

EFFECTIVENESS OF (*Phaseolus lunatus* L.) AS ROLE PLAY ON THE IGF-1 FACTOR IN MALNUTRITION : A SYSTEMATIC REVIEW

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The high rate of malnutrition is still a major problem in the world of health. The increase in stunting rates from year to year is a crucial thing that must be addressed immediately. According to the World Health Organization (WHO), in 2022 the stunting rate will reach 22.3%. Among them 148.1 million children under the age of 5 have a height that is too short for their age, 45 million children have a weight that is too thin for their height (WHO, 2023). Malnutrition is triggered by undernutrition, micronutrient deficiencies, and body mass deficiencies, which can affect growth and development in children. Malnutrition generally occurs in low- and middle-income economies, especially in developing countries, such as Indonesia. The need for nutritious food sources that are not well met, access to food fulfillment with adequate nutritional quality is one of the initial causes of high stunting rates. Not fulfilling adequate nutritional intake can be a trigger for many health problems. According to research conducted by (Zikrah, 2023), malnutrition results in brain growth and maturation, difficulty in remembering, delays in intellectual thought, and attention deficit hyperactivity disorder. Protein deficiency also affects the growth and development process in children. The utilization of Indonesia's local food, which is rich in natural resources, can support the prevention of high stunting rates. The maximization of the potential of local foods that contain high protein is still not too echoed, especially those that have an effect on bone composition, liner growth retardation, bone mineral density, and so on (Kueper et al., 2015).

Healthy bone formation is strongly influenced by micronutrients and macronutrients, one of the macronutrients that plays an important role is protein (Forgie et al., 2020). In accordance with the Body Mass Index (BMI), the estimated protein required amounts to 2.0 kg in a healthy adult male with a BMI of 70 kg, with a comparison of the total mass of protein in muscle in the human skeleton is 5.0 kg (Bounjour, 2015). This means that 19% of body weight is the weight of protein contained in body mass. The total weight of the human body is 13.3 kg with 15% and 37.6% in bone and skeletal muscle, respectively. Malnutrition affects the growth process in bone tissue and hormonal functions that affect growth rate, bone formation, bone size and the formation of IGF-1 in the pituitary growth hormone (Florencio et al., 2015). Fulfillment of micro nutrients and macronutrients must be fulfilled so that the process of bone growth is not disturbed. One of them is macronutrients sourced from protein. Protein is needed for intracellular and extracellular bone formation and affects the amount of amino acids needed by the body in bone mineral levels and body metabolism (Bounjour, 2016). This action is governed by the regulation of hormones produced by IGF-1 (Prahasanti and Perdana, 2022). In type 1 growth (IGF-1) functions as growth differentiation, and inhibits apoptosis in many tissues, increases proliferation and plays a major role in osteoblast stimulation, and bone matrix synthesis (Youssef., 2017). The IGF-1 factor also plays a role in stimulating osteoblasts by carboxylating osteocalcin, binding to insulin receptors (IR) in diosteoblasts and osteoclasts and to insulin receptors (IRS) which are only present in osteoblast parts. These parts play an important role in bone formation and tissue healing (Tao Qiu et al., 2018; Xiaoxuan, et al., 2020). There is a significant difference between body weight and femur bone that is malnourished compared to the control group which has a drastic decrease (Kastella et al., 2024).

Food sources that have a high protein content can be a source of amino acids. The high level of amino acids affects the amount of protein content. One food that has a high source of protein and amino acids is lima beans. Lima beans (*Phaseolus lunatus* L.) or more commonly

known as paga beans in West Sumatra, is one of the local food sources with enormous potential to substitute protein intake needs other than animal protein groups (Prasetya, 2020). Legumes are classified as an affordable source of protein with rich carbohydrates, dietary fiber, protein, fat, and minerals. Vegetable protein from the legume group can reduce nutritional deficiencies and can be an alternative choice for diets because it has twice as much protein content as cereals (Farinde et al., 2018). The protein content of legume grains ranges from 40g/100g much higher than cereals which are only 7-11.8g/100g with the same content as meat protein which is 18-25 g/100g. Paga beans have good nutritional content and are a good source of protein, amino acids (AA), minerals, dietary fiber, and B-complex vitamins (folate, B6, and niacin). Paga beans show high levels of calcium, iron, zinc, phosphorus and potassium. These mineral components are necessary for the body to help muscle movement, maintain the nervous system, and keep bones and teeth strong. The high levels of phosphorus and potassium are 1181.7 and 4080 mg/100 g, making paga beans an important food source component (Adebo, 2023).

The content of lima beans is beneficial in the growth process in humans. Among them, paga beans contain 19.93-21.40% protein, 60.55-74.62% carbohydrates, 0.99-1.21% fat, 3.46-3.61% ash content, and 4.20-5.50% fiber (Diniyah et al., 2015). Lima beans have amino acids leucine, isoleucine, arginine, lysine and glutamine, which are very instrumental in the production of growth and development hormones, as well as calcium absorption and bone health (Adebo, 2023; Zdzieblik et al., 2017). The high level of amino acids involved in growth and various other nutrients including arginine, which can reduce malnutrition especially in developing countries (Ishaya & Aletor, 2019). Low levels of essential amino acids can cause growth failure in childhood, where the required concentration is 331 at the age of 12-59 months (Samba et al., 2016). Paga beans are one of the beans that are high in arginine amino acid content. Lima bean preparations made into flour are more effective in increasing the body weight of rats after acute malnutrition and protein energy deficiency by the influence of protein, carbohydrate, fat, and micronutrient components (Maliza et al., 2024). When the body does not get enough food intake, it will make the body weight decrease due to lack of protein intake. When cells get enough protein intake, the body will break down the protein as energy or store it as fat. When both micronutrients and micronutrients are lacking in the body, a certain amount of protein is broken down into amino acids. These amino acids can then affect the body's metabolic rate which has an impact on weight loss, which can result in lower levels of (IGF 1) and Growth Factors (GH) than insulin which can interfere with liner growth in height and weight (Sari et al., 2021; Hawkes & Grimberg et al., 2015).

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