Comparison of Height, Body Mass Index, and Nutrient Adequacy Ratio of the Nutritional Status of School-Age Children in Coastal and Non-Coastal Areas in Aceh

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Abstract: Nutrition is one of the most common issues in several developing countries including Indonesia, which is currently facing malnutrition. Indonesian's coastal and non-coastal areas have different environments which lead to differences in commodities and types of food affecting children's nutrition. This study aimed to assess the nutritional status of school-age children based on height, bodymassindex, and nutrient adequacy ratio in coastal and non-coastal areas in Aceh. The study used a descriptive comparative research design, with a population of 226 children. A representative sample of 98 school-age children (49 from each area) was selected by using the simple random sampling technique. The instrument of data collection was the Food Recall 24 Hour. The methods employed were interview, and weight and height measurement forms. The data were analyzed by using independent sample *t*-test. The results indicated that there were no differences either in nutritional status of school-age children incoastal and non-coastal areas ($\rho = .156$), in height ($\rho = .155$), in body mass index ($\rho = .064$), or in nutrient adequacy ratio ($\rho = .188$). It is suggested that the Health Office pay more attention to and evaluate nutrition programs of school-age children at the puskesmas level to improve the promotion of healthy living community movement in coastal and non-coastal areas so that they are more aware of good nutrition, and also to provide training in the use of nutritious food sources within the areas.

1 INTRODUCTION

Nutrition is one of the essential factors determining the level of health and balance of one's physical and mental development. In the case of a child's growth and development, nutritional adequacy is a crucial issue that parents should pay close attention to (Suryanto & Restuastuti, 2016). Nutritional problems in elementary school children are still relatively high. The World Health Organization (2014) reported that in 2013, 17% (98 million) of children in developing countries experienced malnutrition, with the highest prevalence of 35.7% was stunting in the Asian region. Indonesia, in fact, is included in the five categories in the world in terms of the number of stunting in children. One in three (37.2%) Indonesian children, approximately, suffered from stunting (World Food Programme, 2014). The Basic Health Research (2013) found that the prevalence of stunting in children aged 5-12 years was 30.7%, malnutrition based on body mass index (BMI) was 11.2%, and obesity categorized as high with an incidence of 18.8%. In the case of malnutrition, Aceh Province, Indonesia, ranked seventh with a prevalence of 26.3% (Basic Health Research, 2013).

The nutritional problems occuring in the community are closely related to environmental aspects as they have the largest impact on the level of public health, such as differences in the types of commodities, food produced and food available in the environment (Umi, 2005). Malnutrition can be triggered by several factors including food intake, patterns of health care, and parenting (Burchi, 2012; Meriska, 2014).

Based on the geographical condition, people in coastal areas are very likely to consume more animal protein sources from the sea such as fish and clams. In contrast, most rural people tend to consume more

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carbohydrate and vegetable protein sources (Hamidah, Sartono, & Kusuma, 2017). A study by Umi (2005) revealed that the level of energy intake of children in coastal areas and mountainous areas was significantly different (p = .05); the intake was higher in coastal areas than in mountainous areas. The level of energy intake of children in coastal areas was quite fulfilled (77.09%) while that in mountainous areas was fairly sufficient (51.43%). On the other hand, the level of protein intake of children in coastal areas and mountainous areas was significantly different, in which the intake was better in coastal areas. Further, Hamidah's study (2016) on the differences in consumption patterns of protein-based foods in coastal areas, low landsand highlands concluded that there were differences in terms of diversity, frequency, and amount of food consumed by families within the three areas.

Children who experience malnutritionare highly likely to grow small, thin, and short. Poor nutrition will have an adverse impact on the children's cognitive ability or intelligence, and decline the productivity of the children's performance in everyday life (Indonesian Ministry of Health, 2014). There should be efforts taken to increase the availability of quality food to help improve the children's nutrition (Almatsier, 2009).

