

Differences in Effects of Latrine Availability and Toddler's Nutritional Status on Incidence of Diarrhea in Rural Areas of Bondowoso and Coastal Area of Situbondo

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Abstract

Diarrhea caused by a wide variety of factors such as infections (bacteria, virus, parasite, etc), food poisoned, allergic, and contaminated water sources or drinking water. Diarrhea is distinguished into acute diarrhea that occurs <14 days and chronic diarrhea lasting more than 14 days. The research was conducted along the coastal area of Situbondo and in rural area of Bondowoso to analyze the difference of factors which affects diarrhea in those area. This research applied observational analytics with case-control retrospective design. 150 samples (mother of toddler) obtained using random sampling in 6 community health center along the coastal area of Situbondo and 6 community health center in rural area of Bondowoso. The dependent variable in this research was the number of severe diarrhea cases (secondary data from community health center) and the independent variable was the availability of latrine and toddlers' nutritional status. This research shows that there was a difference in latrine availability in a case group and control group in both areas with $P = 0.000$ ($P < \alpha$) in the coastal area of Situbondo and $P = 0.000$ ($P < \alpha$) in the rural area of Bondowoso. The availability of latrine in the coastal area of Situbondo contributed to the occurrence of diarrhea cases ($P = 0.020$), but had no impact in rural area of Bondowoso ($P = 0.068$). This research also shows us that there was a difference of nutritional status in case group and control group to the occurrence of diarrhea in both areas which account for ($P = 0.002$) and ($P = 0.006$) respectively. And then, there was an impact of nutritional status to the incidence of diarrhea ($P = 0.006$ and $P = 0.039$).

Keywords: Diarrhea, Latrine Availability, Toddlers' Nutritional Status

I. INTRODUCTION

Diarrhea is the cause of death for children under 5 years of age (toddlers) more than AIDS, malaria, and combination of measles. It is the second biggest cause of death for toddlers. While diarrhea is the biggest cause of death for toddlers (aged 12-59 months) with 25.2%. [2] Diarrhea can also cause dehydration, growth disruption, and malnutrition for toddlers. [1]

The use of pipes to distribute clean water and improving sanitation quality were proven to have major impact in decreasing number of diarrhea cases in India [3]. Besides that, the use of soap when washing hands also contribute to reduce the risk of diarrhea to 50% [4]. Diarrhea could also give a terrible impact on toddler's nutritional status, so nutrition aspects also played a major role to control number of diarrhea cases on toddlers [5].

Based on diarrhea bulletin, the frequency of extraordinary events of diarrhea in 2010 brought East Java to the second highest position after Central Sulawesi with 21 incidences [6]. Diarrhea cases which occurred in East Java based on sex type, districts, and community health center in 2014 has ranked Pamekasan in the first place with 520% followed by Bondowoso with 255%, Pasuruan with 253%, and Situbondo with 225% [7].

The geographic conditions of Bondowoso formed by 44.4% of mountains and hills, 24.9% of plateau, and 30.7% of lowland [8]. While geographic conditions of Situbondo is mainly formed by coastal area which cover half of the area. In the last 4 years, the number of diarrhea cases in Situbondo tend to increase with 35.373 cases in 2012, 35.686 cases in 2013, and slightly decrease to 32.003 cases in 2014. This would need a serious attention due to the impact of healthy environment on diarrhea [9].

High occurrence of diarrhea and the differences in geographic and demographic conditions of Bondowoso and Situbondo has been a strong motivation to conduct a research on how is the difference of factors within case group and control group affect the incidence of diarrhea in both areas.

II. METHODS

The type of research was observational analytics without any treatment to respondents, using case-control retrospective design to took a closer look on the previous cases and observe factors affecting the occurrence of diarrhea. This research located in 6 community health centers in the coastal area of Situbondo which are Community Health Center Besuki, Community Health Center Panji, Community Health Center Situbondo,

Community Health Center Asempagus, Community Health Center Banyuputih, Community Health Center Panarukan, and 6 Community Health Centers in Bondowoso which are Community Health Center Wringin, Community Health Center Curahdami, Community Health Center Nangkaan, Community Health Center Tegalampel, Community Health Center Wonosari and Community Health Center Tengarang. By used Lemeshow (1997) sample formula^[10], 37 sample acquired on each group (case and control) in both areas so there were 150 samples in total. 75 samples for case group and 75 for control group. Some of inclusions criterias in this research were mother of children aged 1-60 months, had been to community health center for severe diarrhea (case group), had not been suffered severe diarrhea (control group), and willing to be a respondent.

