http://ejournal.seaninstitute.or.id/index.php/healt
Jurnal Eduhealt, Volume 14, No. 04 2023
E-ISSN. 2808-4608

Moringa Oleifera and Undernutrition: A Narrative Review

Safrina Oksidriyani
Nutrition Department, Faculty of Medicine, Universitas Negeri Semarang, Semarang, Indonesia

ARTICLE INFO

Keywords:
Moringa Oleifera
Undernutrition
Malnutrition
Child.

ABSTRACT

Malnutrition is nutrient deficits or excesses, an imbalance of critical nutrients, or inadequate nutrient utilization. Undernutrition presents itself in four ways: wasting, stunting, underweight, and lacking micronutrients. Meanwhile, overweight and obesity are two forms of overnutrition. In 2020, the World Health Organization projected 149 million stunted children under five, 45 million wasted children, and 38.9 million overweight or obese children. We conducted a comprehensive literature search across databases such as Google Scholar, PubMed, and ScienceDirect. We searched for articles using MeSH-compliant keywords including "Moringa oleifera", "malnutrition", "undernutrition", "stunting", "wasting", "growth disorders", "overnutrition", "obesity", and "overweight",This review included studies published between 1 January 2020 - 31 May 2023 that were human or animal research studies, written in English and were full-length articles. Studies that were (i) not relevant to the main focus of the review; (ii) Ph.D. dissertations, conference proceedings, unpublished studies; (iii) abstracts, case studies, in vitro studies, non-experimental studies, protocols and reviews; and (iv) duplicate were excluded. The key findings of each research project were summarized based on the year, the study group, the technique utilized, the interventions used, the variables considered, the primary outcomes, and the concluding remarks for data interpretation. Moringa oleifera is readily available in Indonesia as a local food ingredient. Studies have demonstrated the beneficial effects of Moringa oleifera on malnutrition, encompassing both undernutrition and overnutrition, through various mechanisms, including enhanced antioxidant capacity and modulation of appetite-regulating hormones.

Email :
safrinaoksidriyani@mail.unnes.ac.id

1. INTRODUCTION

Malnutrition is nutrient deficits or excesses, an imbalance of critical nutrients, or inadequate nutrient utilization. Undernutrition presents itself in four ways: wasting, stunting, underweight, and lacking micronutrients. Meanwhile, overweight and obesity are two forms of overnutrition. In 2020, the World Health Organization projected 149 million stunted children under five, 45 million wasted children, and 38.9 million overweight or obese children (World Health Organization, 2024). Undernutrition is responsible for around 45% of fatalities among children under the age of five. These are especially common in low- and middle-income countries. At the same time, childhood overweight and obesity are practically everywhere. Malnutrition affects every country on the globe. Combating all types of malnutrition is one of the most significant global health challenges (2022 Global Nutrition Report: Stronger Commitments for Greater Action, 2022).

Moringa oleifera (MO), known as the "miracle tree," flourishes in nearly all tropical and subtropical regions worldwide. However, it is believed to be indigenous to the sub-Himalayan tracts of Afghanistan, Bangladesh, India, and Pakistan. India, Africa, South and Central America, Mexico, Hawaii, Asia, and Southeast Asia cultivate MO commercially (Pareek et al., 2023). Reports suggest that MO is a rich source of protein and micronutrients (Islam et al., 2021).

There are different existing nutritional interventions to address under nutrition and micronutrient deficiencies through supplementation, fortification, and improved complementary food products to improve dietary quality and to end malnutrition. These strategies are helpful to minimize

micronutrient depletion among vulnerable groups. But they are not cost-effective and out of the capacity of the majority of poor rural and semi-urban communities. Therefore, upgrading locally available, culturally acceptable, and affordable food item to nutrient-dense food is a key and sustainable promising solution to solve under nutrition(Gelli et al., 2017; Hossain et al., 2017; agedew et al.,2022)

