THE ASSOCIATION OF WATER, SANITATION, AND HYGIENE WITH HEIGHT-FOR-AGE Z-SCORES OF CHILDREN AGED 24-59 MONTHS LIVING BY DOWNSTREAM OF RIVER

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ABSTRACT

The low height-for-age can prevent children reaching their physical and cognitive potential. It is usually associated with poverty, chronic or recurrent undernutrition, poor maternal health, environment and nutrition. The downstream area of the river has a small slope characteristic and is used for various human activities such as source of household's water and food, sanitation, and many others. This study aimed to determine association of Water, Sanitation, and Hygiene (WaSH) and nutritional status (height-for-age z-scores) of children aged 24-59 Months Living by Downstream of Kuantan River. Cross sectional study was conducted among 72 children aged 24-59 months living by the downstream area. The height-for-age z-scores (HAZ Score) dan Weight-for-age z-score (WAZ Score) was assessed by anthropometric measurement while WaSH were measured by interview with their parents as well as observations of the household environment. The means of HAZ dan WAZ score were -1.1 ± 1.09 and -1.23±1.06 respectively. Lower HAZ scores were found in households that have inadequate water sources, unimproved sanitation and washing hands with soap after defecating (-1.41 vs -1.02; -1.78vs-1.04; -1.14 vs -1.08). Although descriptively WaSH may be a risk factor associated with the HAZ score, but statistically they are are not significant. WAZ score were correlated with HAZ Score (pvalue 0.001; r=0.58). Environmental conditions around the river can have an impact on children's health. Even though statistically WaSH is not related to HAZ scores, it is necessary to consider the potential for all three to become risk factors because the gap between groups is quite large.

Keywords : Children, HAZ score, River, Stunting, WaSH

Introduction

Growth is a key element of a children's health. The growth of all children should be monitored regularly, especially during the first months of life[1]. Growth failing which causes stunting, reflects the occurrence of inadequate intake and chronic and recurrent infectious diseases[2,3]. The impact of impaired growth in children's height can have short, medium and long-term consequences. In the short term, stunting can increase morbidity and mortality from infectious diseases, especially pneumonia and diarrhoea [4,5]. The medium-term impact of height growth disorders is related to child development such as cognitive abilities, education and child behavior[4,6].

In the long term, children who experience impaired growth early in life have a risk of developing hypertension, cardiovascular disease, and type 2 diabetes, especially in children who gain weight very quickly and become obese after they are 2 years old[4,7].

Child growth standards can be seen in two forms : using the Z-score table from the ministry of health which refers to WHO and through the child growth Z-score chart[8]. *Heigh of age z score* (*HAZ Score*) or *Length for age Z Score (LAZ score)* is a standardization of children's height using WHO growth standards. By standardizing height, a person obtains a height measurement that is independent of age and gender. A decrease in the HAZ score indicates growth disturbance from time to time[9]. The average LAZ (length for age Z score) of newborns in developing countries is -0.5 and may continue to decline until it reaches -2.0 at the age of 18-24 months[10]. However, the growth faltering of children's height can continue to occur after the age of 24 months where socio-economic influences[11,12], parental education and the household environment such as the use of a latrine or toilet have a big effect on the age of 24-59 months[12,13].

Nutritional factors and recurrent infectious diseases are the main determinants of stunting. Children's nutritional intake must meet their needs, both macronutrients and micronutrients. to meet the nutritional adequacy rates for children, parents must pay attention to their children's food intake, both in quantity and diversity. Apart from nutritional factors, water, sanitation and hygiene (WaSH) can be determinant factors for stunting incidents [14,15]. This is closely related to the risk of recurrent infectious diseases in children. Inadequate availability of clean water, poor sanitation and hygiene can cause the risk of children experiencing diarrhea, Soil-transmitted helminth (STH) and environmental enteropathy which leads to the incidence of stunting [16].

Children living in watersheds are a vulnerable group experiencing the adverse effects of an unhealthy environment both physically and behaviorly. River pollution often caused waterborne diseases in developing country. Water pollution in Indonesia is generated from household and municipal discarding of sewage, industrial waste and agricultural run-off [17]. Research shows an increase in the concentration of water pollutants in upstream to downstream areas [17-20]. This is due to activities that cause water pollution to accumulate in the downstream parts of the river. This study aimed to determine association of Water, Sanitation, and Hygiene (WaSH) and nutritional status (height-for-age z-scores) of Children Aged 24-59 Months Living by Downstream of Kuantan River.