The dependent variable in this research was severe diarrhea. While latrine availability in and household and nutritional status were independent variables. Questionnaire was used as the research instrument for acquiring data. Containing various questions related to independent variables and food recall to calculate toddler's nutrition consumptions. Questionnaire was the primary data source while Growth Chart is the secondary data source. The collected data was categorical type so it was presented in the form of frequency¹⁵. Whereas, bivariate analysis used Mann Whitney test applied to find out the difference of diarrhea cases in the coastal area of Situbondo and rural area of Bondowoso. Multivariate analysis used Logistic Regression to look which influential variable which affects dependent variable.

III. RESULTS

A. General Description of Rural Area, Bondowoso

Based on data from Health Department of Bondowoso in 2014, geographical condition of Bondowoso formed by 44.4% of mountains and hills, 24.9% of plateau, and 30.7% of lowland. Bondowoso is surrounded by Ijen mountain and Argopuro mountain. Bondowoso shares border with Situbondo in the North and West, Jember in the South, Banyuwangi in the East. In 2014, Bondowoso had 754,647 inhabitants with th density of 484 inhabitabts/km². There are 25 community health center available in Bondowoso with 219 rural districts and urban districts.

B. General Description of Coastal Area, Situbondo

Situbondo located in East Java province well known for its Pasir Putih Beach. Situbondo bordering Madura strait in the North, Bali strait in the East, Bondowoso in the South, and Probolinggo in the West. Situbondo covers the area of 1,638.50 km², spans 150 km long from the West to East. The temperature is around 25.8 – 29.8 C with total 664,775 inhabitants.

Table 1. Characteristic of Toddlers and Family

Variables	Bondowoso		Situbondo	
	Case	Control	Case	Control
Mother Age				
-under productive ages (<25 y.o)	13	15	15	22
Mother Age				
-productive ages (25-35 y.o)	23	22	22	15
Mother Age				
-upper productive ages (>35 y.o)	1	1	1	-
Mother Education				
-high education level (senior high school, bachelor degree, etc)	6	15	3	14
Mother Education				
-low education level (elementary and junior high school)	32	22	34	24
Family income / month				
-upper 1.500.000 rupiahs	3	9	1	6
Family income / month				
-under 1.500.000 rupiahs	34	29	36	32
Total family member				
-(<=4 people)	24	27	26	23
Total family member				
-(>4 people)	14	10	12	14
Toddlers Age				
-(1-3 y.o)	21	17	13	16
Toddlers Age				
> 3 y.o	16	21	25	11

Case: Diarrhea Control: Not Diarrhea

Table 2. Total Amount of Energy, Protein, Fat, and Carbohydrate Consumption of Toddlers in The Rural Area, Bondowoso 2017

Total Amount (gram/day)	Bondowoso			
	Energy	Protein	Fat	Carbohydrate
Mean	1315.15	23.57	40.98	549.54
Standard Deviation	242.08	5.04	9.27	217.89
Minimum	776	15	25	220
Maximum	1788	37	65	950

Based on the Table 2, the average energy consumption of a toddler was 1315.15±242.08 KCal per day with the minimum consumption of energy was 776 Kcal and maximum consumption was 1788 Kcal per day. The average protein consumption of a toddler was 23.57±5.036 gram per day with the minimum amount of consumption was 15 grams and maximum amount of consumption was 37 grams per day. Toddler's average consumption of fat was 40.98±9.27 gram per day with the smallest amount required was 25 gram and the highest amount required was 65 gram per day. The average amount of carbohydrate consumption was 549.54±217.89 grams with minimum amount of 220 grams and maximum amount of 950 grams per day. The average amount of energy consumption needed by toddler was 1330.49±217.09 KCal per day with minimum amount of 898 Kcal and maximum of 1768 Kcal per day.

Table 3. Total Amount of Energy, Protein, Fat, and Carbohydrate Consumption of Toddlers in The Coastal Area, Situbondo 2017

Total Amount (gram/day)	Situbondo			
	Energy	Protein	Fat	Carbohydrate
Mean	1330.49	25.60	44.74	571.27
Standard Deviation	217.09	7.87	14.23	216.57
Minimum	898	14	24	264
Maximum	1768	64	114	972

Based on the Table 3, the average energy consumption of a toddler was 1330.49±217.09 KCal per day with the minimum consumption of energy was 898 Kcal and maximum consumption was 1768 Kcal per day. The average protein consumption of a toddler was 25.60±7.87 gram per day with the minimum amount of consumption was 14 grams and maximum amount of consumption was 64 grams per day. Toddler's average consumption of fat was 44.74±14.23 gram per day with the smallest amount required was 24 gram and the highest amount required was 114 gram per day. The average amount of carbohydrate consumption was 571.27±216.57 grams with minimum amount of 264 grams and maximum amount of 972 grams per day.

