The Omega-3 Fatty Acids can Significantly Increase the Height of Children Under Five with Stunting

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Abstract

Children with stunting are a global public health problem that has implications for impaired physical growth, which has an impact on increasing morbidity and mortality. This study aims to study the role of omega-3 fatty acid supplementation on anthropometric measures of toddlers with stunting, especially height. This type of research was an experimental randomized clinical trial design, in the form of pre-post test control group design. Subjects who participated in this study were toddlers aged 12-36 months, consisting of 12 children as a control group who received placebo, and 12 children as a treatment group who received omega-3 fatty acid supplementation for 2 months. The parameters observed was height. The collected data were analyzed using t-test. The results of the study showed that there was a difference in changes in the subject's height in the treatment group compared to the control group (p-value = 0.009294). It was further concluded that supplementation of omega-3 fatty acids in children under five with stunting could significantly increase height.

Keywords: *omega-3 fatty acids, stunting, children under five, height*

Introduction

Children with stunting are a global public health problem, which can increase morbidity and mortality.[(1),(2)] However, the most serious problem that needs important attention is the inhibition of cognitive and motor development due to brain volume that does not reach optimal size.[(2)] In this regard, Martorell & Zongrone states that failure to promote linear growth has serious consequences, both in the short and long term, both on health and the formation of quality human capital.[(3)]

Semba et al. through metabolomics studies concluded that there is a relationship between stunting and low serum omega-3 fatty acids. This nutrient is essential for growth and development. The results of his study also explained that interventions to reduce stunting could be done by increasing food intake of omega-3 fatty acid sources.[(2)]

Koren et al. reported that exposure to omega-3 fatty acids at an early age can accelerate growth and improve bone quality.[(4)] It was also explained that omega-3 fatty acids can improve bone health through increased absorption of calcium in the intestine, and increase osteoblast activity and differentiation, reduce osteoclast activity and encourage mineral deposits needed for bone development.[(5)] Since 1929, Burr & Burr asserted that omega-3 fatty acids EPA and DHA are essential for health, and deficiency of these nutrients in the diet can cause illness.[(6)] Then it was mentioned that omega-3 fatty acids EPA and DHA were concentrated in nerve tissue, including the brain, retina and breast milk. In particular, DHA is very much a phospholipid compound in the brain and is an essential component for brain growth. Based on the explanation above, supplementation of omega-3 fatty acids is expected to increase linear growth or height in children under five with stunting.

Material and Method

This study was an experimental research, a clinical trial using a randomized controlled trial (RCT), with a specific design that was pre-post test control group design. The sample size was 24 children under five, who were recruited from data available at the "Sikumana" Community Health Center, Kupang; with inclusion criteria namely healthy (physical, mental, social and normal activities), age: 12-36 months, nutritional status:

stunting (height / age <2 standard deviations), and their parents agree with their children's involvement in the study this. The sample was divided into 2 groups namely; 12 children as a control group who received placebo and 12 children as a treatment group who received omega-3 fatty acid supplementation. The allocation of children under five to the group is done by simple random sampling, using a lottery.

The dose of omega-3 fatty acids given to the treatment group was adjusted for the child's weight ie; body weight >10-20 kg given 500 mg of omega-3 fatty acids and children with a weight of ≤10 kg were given 350 mg of omega-3 fatty acids. This supplementation was given every day, for 60 days by health cadres.

The height of a toddler was measured using microtoise which has been calibrated before. Height measurements were carried out by health cadres and monitored or assisted by researchers. Height of children aged less than 2 years plus 0.7 cm as a correction. Height measurements were carried out in both groups in the phase before giving treatment (pre test) and after giving treatment (post test). The collected data was numerical data so that it was presented in the form of mean ± SD[7], and then analyzed using an independent sample t-test, about the difference in height gain between the treatment and control groups. Prior to the t-test, all data were proven to be normally distributed based on the results of the Saphiro-Wilk test and had a homogeneous variance based on the Levene test results.

Findings

The results of height measurements in the pre-test and post-test phases in the treatment and control groups are presented in Table 1.

