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Nuggets of lemuru (*Sardinella Lemuru*) fish durian seed flour to increase height of stunting in elementary school children

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Abstract--The prevalence of stunting school children in Indonesia, according to Riskesda 2010 is about 35%, 41.7% is found in rural areas, and 29.3% in urban areas. This study is clinical intervention, design of pre and post test with control group in public elementary school children 104255 Paluh Sibaji District of Pantai Labu - Deli Serdang District of North Sumatra Province for 4 weeks. A total samples of 36 children, consisting of a control and intervention group. The control group was given regular chicken nuggets, the intervention group was given nuggets of durian seed flour, each time giving nuggets 100 grams per day. Data analysis is used with t dependent and independent tests. The results of the study found that there was a significant increase in height z score (0.002) in the intervention group before and after the administration of nuggets of durian seed flour lemuru fish. There are difference significantly of height z score between control and intervention groups (0,000). Linear lines show if the child is given nuggets of durian seed flour lemuru fish @ 100 grams per day for 4 weeks then there will be an increase in height z score of average -2.23 cm. Therefore it is necessary to promote efforts to the public about the benefits of these nuggets.

Keywords---nugget of lemuru fish, durian seed flour, stunting, z score.

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Introduction

The prevalence of stunting school children in Indonesia, according to Riskesda 2010 is about 35%, 41.7% is found in rural areas, and 29.3% in urban areas (Salimar *et al.*, 2013; Lestari, W. *et al.* 2018; Kementerian Kesehatan RI Badan Penelitian dan Pengembangan, 2018). Riskesda report 2013, the prevalence of stunting school children is about 30.7%, this is a decrease from the previous year (Idwan, Yusran and Nirmala, 2018). Nevertheless, school children of stunting need to be taken seriously to pursue stunted growth, one of which is the administration of calcium, zinc and protein. Research that has been conducted by giving nuggets of lemuru fish in stunting children aged 13-36 months for 21 days is known to increase the intake of calcium, zinc and protein, as well as the addition of height, evidenced by an increase in the average value of z score about -0.21 almost reaching the median (Martony, Lestrina and Amri, 2020).

An initial survey conducted at SDN Labu Beach found about 20% of children have stunted. This condition describes in general child's past nutritional status, while children in the period 6-12 years need adequate nutritional intake for growth and development, especially linear growth. This period can be pursued if given adequate nutritional intake, so it is expected to reduce cases of stunting in children. Therefore, it is necessary to study on interesting food models, easily accessible, and a cheap cost, namely lemuru fish nuggets with durian seed flour. The selection of lemuru fish because the marine products are abundant and cheap. Lemuru fish is often used for the fish canning industry, rarely consumed by the wider community because of its many thorns, but rich in nutrients. (Martony, Lestrina and Amri, 2020). Durian seed flour made from durian seeds, processed into flour, rich in nutrients such as energy 388 kcal, protein 8.97 grams carbohydrates 85.4 gr, calcium 98 mg, and phosphors 13 mg, fat 1.14 gr which is beneficial for growth than wheat flour (Verawati and Yanto, 2019).

Method

This study is clinical interventios, design *pre and post test with control group*. The study consisted of intervention and control groups, conducted for 4 consecutive weeks. The intervention group was given nuggets of durian seed flour lemuru fish. Control group given regular chicken nuggets. Before and after the intervention measured the child's height and was assessed z score. The study conducted ini SDN (Government Elementary School) 104255 Paluh Sibaji Pantai Labu District, Deli Serdang Regency of North Sumatra Province. The population is elementary students in grades 4 and 5 are 42 people. Sample calculation based on Lemeshow (1997) with α 0.05, confidence level 0.1, and prevalence of stunting in North Sumatra 2018 (Riskesda) 32.4% so the minimum sample is 36 people consisting of intervention (18 people) and control (18 people) group. The inclusion criteria of the study sample were children aged 10-12 years, living with both parents or one of them, not allergic to fish and eggs and free from worms.