Methods

Cross sectional study was conducted among 72 children aged 24-59 Months who lives by the downstream area. The study was developed in downstream area of Kuantan River, Kuantan Singingi, Riau Province. The height-for-age z-scores (HAZ Score) and Weight-for-age z-score (WAZ Score) was assessed by anthropometric measurement while water, sanitation and hygiene

were measured by interview with their parents as well as observations of the household environment. Height measurement using a stadiometer with the brand and type SAGA AU AL-01, weight measurement using the OMRON HN-286 digital body weight scale. This study was approved by The Research and Community Engagement Ethical Committee Faculty Of Public Health Universitas Indonesia No: Ket- 572/UN2.F10.D11/PPM.00.02/2022. The characteristics of children were expressed as a median, minimum and maximum, mean, standard deviation and proportions, depending on the data type. The Independent t-test was used for comparisons and Pearson correlation was used for correlation between groups.

Results

The means of HAZ dan WAZ score were -1.1 ± 1.09 and -0.983±1.06 respectively. Based on Peraturan Menteri Kesehatan Republik Indonesia No 2 Tahun 2020, HAZ Score < -3 SD is categorized as severely stunted and - 3 SD to < - 2 SD is categorized as stunted. In this study, it was found that 13 children had a HAZ score <-2 SD, consisting of 3 respondents were severely stunted and 10 children were stunted. The group of stunted and severely stunted children can be seen in Figure 1 in the red bar. Meanwhile, the normal child's height category can be seen in the blue bar. The characteristics of respondents were described in Table.1
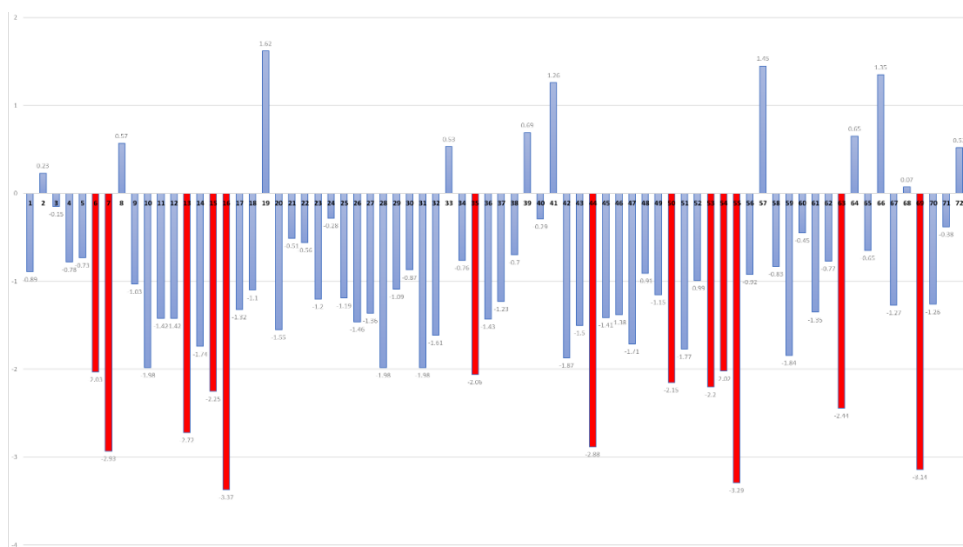

Figure.1 The distribution of HAZ scores in children aged 24-59 months years

Regarding the sociodemographic factors, 52,8% children were male, Number of Household Members were 5 person (34.7%) and mother's education was high school (50%). The mean age of children was 37 ± 8.03 months and the median (min-max) age of mothers was 32; 22 – 47 years. The mean height of mother was 154 ± 4.23 cm (Table 1).

Access to drinking water is grouped adequate and inadequate water sources. Meanwhile, sanitation is grouped into improved (safe and adequate alone) and unimproved (open defecation and use of shared latrines). This grouping is based on indicators of access to drinking water and sanitation by Badan Perencanaan Pembangunan Nasional (BAPPENAS) / The Ministry of National Development Planning. The research results showed that most drinking water access was categorized as adequate (77.8%) and improved sanitation (91.7%). Hygiene is seen from the mother's habit of washing her hands with soap. Most mothers had performed handwashing with soap when changing their child's diaper (100%), after defecating (59.7%), before eating (75%), before breastfeeding their child (73.6%), and before preparing food (70.8%) (Table 1).