Table 1. The mean score of height in the pre-test and post-test phases in the treatment and control groups

Group	Height (cm)			
	n	Pre test	Post test	Difference (Δ)
Control	12	78.25 ± 5.63	78.87 ± 5.81	0.63 ± 0.29
Intervention	12	73.78 ± 7.15	74.88 ± 7.13	1.12 ± 0.52
p-value				0.009294

Referring to Table 1, it is known that the mean score of height increase in the treatment group (1.12 cm) was higher than the mean score of height increase in the control group (0.63 cm). Based on the results of the t-test, the difference in height gain from the two groups was significant, as evidenced by the p-value of 0.009, so that it could be interpreted that giving omega-3 fatty acid supplementation was effective to increase the height of a toddler with stunting.

Discussion

Based on the results of the study it is clear that the height increase of the group of children under five who received omega-3 fatty acid supplementation was significantly greater than the group of children who did not get the nutrient.

This condition is in line with the results of Koren et al., (2014) research on female mouse model fat-1 mice by administering high concentrations of omega-3 fatty acids to increase bone growth during pregnancy and postnatal periods. It can be concluded that exposure to high concentrations of omega-3 fatty acids at an early age can accelerate bone growth through changes in growth plates, increased proliferation and differentiation of chondrocytes. Lau, et al., (2013) reported that giving sunflower oil or fish oil for 12 weeks to growing mice had an impact on increasing calcium through absorption in the small intestine. In investigating the role of these unsaturated fatty acids in bone development, it is known that EPA and DHA increase mineralization, and then stimulate the differentiation of MSC (mesenchymal stem cells) into osteoblasts. The addition of arachidonic acid derived from omega-6 fatty acids inhibits the differentiation process into osteoblasts compared to cells that are given DHA. Then, the reduced omega-6 / omega-3 ratio indirectly in the bone has an effect on increasing osteoblast activity, which initiates an increase in bone formation early in life. It was also explained that omega-3 fatty acids could improve bone health through increased intestinal calcium absorption, and increased osteoblast activity and differentiation, reduced osteoclast activity and promoted mineral deposits in bone development.

Koren et al. reported that exposure to omega-3 fatty acids at an early age can accelerate bone growth and improve bone quality. In his experiments using genetically modified fat-1 mice whose bodies were able to synthesize omega-6 fatty acids into omega-3s, it was found that there was accelerated bone growth as evidenced by the increasing length of the tails of both male and female mice. This acceleration rate of growth is the result of increased thickness of the bone growth plate, along with the thickening of the proliferation, prehypertropic and hypertropic zones. Then, the influence of omega-3 fatty acids is explained through 2 mechanisms, namely: (a) omega-3 fatty acids stimulate osteoblast differentiation through increased expression of parathyroid hormones and insulin-like growth factor 1, thereby increasing bone formation; (b) omega-3 fatty acids inhibit osteoclastogenesis through reduced NF-κß expression and signal modulation from RANKL, thereby reducing bone resorption.(4)

In addition, Kajarabille et al. explained that omega-3 fatty acids can regulate bone metabolism, including reducing the release of prostaglandin E2 (PGE2) which is an important factor in osteoclast differentiation, nuclear kappa-β ligand (RANKL) receptor activation. Furthermore, these omega-3 fatty acids can modulate a number of proinflammatory cytokines, increase IGF-1 production and improve bone calcium enhancement. Thus, these fatty acids can maintain bone health and reduce bone loss.(8)

Gyurko & Van Dyke explained that RvE1 is a derivative of omega-3 fatty acids that are effective in preventing and restoring bone loss in inflammatory bone disease periodontitis. This experiment provides evidence of the action of RvE1 on bone. Aside from being an anti-inflammatory, RvE1 also works on bone cells and promotes bone maintenance.(9) Other evidence is shown by Gao et al that bioactive compounds derived from omega-3 fatty acids EPA and DHA can prevent bone loss and induce bone formation regeneration. It was also explained that RvE1 is a derivative of EPA omega-3 fatty acids which have anti-inflammatory and proresovin action mediated by the ChemR23 receptor which directly also functions to maintain bone through osteoblasts. In transgenic mice with ChemR23 receptors found additional anti-inflammatory action of RvE1 which directly impacts bone remodeling by suppressing bone resorption.(10) The same thing was reported by Harerra et al. that RvE1 can inhibit osteoclast growth and bone resorption.(11)

Conclusion

Based on the results of the study concluded that omega-3 fatty acids can significantly increase the height of children under five with stunting.

Ethical Clearance: This study had received ethical approval from the Health Research Ethics Commission, Faculty of Public Health, Universitas Airlangga, with number 322-KPK.

Source of Funding: Authors

Conflict of Interest: No

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