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Short Communication
Effect of Fish Consumption as a Local Food Alternative for the Reduction of Stunting in Toddlers

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Abstract

Background and Objective: The insufficient consumption of food containing protein is one of the factors contributing to stunting in children. The stunting prevalence in Saptosari, Gunung Kidul District, Yogyakarta Province, Indonesia, is high at 48.2%. This study aimed to analyze the impact of fish consumption as a local food alternative for the reduction of stunting in toddlers. **Materials and Method:** This observational study used the prospective cohort approach. The study was conducted in the Ngrenehan shoreline, Gunung Kidul, Yogyakarta, Indonesia. The data were collected from March to June 2017. The study included 50 participants from a total of 96 people. The samples were determined using simple random sampling technique. The data on stunting reduction were collected by comparing the height/age z-score between the height at toddler age and the normal height of school-age children. Data regarding fish consumption were collected through interviews using a semiquantitative food frequency questionnaire. **Results:** There was a relationship between fish consumption and stunting reduction. The chi-square analysis resulted in a p-value of 0.011 and an odds ratio (OR) value of 6.11 (1.66-22.49). Toddlers with low fish consumption were stunted at a rate of six times higher than those with adequate fish consumption. **Conclusion:** Due to the positive relationship between fish consumption and stunting reduction, it is highly recommended for children and societies to consume fish, which can be considered a local food alternative.

Key words: Fish consumption, food alternative, protein, stunting reduction, toddler

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Food consumption directly affects human growth. The consumption of food low in protein is one of the many factors causing malnutrition as well as growth and developmental delays. Fish contain high amounts of protein[1] and are an affordable source of protein to many people. According to fish production data from the Public Health Office, Province of Yogyakarta, Indonesia[2], it is estimated that the average availability of fish per capita is 20 kg year^{-1}. Locally, the availability of fish production per capita in Gunung Kidul is high. However, fish availability does not reflect the locals' consumption rates[2]. It is reported that 100 g of fresh fish contains 17.57 g of protein and 240 kcal of energy[3].

Diet is one of the factors commonly used to reduce stunting. The consumption of fish is believed to reduce stunting[4]. The reported yearly stunting rate in Saptosari, Gunung Kidul District, Province of Yogyakarta, Indonesia, is relatively high at 48.2%[5]. One of the causes of the high number of malnutrition cases is the lack of protein in diets. Fish consumption is a food alternative to overcome the problems of protein-related malnutrition, including stunting. Consuming fish is recommended for the optimization of growth and development in children[6].

Optimized and balanced nutritional intake is an important factor in achieving normal growth and determining the quality of human nutritional resources. Growth spurts in children comprise periods of sensitivity where malnutrition has a major impact on growth in the form of health disorders. Resources that promote prime health conditions, either physically or mentally, indicate the success of national development programs. Preparing the younger generation through health education at an early age has become a primary factor in improving human health[7]. Important factors for empowering a good quality of life are nutrition, education, information, technology and other public services. Among the factors mentioned, nutrition plays the most important role in children's growth and development[8].

It is expected that children who consume fish will obtain optimal growth and have improved nutritional status. Therefore, it is important to study fish consumption and its relation to children's height, which is measured during nutrition screenings for stunting in children who live in the region. This study was conducted to evaluate the relationship between fish consumption and the reduction of stunting in toddlers so that recommendations can be made based on the results of this study.

MATERIALS AND METHODS

This study is an observational analytic epidemiology study (cohort retrospective study). The data collected for the study contained two variables, namely, an independent variable (protein consumption) and a dependent variable (stunting reduction). The data were compiled retrospectively for the periods when the children were stunted or normal. This study was conducted in the Ngrenehan shoreline, Gunung Kidul, Yogyakarta, from March to June 2017.

The population of this study was children with a history of stunted growth that attended elementary schools in the Ngrenehan shoreline, Gunung Kidul District, Yogyakarta Province, Indonesia. Ninety-six children were included in the sample population, i.e., children who were newly enrolled in elementary schools that had parental consent were considered respondents in the study. Inclusion criteria were as follows: childhood anthropometry data from Integrated Health Services (*pos pelayanan terpadu*, *Posyandu*) was available, the student was newly enrolled in elementary school and existing data regarding the new elementary school students' height (*Tinggi Badan Anak Baru masuk Sekolah dasar*) was available. This study included 50 subjects from 96 eligible children. A simple random sampling technique was used to determine samples using a lottery for *Posyandu* records; 50 children were selected and included.

Data analysis: Univariate and bivariate analysis techniques were used. The univariate analysis was performed to describe the characteristics of each variable of the study, which included fish consumption and stunting reduction status. The bivariate analysis was performed to understand the relationship between the independent and dependent variables. A chi-square test was performed. The probability of 95% was used in all statistical analyses; therefore, $p<0.05$ was considered significant. All statistical tests were performed using SPSS software version 16.0 (SPPP Corporation Inc., USA).

RESULTS AND DISCUSSION

The study was conducted in Kanigoro, Saptosari, Gunungkidul District, Yogyakarta Province, Indonesia. The subjects involved in this study were 50 children. The data on age and sex of the subjects is shown in Table 1. The subjects ages ranged from 7-10 years, with a mean age of 8 years, accounting for 20 children (40%). Most subjects were male, accounting for 28 children (56%). It is important to note that

the onset of female sexual development is earlier than in males. Male sexual development usually occurs approximately two years later than females, so a height difference between male and female children was expected[9].