Pidie is one of the districts in the Aceh Province, ranked second after East Aceh for people with malnutrition. The number of children suffering from malnutrition reached 32 cases and the number of malnourished patients reached 488 people (Bakri, 2015). Data on Pidie District Nutrition Status Monitoring Report (2014) showed that the prevalence of short stature children was 30.8% and very short stature of 8.35%, within the work area of Muara Tiga Puskesmas (community health center). There was also an increase in the prevalence of stunting among infants from 2013 to 2014 (Ariyanti, 2015).

Nutritional deficiencies in school-age children will result in a long-term effect until adulthood, such as growth failure, if parents neglect the patterns of feeding with insufficient nutritional values. Therefore, the District Health Office should concern more on the nutritional problems of school-age children in order for the community to have more awareness in evaluating the nutrition of these children.

The preliminary study has shown that there were children aged 6-12 years with low body weight in the coastal areas in Pidie District. To make ends meet, the local people have been working as fishermen. 85% of the children stated that they consumed rice and fish obtained from fishing daily, often consumed processed salted fish, rarely ate fruits, and only had common side dishes brought by their parents. Every week the children would be served with vegetables such as kale, corn, potatoes, spinach, mustard greens, and eggplants, and during their parents fishing periods, they would prepare their own meals. In non-coastal areas in Pidie District, on the contrary, the people's livelihoods included paddy farming, livestock farming, and vegetable gardening as these areas are far from urban or shopping centers. There were also children aged 6-12 years who were underweight. The results of interviews showed that out of 10 children, 80% of of them mentioned that every day they would consume rice and processed foods from their parents' gardening, including side dishes (i.e., vegetable beans, beans, eggplants, melinjo leaves, melinjo fruit, sweet potato leaves, bananas, kale, mustard greens, spinach, gambas fruit, pumpkin, lime leaves, celery, reed starfruit, fern leaves, papaya leaves, mustard leaves, coconuts, and peanut shells), and fruit (i.e., papaya, cucumber, banana, mango, guava, and watermelon).

From the aforementioned findings, it can be further stated that there is a difference in the daily consumption of children either in coastal or non-coastal areas. As such, community nurses need to make efforts to improve community nutrition through a socio-cultural approach towards the eating culture of coastal and non-coastal communities, one of which is by organizing the Family Nutrition Awareness Program (KADARZI). The approach that may be taken is by teaching families on the nutritional values of food (i.e., contents of proteins, calories, and carbohydrates), and by teaching families in the preparation of healthy and balanced diets from any potential food within the coastal and non-coastal areas. With the involvement of parents, Puskesmas, cadres Posyandu, cadres of nutrition health, and PKK (Family Welfare Empowerment) women, there should be a significant impact in achieving good nutrition for children.

The differences in food commodities and types have made it obvious that there is an influence of the quality or quantity of nutrition in food dishes consumed by children, especially on children's physical growth. Therefore, the study sought to assess the nutritional status of school-age children incoastal and non-coastal areas, by comparing their height, body mass index (BMI), and nutrient adequacy ratio.

2 METHODS

This study employed a comparative research design intending to obtain differences in the nutritional status of school-age children in coastal and non-coastal areas. Population in this study were 226 children aged 6-12 years living in one village, Sigli Sub-district and one village, Mutiara Sub-district, in Pidie District, Aceh Province. A representative sample of 98 children, with 49 children selected in each village, was taken by using the simple random sampling (lottery) technique.

The measuring instruments used included a Food Recall 24 Hour form, a height gauge of Gea Medical Brand microtoise with a capacity of 200 cm, and a weight gauge with a tread needle scale of Gea Medical Brand with a capacity of 120 kg. The scale has been calibrated in the Metrology UPTD (regional technical implementation unit) of Banda Aceh City.

Data collection was conducted from July 16 to 23, 2018, after receiving permission for research at both sites. The selected respondents were given an explanation of the procedural research and also the informed consent to be signed by both the respondents and their families/guardians prior to data collection. Data on height and BMI were obtained from direct measurements on the respondents, which then calculated by using the *Z*-score of the 2005 WHO Anthroplus application. Meanwhile, the nutrient adequacy ratios was gained from the interviews with Food Recall 24 Hour, and were later measured for energy and protein adequacy ratios. The calculation of the nutrient adequacy ratios were manually referred to the Food Composition List to consult for the contents of the nutritional values and weights of food in each food consumed by children. Appropriate univariate and bivariate analyses (independent sample *t*-test) were conducted in the data analysis.