Table 1. Descriptive analysis of study variables

Karakteristik Responden	Frekuensi (n=72)	Persentase (%)
Sex		
Male	38	52.8
Female	34	47.2
Number of persons in household		
3 Orang	11	15.3
4 Orang	24	33.3
5 Orang	25	34.7
6 Orang	9	12.5
7 Orang	2	2.8
8 Orang	1	1.4
Mother's formal education		
Elementary school	3	4.2
Junior high school	13	18.1
Senior high school	36	50.0
Bachelor	20	27.8
Adequate water sources	56	77.8
Improved Sanitation	66	91.7
Handwashing with soap after cleaning child stools	72	100
Handwashing with soap after defecation	43	59.7
Handwashing with soap before eating	54	75
Handwashing with soap before breastfeeding	53	73.6
Handwashing with soap before preparing food	51	70.8
Height-for-age z-scores (HAZ Score)	-1.1 ± 1.09	
Weight-for-age z-score (WAZ Score)	-0.983 ± 1.06	
Child's age in (month) (mean ± sd)	37 ± 8.03	
Mother's age (year) (median, min-max)	32; 22 - 47	
Mother's height (cm)	154 ± 4.23	

The comparison of HAZ scores on access to drinking water, sanitation and hygiene can be seen in Table 2. Lower HAZ scores was found in households that have inadequate water sources, unimproved sanitation and washing hands with soap after defecating (-1.41 vs -1.02; -1.78vs-1.04; -1.14 vs -1.08). Although descriptively WaSH may be a risk factor associated with the HAZ score, but statistically the three are not significant. We also conducted statistical analysis to find the correlation of other factors that might be related to the HAZ score, such as the WAZ score, the child's age, and the mother's height. Only WAZ score had correlation with HAZ score (pvalue = 0.001; r=0.58) (Figure 1).

Table 2 The Association of Water, Sanitation, dan Hygiene with Height-for-age z-scores

| Water, Sanitation, dan Hygiene	n	mean±sd	Pvalue
Access to household drinking water			0.211
Adequate water sources	56	-1.02±1.15	
Inadequate water sources	16	-1.41±0.82	
Sanitation			
Improved sanitation	66	-1.04±1.12	0.113
Unimproved sanitation	6	-1.78±0.32	
Handwashing with soap after cleaning child stools			-
No	0		
Yes	72	-1.1±1.09	
Handwashing with soap after defecation			
No	29	-1.14±1.02	0.809
Yes	43	-1.08±1.15	
Handwashing with soap before eating			
No	18	-0.84±1.21	0.245
Yes	54	-1.10±1/05	
Handwashing with soap before breastfeeding			
No	19	-0.79±1.19	0.142
Yes	53	-1.22±1.04	
Handwashing with soap before preparing food			
No	21	-0.75±1.15	0.082
Yes	51	-1.25±1/05	

a)

b)

c)
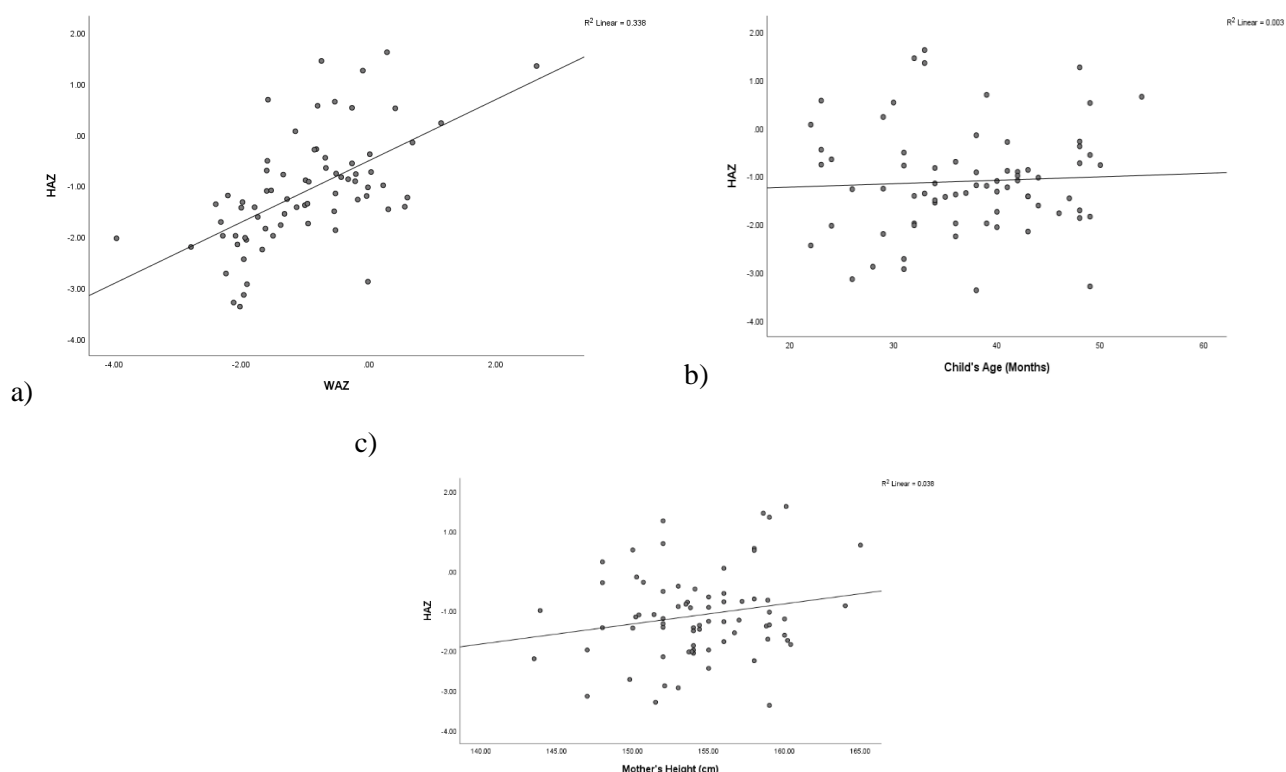
Figure. 1 Correlation between WAZ score (a), child's age (b), and mother's height (c) with HAZ score

