leaves in the context of supportive therapy for various diseases.

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REFERENCES

Ahsan, F., Rahmawati, N. Y., & Alditia, F. N. (2020). Lawan Virus Corona: Studi Nutrisi untuk Kekebalan Tubuh. Airlangga University Press.

Amaliyah, S. (2023). Potensi Daun Kelor sebagai Herbal untuk Penyakit Hati Stadium Lanjut. Universitas Brawijaya Press.

Arza P, Ilham D, Anggraini F. The Effect of Egg White and Honey Intervention in TB Patients Towards Blood Pressure and Hb Levels. Proc Third Andalas Int Public Heal Conf AIPHC 2019, 10-11th Oct 2019, Padang, West Sumatera, Indones. 2020; Mueller-Wieland K. Tuberculosis and nutrition. Dtsch Med J. 1961;12:145–9.

Batubara, F. R. (2023). Prinsip Dasar dalam Nutrisi dan Gizi Klinis.

Bhargava A. Undernutrition, nutritionally acquired immunodeficiency, and tuberculosis control. BMJ. 2016;355(October):11–2.

Casha AR, Scarci M. The link between tuberculosis and body mass index. J Thorac Dis. 2017;9(3):E301–3.

Dinas Kesehatan Kabupaten Jombang. (2023). Profil Kesehatan tahun 2023.

Haley WE, Freeman. Vitamin A and D deficiencies associated with incident tuberculosis in HIV-infected patients initiating antiretroviral therapy in multinational case-cohort study Mark. Physiol Behav. 2018;176(1):139–48.

Kemenkes R. Pencegahan dan Pengendalian Penyakit Buku Pedoman Sekolah Peduli

DOI: https://doi.org/10.30994/sjik.v13i2.1175
ISSN: 2252-3847 (print); 2614-350X (online) Vol.13 No.2 November 2024 Page. 179-189

Tuberkulosis (TBC) Dalam Rangka Gerakan bersama (Geber) melawan Tuberkulosis di Satuan Pendidikan. 2021.

Kiki, Y. K. (2018). Micronutrients in Moringa oleifera and their potential in food fortification (Doctoral dissertation, Tesis]. Toronto: University of Toronto).

Matinahoru, M. (2022). Uji Klinik Bee Pollen Dan Daun Kelor (Moringa Oleifera) Sebagai Terapi Suportif Untuk Perbaikan Fungsi Hati Dan Status Nutrisi Pasien Tb Paru= A Clinical Trial On The Use Of Bee Pollen And Kelor Leaves (Moringa Oleifera) As Supportive Therapy For Repairing Liver Function And Nutrition Among Tb Patients (Doctoral Dissertation, Universitas Hasanuddin).

Montes K, Atluri H, Silvestre Tuch H, Ramirez L, Paiz J, Hesse Lopez A, et al. Risk factors for mortality and multidrug resistance in pulmonary tuberculosis in Guatemala: A retrospective analysis of mandatory reporting. J Clin Tuberc Other Mycobact Dis [Internet]. 2021;25:100287. Available from: https://doi.org/10.1016/j.jctube.2021.100287.

Prastowo, A., Lestariana, W., Nurdjanah, S., & Sutomo, R. (2016). Efektifitas Pemberian Ekstra Putih Telur Terhadap Peningkatan Kadar Albumin Dan Il-6 Pada Pasientuberkulosis Dengan Hipoalbumin. Jurnal kesehatan, 9(1), 10-18.

Priharwanti, A., Mastuti, D. N. R., Wasaraka, Y. N. K., Fatmawati, T. Y., Nurhayati, A., Astani, A. D., ... & Nabilah, I. (2024). Buku Ajar Gizi Dalam Daur Kehidupan. PT. Sonpedia Publishing Indonesia.

Setiawan, N. B. W., Putra, A. I. Y. D., Sanjiwani, M. I. D., Indrayani, A. W., & Wahyuniari, I. A. I. (2022). Immunonutrition and Hepatoprotectant Aspects of Moringa Oleifera Leaf Nanoemulsion Syrup as an Antituberculosis Adjuvant for Children with Tuberculosis. Journal of Tropical Biodiversity and Biotechnology, 7(3), 68291.

Siagian H, Christyaningsih J. Chemical Substance of Moringa Leaf (Moringa Oleifera) As an Immunomodulator (Expression of Ifn-Γ and Il-12) in Mycobacterium Tuberculosis Infection. 2022;12:669–73.

Sinha P, Davis J, Saag L, Wanke C, Salgame P, Mesick J, et al. Undernutrition and Tuberculosis: Public Health Implications. J Infect Dis. 2019;219(9):1356–63.

Sugiarto. Uji Klinik Bee Pollen Dan Daun Kelor (Moringa Oleifera) Sebagai Terapi Suportif Untuk Perbaikan Fungsi Hati Dan Status Nutrisi Pasien Tb Paru. 2016;4(1):1–23.

Téllez-Navarrete NA, Ramón-Luing LA, Munõz-Torric M, Osuna-Padilla IA, Chávez-Galán L. Malnutrition and tuberculosis: The gap between basic research and clinical trials. J Infect Dev Ctries. 2021;15(3):310–9.