3 FINDINGS

3.1 Demographic Characteristics

The characteristics of the respondents are described in table 1. The average age of primary school children in coastal areas was 9 years and 9 months old while that in non-coastal areas was 8 years and 8 months old. However, in terms of birth weight, the respondents of both areas had a relatively similar weight of 3kg. The average respondents' education in coastal areas was Grade 4 while that in non-coastal areas was Grade 2. Further, both coastal and non-coastal areas were predominantly females. For the past three years, the children in coastal and non-coastal areas were mosly had a history of fever. In terms of parents' livelihoods, in coastal areas, the fathers have been working as fishermen and the mothers as housewives, whereas in non-coastal areas, both fathers and mothers were farmers. The parents living in coastal and non-coastal areas had generally primary school educational background, with the average family income under the Aceh government's minimum wage (Rp. 2,700,000).

3.2 Nutritional Status of Children in Coastal and Non-Coastal Areas

The nutritional status of the respondents in coastal and non-coastal areas is depicted in Table 2. The table shows that the nutritional status of school-age children in these two areas was mostly categorized as malnourished, in which 25 (51%) respondents in coastal areas had an average nutritional value of 176 (SD 52.33) while in non-coastal areas, 28 (57.1%) respondents had an average nutrition of 159 (SD 62.95).

3.3 Height-based Nutritional Status

Therespondents'nutritional status based on height in coastal and non-coastal areas is shown in Table 2. Overall, the nutritional status of school-age children in both areas was generally in the normal stature category, where in 40 (81.6%) respondents in coastal areas had an average *z*-score of -1.24 (SD 1.014) and 31 (63.3%) respondents in non-coastal areas had an average *z*-score of 1.50 (SD 1.091).

3.4 Body Mass Index of Children in Coastal and Non-Coastal Areas

Table 2 provides BMI of the respondents in coastal and non-coastal areas, in which the BMI was mostly normal in both areas, with 43 (87.8%) respondents in coastal areas had an average *z*-score of -.37 (SD 1.183) and 30 (61.2%) respondents in non-coastal areas of -.64 (SD 1.908).

3.5 Nutritient Adequacy Ratio of Children in Coastal and Non-Coastal Areas

Figures on the nutrient adequacy ratios of the respondents in coastal and non-coastal areas are

reported in Table 2. In general, the nutritional status of school-age children based on the nutrient adequacy ratios was low in both areas, with 25 (51%) respondents had an average value of 177 (SD 52.18) in coastal areas and 27 (55.1%) respondents had an average of 162 (SD 64.26) in non-coastal areas.

Table 1. Demographic characteristics of school-age children incoastal and non-coastal areas (n=98).

Demography	Coastal area (n=49)	Non-coastal area (n=49)
Children		
Age, mean (SD)	9.11 (1.79)	8.60 (1.70)
Birth Weight, mean (SD)	3:00 (.48)	3:00 (.75)
Sex, f (%)		
Boys	23 (47)	21 (43)
Girls	26 (53)	28 (57)
Current Education, f (%)		
Grade 1 of elementary school	7 (14.3)	6 (12.2)
Grade 2 of elementary school	6 (12.2)	13 (26.5)
Grade 3 of elementary school	6 (12.2)	10 (20.4)
Grade 4 of elementary school	11 (22.4)	2 (4.1)
Grade 5 of elementary school	7 (14.3)	9 (18.4)
Grade 6 of elementary school	12 (24.5)	9 (18.4)
History of Diseases, f (%)		
Fever	46 (94)	46 (94)
Itchiness	1 (2)	0(0)
Urinary tract infection	1 (2)	0(0)
Polyp	1 (2)	0(0)
Down syndrome	0(0)	1 (2)
Asthma	0(0)	1 (2)
Fracture	0(0)	1 (2)
Father's occupation, f (%)		
Fisherman	33 (67)	0(0)
Farmer	0(0)	35 (72)
Trader	9 (19)	2 (4)
Civil Servant	3 (6)	1 (2)
Entrepreneur	4 (8)	11 (22)
Mother's Occupation, f (%)		
Housewife	35 (72)	17 (35)
Farmer	0(0)	28 (57)
Weaver	6 (12)	0(0)
Trader	6 (12)	0(0)
Labor	2 (4)	0(0)
Entrepreneur	0(0)	3 (6)
Teacher	0(0)	1 (2)
Father's Education, f (%)		
Primary	37 (76)	39 (80)
Secondary	11 (22)	10 (20)
Higher Education	1 (2)	
Mother’s Education, f (%)		
Primary	33 (67)	33 (67)
Secondary	14 (29)	14 (29)
Higher Education	2 (4)	2 (4)
Parent Income, f (%)		
Under Aceh minimum rate	48 (98)	49 (100)
Above Aceh minimum rate	1 (2)	0(0)