Extensive research on MO has revealed no negative consequences for human health (Stohs & Hartman, 2015). Developing tropical nations have used MO trees to combat malnutrition, particularly among infants and lactating mothers. MO's therapeutic properties are due to alkaloids, fatty acids, flavonoids, glucosinolates, glycosides, phenolic acid, sterols, and terpenes. Furthermore, MO is high in vitamins, minerals, and carotenoids, which boosts its medical value and makes it a superfood (Pareek et al., 2023). Toddlers require a high calcium level in MO extract during their growth period. Other studies also mention that administering MO extract can increase toddlers' height by 0.342 cm. Extracting MO leaves makes consumption easier for adults and children (Muliawati & Sulistyawati, 2019). This review aimed to investigate and synthesize relevant literature to better understand the health benefits of MO in preventing and combating malnutrition.

2. METHODS

We conducted a comprehensive literature search across databases such as Google Scholar, PubMed, and ScienceDirect. We searched for articles using MeSH-compliant keywords including “Moringa oleifera”, “malnutrition”, “undernutrition”, “stunting”, “wasting”, “growth disorders”, “overnutrition”, “obesity”, and “overweight”,

This review included studies published between 1 January 2020 - 31 May 2023 that were human or animal research studies, written in English and were full-length articles. Studies that were (i) not relevant to the main focus of the review; (ii) Ph.D. dissertations, conference proceedings, unpublished studies; (iii) abstracts, case studies, in vitro studies, non-experimental studies, protocols and reviews; and (iv) duplicate were excluded. The key findings of each research project were summarized based on the year, the study group, the technique utilized, the interventions used, the variables considered, the primary outcomes, and the concluding remarks for data interpretation.

3. RESULTS AND DISCUSSION

Moringa oleifera and undernutrition

Undernutrition, a type of malnutrition, refers to insufficiencies or irregularities in the amount of energy and necessary nutrients an individual requires from their daily diet. Undernutrition in childhood can manifest as stunted growth, being underweight, experiencing wasting, and lacking essential micronutrients (World Health Organization, 2024).

According to several studies, MO can help alleviate undernutrition by improving food's nutritional and phytochemical characteristics. The health benefits of MO leaves and pods may be especially beneficial for pregnant and nursing mothers. One hundred grams of MO leaves contain protein, iron, copper, sulfur, and vitamin B. They may provide a woman with nearly a third of her daily calcium needs. The protein content of MO dried leaves reached 29.4%, fat 5.2%, carbohydrate 41.2%, and fiber 12.5%. In dried MO leaves, calcium content is 17 times higher than in milk, vitamin C is seven times higher than in oranges, and vitamin A is ten times higher than in carrots (Islam et al., 2021). Ntila et al. suggest using MO to fortify white maize-based supplemental diets to prevent child malnutrition due to its increased antioxidant activity (Ntila et al., 2020).

Researchers reported that adding MO leaf powder considerably enhances the intake of minerals, vitamins, protein, carbohydrates, vitamin A, and calcium. A study has found that including MO, a plant species abundant in protein and minerals, can effectively combat malnutrition and enhance the nutritional content of supplementary foods (Shija, 2019). Previous research has shown that augmenting the MO leaves leads to higher protein, sugar, calcium, fiber, and β-carotene concentrations. This enhances the assimilation of nutrients present in MO leaves (Tunny. Rahma et al., 2020).

The dehydrated leaves of the MO tree contain the majority of the nutrients. The leaves can be processed into a fine powder and added to regular meals to offer essential nutrients. Another study

demonstrated that administering MO leaf powder to children for 60 days resulted in a 70% improvement from moderate to mild protein-energy malnutrition (PEM) in affected children. Additionally, 60% of children with mild PEM experienced a significant boost in their nutritional status. Therefore, MO leaf powder can serve as a nutritional supplement to address young infants' protein-energy malnutrition (PEM). Due to its affordability, MO enables parents to provide nutrition to their children more economically than pricey alternatives such as powdered milk, cooking oil, and sugar. Consequently, malnourished infants experience faster recovery. The main advantage of using MO is that it is a local resource. MO leaves are rich in vital nutrients, including vitamin B complex, vitamin C, calcium, potassium, magnesium, selenium, zinc, and amino acids like arginine and histidine. Newborns benefit significantly from these nutrients (Srikanth et al., 2014).