Before intervention, have been done organoleptic tests of fish nuggets lemuru durian seed flour. Height is measured and calculated the median value using the z score approach from WHO Antroplus. The results of the measurement determine the control and stunting group, then calculated the difference in z score before and

after the intervention. Data have been analyzed by dependent and independent t test using SPSS version 22 software. The research was conducted after being approved by the ethics commission of the Medan Ministry of Health with the issuance of Ethical Clearance Number 0i.1853 / KEPK / Poltekkes Kemenkes Medan / 2021. Before the study, researcher get the approval from parents of the student. Conduct of research free from conflicts of interest.

Result

Based on the results of height measurements using the z score approach before and after the study can be observed such as Table 1 below.

Table 1
Difference z score from paired t test in control and intervention groups

	Control	Intervention	Paired t test	
	Mean z score (cm)		control	intervention
Before	-1.2200	-2.5350	0.125	0.002
After	-1.0978	-2.4639		
Paired Difference	-0.1222	-0.0711		
Correlation	0.886	0.981		
Sig correlation	0.000	0.000		

Based on Table 1, it is known that there was an increase in height with z- score approach from the results of the paired t test (0.002) in the intervention group given nuggets of durian seed flour lemuru fish. Meanwhile, the control group that was given only the usual nuggets of height gain was meaningless or in other words not so different before and after the intervention. The difference in the average addition of z score in the intervention group based on the mean paired difference of -0.0711 cm = -0.07, control group, was about -0.1222 cm = -0.12 cm. The difference a z score was greater in the intervention group than in the controls (-0.07 > -0.12). Based on t independent test, z score test after the administration of intervention between the control group and the intervention can be observed as in table 2 below.

Table 2
Average z score independent t test between control and intervention group after intervention

Group	N	Mean	Levene's test (Sig)	t independent test (Sig)	Addition difference z score
Control	18	-1.0978	0.083	0.000	-0.12
Intervention	18	-2.4639			-0.07

Table 2 provided average z score after intervention between of them is difference (*p value* 0.000), and it means that the difference in increase in z score in the intervention group was higher than the controls. Based on organoleptic tests of durian seed lemuru fish nuggets with wheat flour lemuru fish nuggets can be

observed as in table 3 below. The content of calcium and zinc in durian seed flour lemuru fish nuggets is higher than in wheat flour lemuru fish nuggets.

Table 3
Comparison of nutritional value @ 100 grams of wheat flour lemuru fish nuggets with durian seed flour lemuru fish nuggets

No	Nutritional Content	Lemuru Fish Nugget Wheat Flour	Lemuru Fish Nugget Durian Seed Flour
1	Protein / gram	9.33	9.33
2	Calcium (ca)/mg	121.76	1217.6
3	Zinc (Zn)/mg mg	2.09	20.9

Based on the analysis of linear estimates from the test results above, it can be assumed that the estimated increase z score of -2.23 cm if nuggets of fish lemuru durian seed flour if given in 4 consecutive weeks @ 00 grams per day. This can be observed as in Figure 1 below.

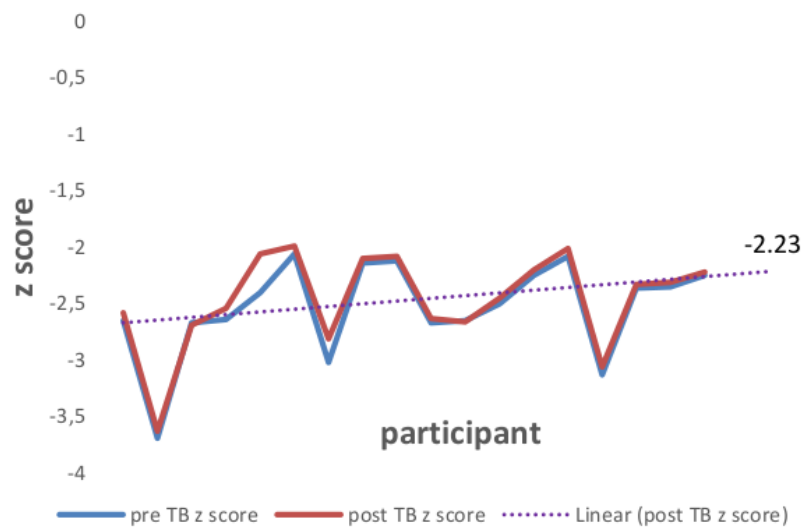


Figure 1. Estimated linear lines in stunting children given nuggets of lemuru fish