3.6 Comparison of the Nutritional Status of School-Age Children inCoastal and Non-Coastal Areas

Table 3 summarizes the comparison of the nutritional status of school-age children in coastal and non-coastal areas. The table shows that there were no significant differences between the nutritional status (*p*-value = .156), between height (*p*-value = .155), between BMI (*p*-value = .064), and between nutrient adequacy ratios (*p*-value = .188) of school-age children in both areas.

Table 2. Nutritional status, height, body mass index, nutrient adequacy ratio of school-age children in coastal and non-coastal areas (n=98).

Variables	Percentage	Mean	SD
Nutritional Status			
Coastal areas			
Good	49	176.1	52.33
Poor	51		
Non-coastal areas			
Good	42.9	159.3	62.95
Poor	57.1		
Height			
Coastal areas			
Normal	81.6	1.27	1.014
Short	18.4		
Non-coastal areas			
Normal	63.3		
Short	36.7	1.57	1.091
Body Mass Index			
Coastal areas			
Normal	87.8	-.40	1.183
Thin	4.1		
Very thin	2.0		
Fat	4.1		
Obese	2.0		
Non-coastal areas			
Normal	61.2	-1.00	1.908
Thin	12.2		
Very thin	16.3		
Fat	6.1		
Obese	4.1		
Nutrient Adequacy Ratio			
Coastal areas			
Normal	26.5	177.6	52.58
Low	51.0		
High	22.4		
Non-coastal areas			
Normal	42.9	162.0	64.26
Low	55.1		
High	2.0		

Table 3. Comparison of nutritional status of school-age children in coastal and non-coastal areas (n=98).

Measure Results	Mean	95% CI		*Sig. (2-tailed)*
		Lower	Upper	
Nutritional Status				
Coast	176.1	-6.5	39.9	.156
Non-coast	159.3			
Height				
Coast	-1.3	-.1	.7	.155
Non-coast	-1.6			
Body Mass Index				
Coast	-.4	-.4	1.2	.064
Non-coast	-1.0			
Nutrient Adequacy Ratio				
Coast	177.6	-7.8	39.2	.188
Non-coast	162.0			

4 DISCUSSION

Nutrition is the key pillar of health and well-being throughout one's life cycle (Rohaedi, Julia& Gunawan, 2014). Therefore, nutritional deficiencies may yield to growth and development failures which can continue into adulthood if not addressed early (Rahmad, 2017). To determine one's good nutritional status, the availability of nutrients in the body cells should be in sufficient amount. In principle, however, one's nutritional status is directly affected by food consumption and disease infection (Saputri, 2010).

Further, mother's knowledge of nutritional intake and parenting methods are also closely related to maternal education and food habits in the family and community. The demography of this present study reported that the family heads worked either as fishermen or farmers with the income below the minimum wage of Aceh workers. In addition, the average maternal education in these two areas was elementary school education, making it understandable that the awareness of mothers in the maintenance and modification of food concerning its nutritional values was very lacking, which subsequently had an impact on their children's nutrition.