Discussion

Average Height of age z score (HAZ Score) or Length for age Z Score (LAZscore) is a standardization of children's height using WHO growth standards. By standardizing height, a

person obtains a height measurement that is independent of age and gender. According to PMK No 2, 2020 (8) concerning child anthropometric standards, HAZ score <-3 SD is grouped as very short (severely stunted), - 3 SD to <-2 SD is grouped as stunted, -2 SD to +3 SD is normal and > +3 SD is included in the high category. Analysis of IFLS (Indonesia Family Life Survey) data 1993, 2000, 2007 and 2014 shows that the average HAZ score for children under five in Indonesia was -1.36. Based on age group, the average HAZ score is lower in children aged 24 – 59 months was -1.75 compared to the 0-23 month age group was -1.19 [21]. When compared with previous research, the average HAZ score in this study was higher (1.1).

Water is an essential need for human life. Individuals and households may be impacted by varying degrees of access to adequate water and sanitation through a variety of processes or disease transmission pathways[22]. Water needs must be met in terms of water sources, sufficient quantity, supply protection, and water storage. The research results show that the average HAZ score was lower in families that have inadequate water sources (-1.41±0.82 vs -1.02±1.15), although not statistically significant (pvalue 0.211). The results of this study are in line with other research, that improved water and boiled or filtered drinking water are positively related to the HAZ score in children, which means that the better quality of drinking water, the better the child's HAZ score [23, 24].

Sanitation is critical for health, from infection prevention to enhancing and sustaining mental and social well-being. The lack of safe sanitation leads to infection and diseases including diarrhoea, neglected tropical diseases, and vector-borne diseases[25]. In this study, improved sanitation had a better HAZ score compared to unimproved sanitation (-1.04±1.12 vs -1.78±0.32), but statistically not significant (pvalue 0.113). Research in 2021 on the analysis of IFLS surveys shows that household access to sanitation that meets the requirements can significantly increase the HAZ score by 0.22 and reduce the chance of experiencing stunting by 13% [21]. At the community level, increased sanitation coverage increased the WAZ score by 0.3 and HAZ by 0.28 [26].

According to WHO, hygiene interventions include the habit of washing hands at five critical times (before eating, before breastfeeding, before preparing food, after defecating, and after feeding the baby). A broader definition of hygiene includes food hygiene measures (e.g. washing, covering, cooking and storing food), environmental hygiene (e.g. cleaning surfaces), menstrual hygiene, or specific hygiene interventions for the prevention and control of certain diseases (e.g. washing the face for trachoma, wearing shoes for prevention of soil-transmitted helminths, and animal management for zoonotic diseases)[27]. In this study, 6 important times were asked to mothers of children: handwashing with soap after cleaning child stools, after defecation, before eating, before breastfeeding, and before preparing food. Research on the relationship between handwashing and malnutrition in children still shows inconsistent results. This study shows that there is no relationship between washing hands with soap and the HAZ score. However, research in rural

indigenous communities of Jharkhand and Odisha, Eastern India shows the use of a handwashing agent (soap/ash/mud) was strongly and positively related to HAZ [28]. Other research found that there is no relationship between CTPS and impaired child height growth/stunting [29].

Conclusion

Environmental conditions around the river can have an impact on children's health. Even though statistically WaSH is not related to HAZ scores, it is necessary to consider the potential for all three to become risk factors because the gap between groups is quite large. A child's weight loss or underweight children can be an early warning sign of chronic childhood malnutrition. Periodic monitoring of the child's growth should be carried out. Further research is needed to compare children's health conditions, especially nutritional status in upstream river areas

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Conflict of Interest

The authors declare that they have no conflict of interest.

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