As figure 1 is known that linear lines increase, this means it is assumed that every @ 100 grams of nuggets of durian seed flour fish per day for 4 weeks, will occur the addition of z score -2.23 cm. If the grant is extended in time then the addition of z score will be even greater.

Discussion

The difference average z score in this study is greater than previous studies with wheat flour lemuru fish nuggets. ($-0.071 > -0.21$) (Martony, Lestrina and Amri, 2020). This is because the nutritional value contained in durian seed nuggets is higher, especially calcium and zinc, so it is suspected to be the cause of a significant increase z score in child stunting before and after intervention (Table 3). Protein, calcium and zinc contained in the nugget can help synthesize protein as an ingredient for the formation of new cells, especially in the bones. (Lestrina, Tarigan and Martony, 2020; Park *et al.*, 2020; Nailis, Rachim and Pratiwi, 2017). This assumption is based on that limited intake of foods such as protein, calcium and zinc will lead to a decrease in the number of GH receptors and the production of IGF-1 in the hepar resulting in an increased rate of degradation and clearance of IGF-1 or in other words decreased IGF-1 expression (Maggio *et al.*, 2013). More specifically, if protein restrictions occur, osteoblasts will become resistant to IGF-1 activation, this is proven in patients with pelvic bone fractures to cause a longer bone damage recovery period (Bonjour *et al.*, 2007). In addition, due to a decrease in IGF-1 expression it is suspected that bone growth, especially linear parts, will be late rather than usual, especially in a long time.

The correlation value of z score intervention group before and after the giving of nuggets of durian seed flour lemuru fish is very strong, which is 0.981 (98%) in real terms with p value of 0.000 and greater than the control (0.886 or 87%, p value 0.000). The increase z score in the intervention group, 98% was related to the administration of nuggets of durian seed flour lemuru fish, the rest was related to other factors not studied in the study. The selection of supplemental feeding of durian seed nuggets in children aged 10-12 years based on the period of growth II, especially sex hormones will interact with GH / IGF-1 regulate bone growth. Sex steroid hormones, along with IGF-1 help longitudinal bone growth in epiphices found in long bones such as femur, tibia, fibula, humerus (upper arm) (Vannucci *et al.*, 2018). Longitudinal bone growth can be observed with the increasing height of the child. In addition, the interaction of IGF-1 and signaling sex steroids can be observed in radial bone growth that results in sexual dimorphism. The average increase in height is inseparable from the role of thyroid hormone (TH) in regulating the increased regulation of IGF-1 expression in hepar and skeletal during the period of prepubertas growth at a critical point, even known TH is more critical than GH, or in other words IGF-1 is considered able to mediate more TH in the skeletal bone (Cheng *et al.*, 2016; (Yakar, Kriser and Biology, 2018). Therefore, researchers assume that supplemental feeding in prepubess at the critical point of the growth period helps to catch up with stunting children's height compared to other normal children. The assumption of giving nuggets of durian seed flour lemuru fish nuggets is the nutritional content it has is very appropriate to give, because with a short time the value of z score alone is greater than previous studies, even in the control group even when this intervention was carried out.

Conclusion

Giving nuggets of durian seed flour lemuru fish for 4 consecutive weeks, per 100 grams, can increase z score in stunting children greater than children who are only given regular chicken nuggets. The presentation of more varied nuggets prevents

boredom in children, in addition it needs promotional efforts to the community at large.

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