Moringa oleifera and overnutrition

Obesity is a medical term that refers to the rapid, excessive accumulation of body fat (Bahmani et al., 2016). Various chronic conditions like type 2 diabetes, cardiovascular illnesses, stroke, hypertension, and some types of cancer are associated with obesity (Sergent et al., 2012). Obesity can result in detrimental psychological consequences for individuals, including mental health disorders such as depression, social discrimination, and physical restrictions (Ramezani et al., 2018).

A study conducted by Ezzat et al. investigated the impact of providing hard gelatin capsules containing MO to female volunteers between the ages of 45 and 55 who had obesity. The study revealed a significant decrease in BMI, total cholesterol, and LDL levels over an eight-week therapy period (Ezzat et al., 2020). Nambiar et al. undertook a study to investigate the influence of MO on dyslipidemia in a cohort of 35 people diagnosed with type 2 diabetes. The treatment group was administered a daily dosage of 4.6 grams of leaf powder in tablet form for 50 days. The treatment group demonstrated a statistically significant decrease of 1.6% in total plasma cholesterol levels ($p < 0.05$) and a significant increase of 6.3% in HDL ($p < 0.001$) compared to the control group (Nambiar et al., 2010).

MO may have anti-obesity benefits such as lipid profile improvement and body weight reduction. MO accomplishes this by decreasing the concentrations of total cholesterol, triglycerides, low-density lipoprotein, and very low-density lipoprotein while simultaneously boosting the concentrations of high-density lipoprotein. In addition, MO has shown its ability to improve glucose tolerance and insulin signaling. Furthermore, MO also decreased the levels of the hormones leptin, vaspin, and resistin (Ali Redha et al., 2021).

4. CONCLUSION

Moringa oleifera is readily available in Indonesia as a local food ingredient. Studies have demonstrated the beneficial effects of Moringa oleifera on malnutrition, encompassing both undernutrition and overnutrition, through various mechanisms, including enhanced antioxidant capacity and modulation of appetite-regulating hormones.

REFERENCE

Ali Redha, A., Perna, S., Riva, A., Petrangolini, G., Peroni, G., Nichetti, M., Iannello, G., Naso, M., Faliva, M. A., & Rondanelli, M. (2021). Novel insights on anti-obesity potential of the miracle tree, Moringa oleifera: A systematic review. *Journal of Functional Foods*, *84*, 104600. https://doi.org/10.1016/j.jff.2021.104600

Agedew, E., Misker, D., Gelibo, T., Tadelle, A., Makonnen, E., Worku, S., ... & Debella, A. (2022). Does Moringa stenopetala based diet consumption decrease burden of under nutrition in under-five children, Southern Ethiopia?. *Heliyon*, *8*(8).

A. Gelli, E. Becquey, R. Ganaba, D. Headey, M. Hidrobo, et al., Improving diets and nutrition through an integrated poultry value chain and nutrition intervention (SELEVER) in Burkina Faso: study protocol for a randomized trial, Trials 18 (2017) 412.

Bahmani, M., Eftekhari, Z., Saki, K., Fazeli-Moghadam, E., Jelodari, M., & Rafieian-Kopaei, M. (2016). Obesity Phytotherapy. *Journal of Evidence-Based Complementary & Alternative Medicine*, *21*(3), 228–234. https://doi.org/10.1177/2156587215599105

Ezzat, S. M., El Bishbishy, M. H., Aborehab, N. M., Salama, M. M., Hasheesh, A., Motaal, A. A., Rashad, H., & Metwally, F. M. (2020). Upregulation of MC4R and PPAR-α expression mediates the anti-obesity activity of Moringa oleifera Lam. in high-fat diet-induced obesity in rats. *Journal of Ethnopharmacology*, *251*, 112541. https://doi.org/10.1016/j.jep.2020.112541

Global Nutrition Report 2022 : Stronger commitments for greater action. (2022).