Adequacy of nutrient intake plays a crucial role in children's nutritional needs. The role of mothers and parenting is influential in achieving proper children' nutrition. Engle, Menon & Hadad (1997 in Pratiwi, 2016) emphasize that three important components, food, health, and psychosocial stimuli, significantly contribute to the optimal growth of children. At the basic stage, food is highly necessary as it is the main element in the formation of children's nutrition, allowing them to grow properly according to their age. This is in line with the research conducted by Nti and Lartey (2007) on the effect of nutritional status care practices on children in Ghanaian on 100 mothers of infants aged 6-12 months. Their results indicated that care givers who practiced better nutritional care would have children with good nutritional status. Another study by Isnida (2016) concerning the relationship of socio-demographic factors to the nutritional status of children of SD Negeri 1 South Pringsewu found that there was a relationship between maternal education level (p-value < .001), father's type of work (p-value < .001), and family income level (p-value < .001) with the children's nutritional status.

In this study, however, there was no difference in the nutritional status of school-age children in coastal and non-coastal coastal areas. It is highly likely that low proportion of children's nutrition overall with a difference of 4.1%, normal body mass index with a difference of 26.6%, normal stature height with a difference of 18.3%, and low nutrient adequacy ratios in average with a difference of 2.1% have caused no signicant difference between two studied areas. The low average of energy and protein intake in children's food consumption have led to the lack of children's nutritional status in coastal and non-coastal areas. The findings of this study have suggested that the low average of children's nutrition in the two areas may create a risk in the children's long-term growth and development.A slightly similar study by Aulia (2015) on the nutritional status profile of children based on the topography of the residential area of Jepara District,

surveying 30 coastal-area toddlers and 30 hillside toddlers, also claimed that there was no difference in the nutritional status (*p*-value = . 59), energy consumption level (*p*-value = .51), energy efficiency level (*p*-value = .25), and the availability level of (*p*-value = .02) between the coastal area and the hillside.

As nutrition is important in balancing children's physical and mental development, parents should be more attentive to their children during parenting (Ningsih, Suryanto & Restuastuti, 2016). Differences in geographical environments will also lead to differences in children's growth and development, particularly in height. A child's height is influenced not only by genetic traits, but also by environmental factors. Sindiaga (2008) studied the children's height in terms of genetic and environmental factors within the Batak Toba tribe with a sample of 100 children in rural areas and 100 in urban areas aged 8-10 years. His study showed that the rural children's height was more correlated with the fathers' genetic factors while that in urban areas was more correlated with child feeding.

In this study, however, there was no difference between the nutritional status of school-age children with their height in both areas. The study found that the nutritional status was equally normal, with a slight difference of 18.3%, in the two areas. The anthropometric measurements reported that the school-age children in coastal areas had an average height of 126.7 cm while that in non-coastal area of 123.11 cm, indicating that the two regions had an ideal height and thus, the children did not experience a difference in their nutritional status. Additionally, the children's birth weight had an average of 3 kg in both regions, and the normal growth of height inschool-age children in the two areas was closely related to the parents' height. It was observed during data collection that the average height of families accompanying the respondents was generally in good stature, suggesting that their children's would also be alike in the future.

In terms of the energy adequacy level consumed by children, the coastal areas had an average of 65.3% while the non-coastal areas of 65.7%. Despite being under the nutritional needs standard, some children showed good energy intake which helped them to burn the calories during activities and to optimize their growth. Likewise, in terms of the protein content, the children of the coastal areas had an average protein of 114.5% and non-coastal areas of 95.14%. Such a better protein intake also contributes highly in developing the muscle cells and body tissues, in repairing tissue damage, and in maintaining a proper body height of children. Sufficient nutrition will gradually improve the growth and development of children; therefore, malnourished children tend to grow small, thin and short. Poor nutrition in children will also result in the low cognitive ability or intelligence and decline the children's productivity (Indonesian Ministry of Health, 2014).