Table 1 shows the distribution of subjects based on fish consumption and stunting reduction status. Fish consumption was categorized into low and high consumption, while the variable of stunting status was categorized into reduction and no reduction. Table 2 shows 34 children (68%) of the 50 subjects who were categorized as high consumers of fish; 9 subjects showed no reduction in stunting and 25 subjects showed stunting. This study also revealed a significant relationship between fish consumption and the reduction of stunting through chi-square testing ($p<0.01$).

Table 2 shows that 25 children (73.5%) who consumed a high amount of fish experienced a reduction in stunting. This study found a tendency of children who consumed less fish to have a reduced height, which was categorized as having no reduction in stunting. This situation occurred in 11 children. A chi-square test with $\alpha = 0.05$ found a p-value of 0.011. These findings indicated a positive relationship between fish consumption and a reduction in stunting (height-for-age) with an odds ratio (OR) of 6.11 (95% confidence interval =1.299-16.761), which indicated that children with low fish consumption experienced stunting at a rate of six times higher than those with adequate fish consumption. This result was in agreement with that reported by Milman *et al.*[10], who stated that most children with a low consumption of fish have protein levels below the recommended dietary allowance and suffer from stunting ($p<0.001$).

Height-for-age reflects a child's linear growth. The stunted children's heights showed a level of protein consumption chronically below the recommended dietary allowance. Consuming less protein (macronutrients) and micronutrients (Fe, Zn, I and Ca) are some of the nutritional factors that contribute to stunting, as determined by basic health research[11]. Therefore, regulating a proper diet is important to prevent protein deficiency. This can be done through good parenting[11]. Protein is important for cell regeneration, fueling growth and development. Protein deficiency can cause growth and development abnormalities, affect nutritional status and contribute to stunting. The study also reported that consuming low amounts of protein led to an 8.6 times greater risk for children to suffer from stunting[12]. Fish are protein-rich foods that also contain minerals such as Fe, Zn, I and Ca. Stunting has become one of many indicators of a lack of micronutrients. Consuming fish will give the body more protein and micronutrients to help growth and development during childhood[13,14].

Among the many kinds of fish, pomfrets, tuna and milkfish are the most favorable for subjects to consume. Previous research has suggested that ocean fish contain higher Ca, Zn and Fe than lake fish. There was a moderate relationship found in this study between fish consumption and linear growth[15,16]. Consuming fish is also good for a child's growth and development in utero, while breastfeeding and as a toddler[14]. It was also reported that the fish consumption rate had no significant impact on children's growth at specified ages ($p = 0.035$)[17].

There were 11 subjects (68.8%) whose fish consumption was low and did not experience any reduction in stunting. This phenomenon could be caused by the local culture in which the local residents' livelihood is dependent on fishing;

Table 1: The distribution of subject characteristics based on age, sex, fish consumption and stunting reduction

Variables	No. of subjects (n)	Percentage
Age of subjects		
7	18	36
8	20	40
9	10	20
10	2	4
Sex		
Male	28	56
Female	22	44
Fish consumption		
Low	16	32
High	34	68
Stunting reduction		
No reduction	20	40
Reduction	30	60
Total	50	100

Table 2: Correlation between fish consumption and the reduction of stunting in toddlers in the region of Saptosari, Gunung Kidul District, Yogyakarta Province, Indonesia

	Stunting reduction							
	No reduction		Reduction		Total			
Fish consumption	No.	Percentage	No.	Percentage	No.	Percentage	p-value	OR (odds ratio)
Low	11	68.8	5	31.2	16	100	0.011	6.11 (1.66-22.49)
High	9	26.5	25	73.5	34	100		
Total	20	40.0	30	60.0	50	100		

n: Number of subjects

however, they sell the fish to the market and do not use it for their own consumption. There was also a belief in the local community that children who consumed fish would contract worms. Fish are animal protein sources that should be included in their daily diet and are needed for growth development. Protein-based food such as fish prevent chronic malnutrition in regions that heavily depend on fishing. There is an increase in national fish consumption, with 22.0 kg per capita consumed per year[2]. Protein intake affects human growth and development and positively affects the human body[18,19].

The positive role of fish in children's cognitive development is in agreement with results reported by Kusuma[20]. The protein contained in fish is needed to assist growth and development. Fish also contain 1-20% fat, most of which is unsaturated fat that is easily digested, can be used by the body directly and are important for the body. Ocean fish contain unsaturated fatty acids omega-3, EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid), which are good for cell regeneration, the brain and eyes. Ocean fish also contain minerals that are good for growth and development in the growing fetus[21].

It is important to understand stunting to prevent unwanted health risks at a later age. This theory is in line with the study conducted by Victora *et al.*[22], who demonstrated that consuming protein from fish was able to reduce stunting and other malnutrition outcomes in Cambodia. The study also reported that protein in meat and dairy products had positive effects on the reduction of stunting[23]. This study used 6209 subjects between 12-59 months of age. There was also a positive relationship between fish consumption and reduction in stunting. The results of this study showed that stunted and malnourished children consume less animal protein than healthy children. However, vegetable protein consumption was higher than that in healthy children[24]. Due to the positive relationship between fish consumption and the reduction in stunting, it is highly recommended for respondents and societies to consume fish, which can be considered as a local food alternative.

CONCLUSION

There is a positive relationship between fish consumption and stunting reduction ($p = 0.011$). Toddlers who consumed less fish were more likely to experience stunting. Results indicated that children with low fish consumption experienced stunting at a rate of six times higher than those with adequate fish consumption.

SIGNIFICANCE STATEMENT

This study discovers a food alternative for the reduction in stunting by increasing the consumption of fish that are rich in protein, which is needed for the development of cells and normal human growth. This study will help government and health practitioners to assist communities in combating stunting using fish-based food.

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