Islam, Z., Islam, S. M. R., Hossen, F., Mahtab-ul-Islam, K., Hasan, Md. R., & Karim, R. (2021). Moringa oleifera is a Prominent Source of Nutrients with Potential Health Benefits. *International Journal of Food Science*, *2021*, 1–11. https://doi.org/10.1155/2021/6627265

Muliawati, D., & Sulistyawati, N. (2019). The Use of Moringa Oleifera Extract to Prevent Stunting in Toddler. *Jurnal Kesehatan Madani Medika*, *10*(2), 123–131.

M. Hossain, N. Choudhury, K.A.B. Abdullah, P. Mondal, A.A. Jackson, et al., Evidence-based approaches to childhood stunting in low and middle income countries: a systematic review, Arch. Dis. Child. 102 (2017) 903–909.

Nambiar, V., Nambiar, V. S., Guin, P., Parnami, S., & Daniel, M. (2010). Impact of antioxidants from drumstick leaves on the lipid profile of hyperlipidemics. *Journal of Herbal Medicine and Toxicology*, *4*(1), 165–172. https://www.researchgate.net/publication/228499971

Ntila, S. L., Ndhlala, A. R., Mashela, P. W., Kolanisi, U., & Siwela, M. (2020). Supplementation of a complementary white maize soft porridge with Moringa oleifera powder as a promising strategy to increase nutritional and phytochemical values: a research note. *South African Journal of Botany*, *129*, 238–242. https://doi.org/10.1016/j.sajb.2019.07.021

Pareek, A., Pant, M., Gupta, M. M., Kashania, P., Ratan, Y., Jain, V., Pareek, A., & Chuturgoon, A. A. (2023). Moringa oleifera: An Updated Comprehensive Review of Its Pharmacological Activities, Ethnomedicinal, Phytopharmaceutical Formulation, Clinical, Phytochemical, and Toxicological Aspects. *International Journal of Molecular Sciences*, *24*(3), 2098. https://doi.org/10.3390/ijms24032098

Ramezani, M., Changizi-Ashtiyani, S., Sadeghzadeh, F., Hosseini, S.-S., Zarei, A., & Hosseini, N. (2018). Effect of Hydroalcoholic Extract of Some Medicinal Plants on Obesity. *European Journal of Medicinal Plants*, *24*(1), 1–10. https://doi.org/10.9734/EJMP/2018/41111

Sergent, T., Vanderstraeten, J., Winand, J., Beguin, P., & Schneider, Y.-J. (2012). Phenolic compounds and plant extracts as potential natural anti-obesity substances. *Food Chemistry*, *135*(1), 68–73. https://doi.org/10.1016/j.foodchem.2012.04.074

Srikanth, V. S., Mangala, S., & Subrahmanyam, G. (2014). Improvement of Protein Energy Malnutrition by Nutritional Intervention with Moringa Oleifera among Anganwadi Children in Rural Area in Bangalore, India. *International Journal of Scientific Study*, *2*(1), 32–35.

Stohs, S. J., & Hartman, M. J. (2015). Review of the Safety and Efficacy of Moringa oleifera. *Phytotherapy Research*, *29*(6), 796–804. https://doi.org/10.1002/ptr.5325

Tunny. Rahma, Adriani, M., & Wirjatmadi, B. (2020). The Influence of Additional Food Hotong Porridge with Moringa Leaves Mixture on Improvement Nutritional Status of Children Nutritional Children. *Medico-Legal Update*, *20*(1), 459–464. https://doi.org/10.37506/mlu.v20i1.400

World Health Organization. (2024). *Malnutrition*. https://www.who.int/news-room/fact-sheets/detail/malnutrition