Malnutrition can occur due to a number of factors, one of which is the lack of nutrient intake and quality food (i.e., varied, as needed, clean, and safe) consumed by children (Oktavia & Widajanti, 2017; Indonesian Ministry of Health, 2010).Changesin nutritional status can take place because of a change (increase or decrease) in b ody weight, a consequence of the knowledge and attention f parents to nutritional problems. According to Almatsier (2003), food consumption is influenced by two external factors: food provided by the family and the family purchasing ability of food. If the food consumed meets adequate quantity and quality, a good health status will be yielded. Parents, especially mothers, should be good at selecting quality food for their children to consume (Soegeng, 2009). Children needs for energy and protein are relatively larger than adults because children experience rapid growth and development (Auliya, 2015). Almatsier (2001) explains that the lack of energy can cause children's body to experience a negative balance, resulting in the body weight to be lower than the ideal standard, and the lack of protein intake can greatly affect children's nutrition, causing the body tissues to get easily damaged.

In this present study, the total number of nutrient adequacy ratios for children in coastal and non-coastal areas were low, in which the coastal and non-coastal children had a gap of 2.1%. The inadequacies could be seen from the lack of children's energy adequacy of 6.1% between two areas, and the average consumption of protein needs of 55.1% in coastal areas and of 36.7% in non-coastal areas, yielding to a drop in the nutritional status of children.

Brown and Isaacs (2014) argue that eating behavior and food choices of school-age children are strongly affected by parents and siblings as parents are usually responsible for the types, the time, and the amount of meals provided at home.

Nutritional status is a state of body that describes food intake and uses of nutrients, wherein nutrients are needed as the source of energy, growth, and maintenance of body tissues (Almatsier, 2003). School-age children, between the ages of 4-12, require an average calorie of energy between 1,600-

2,100 kcal and an average protein of 35-56gr (Widya Karya Pangan Nasional dan Gizi, 2004). The consumption patterns will determine the qualitative and quantitative aspects of the amount of nutrients consumed.

The people in the coastal areas who are mostly fishermen are more inclined to consume animal protein food from the sea, whereas the people in hilly areas (uplands), most of which are farmers, have a tendency to eat vegetable protein food sources. The difference in the types of these commodities has led to differences in the types and amounts of food commonly consumed daily (Khomsan, 2006).

A person's nutritional status can be seen from what is consumed and how the food pattern is. If the diets are proper and correct, the nutritional status will turn out to be well, and vice versa. Nutrition is further associated with one's economic potential because nutrition is related to brain development, learning ability, and child labor productivity (Almatsier, 2010).

In terms of the nutritional intake, this study found that children in coastal and non-coastal areas had low energy intake with a 6.1% difference. Further, the average consumption of protein was 55.1% in coastal areas and 36.7% in non-coastal areas. The analysis showed that there was no difference in the status of school-age children in the two areas. The finding suggested that both coastal and non-coastal areas have had considerably similar characteristics, i.e., types of food (carbohydrate, protein, fat, and energy) consumed by the children, as evidenced from Food Recall assessment form. The form described that the children in both studied sites consumed almost the same food, such as rice (fried, savory, and steam), mackerel tuna, milkfish, shrimp, bread, vegetables, fried noodles, rice cake, sponge cake, and snacks. These foods were quite similar, and therefore, the impact was relatively the same in spite of differences in location, frequency of food intake, childhood history of illnesses, parental work, and parental education.

Parental income was another influencing factor in the absence of nutritional adequacy differences between children in coastal and non-coastal areas. Due to low wages, the fishermen and farmers preferred selling raw materials gained from fishing and gardening to processing them for their families; thus, preventing their children to attain better energy and protein intake. Research by Khayati (2011) and Lutviana (2010) conformed to this finding that more toddlers (8%) in fisherman families had poor nutritional status than those (4.2%) in farmer families since the toddlers in fishermen families had much lower levels of energy and protein (9% and 12%) deficiency compared to those (4.2% and 1.4%) in farmer families.

5 CONCLUSION

The study concluded that there were no differences in the nutritional status, in height, in body mass index, and also in the nutrient adequacy ratio of school-age children (6-12 years) in the coastal and non-coastal areas in Aceh, Indonesia.

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