Table 4. The Result of Statistical Test

Variables	Bondowoso		P **	Situbondo		P **
	n	P*		n	P*	
	Well nutrition	49			50	
Under Weight	26	0.002	21	0.006	0.039	
Over Weight	0		4			
Latrine availability (qualified)	30	0.000	27	0.000	0.020	
Latrine availability (unqualified)	45		48			

Note:

P*= P Value with Mann Withney Test

P**= P Value with Logistic Regresion Test

From the results of statistical test (Table 4), it was found that there was a difference between toddler's nutritional status in case group and control group with the incidence of diarrhea in the rural area of Bondowoso with P = 0.002 (P < α) and there was a difference between toddlers' nutritional status in case group and control group with the occurrence of diarrhea in the coastal area of Situbondo with P = 0.006 (P < α). From the result of effect test, it was found that nutritional status did affect the incidence of diarrhea in Bondowoso and Situbondo with P = 0.006 and P = 0.039 respectively.

In terms of latrine availability, it was found that the difference between latrine availability in case group and control group in both areas were ($P = 0.000$ and $P = 0.000$). Whereas, in effect test, it was known that the effect of latrine availability on the incidence of diarrhea in the coastal area of Situbondo was real ($P = 0.020$), at the same time, it has no effect on the rural area of Bondowoso ($P = 0.068$).



Figure 1. Latrine availability (in case group) in the coastal area, Situbondo



Figure 2. Latrine availability (in case group) in the rural area, Bondowoso



Figure 3. Latrine availability (in control group) in the coastal area, Situbondo



Figure 4. Latrine availability (in control group) in the rural area, Bondowoso

IV. DISCUSSION

Nutritional status is measured by dividing weight with age and then create group based on Standard Deviation. As a result, there are 4 groups of nutritional status which are malnutrition, overweight, wellnutrition, underweight. The result showed that in both rural and coastal areas, there were a difference between nutritional status in case group and control group with the incidence of diarrhea. For more than 50% of the toddlers in both areas are wellnurtioned with 65.5% in rural area and 66.7% in coastal area.

From the relationship analysis, it was known that nutritional status was closely related to the incidence of diarrhea in both areas. This was in line with the research of Kenneth (2003)^[5], which said that nutritional status related to the occurrence of diarrhea. It was also supported by the research of Yeni (2011)^[11] that underweight was a risk factor of diarrhea. It was also in line with Palupi's research (2007)^[12] which showed that there was significant relationship between undernutrition and duration of diarrhea. Nutritional status itself was determined by how parents treat their children (parenting), such as providing breastfeeding. It also affected by providing balance nutrition based on the age of toddlers which closely related to the educational level of mother and family income.

Based on the result, there was a difference between latrine availability in case group and control group with the occurrence of diarrhea. This result applied to both areas Situbondo and Bondowoso. This fact also reinforced by the research of Nuraeni (2012)^[13] that toddlers were potentially affected by diarrhea 1.99 times more often in families using unqualified latrine compared to families using qualified latrine. This statement also backed by the research of Kusumaningrum, Arie (2014)^[14] which mentions in significance of 0.009 at 95% CI; 1.20 - 3.66. Furthermore, the effect test showed that the incidence of diarrhea in coastal area of Situbondo was affected by latrine availability. Unqualified latrine will cause the condition of water in the well.

The research also showed us that in rural areas of Bondowoso, there were a lot of wellspring which located less than 10 m from septic holding tank. Moreover, "cemplung latrine or latrine without septic holding tank" and unavailability of latrine in some households in rural areas exacerbate the incidence of diarrhea. In the coastal area of Situbondo, most people used latrine without septic holding tank or used their neighbor's latrine. They also disposed their waste directly to the sea without proper sewer that cause air pollution for residents especially toddlers which were in high risk to suffer infection due to their fragile immune system. Furthermore, feces that disposed in open space will be used by flies to lay their eggs which lead to faecal borne disease. To conclude, the availability of qualified latrine will affect the incidence of diarrhea for toddlers. The better the quality of latrine, the less risk toddlers suffered from diarrhea.

V. CONCLUSION

There is a difference between nutritional status of toddlers in both areas with the incidence of diarrhea. Nutritional status also take part to the incidence of diarrhea in the rural areas of Bondowoso. There is a difference in the availability of latrine with the incidence of diarrhea in the rural areas of Bondowoso and coastal area of Situbondo.

Special strategy is required to give counseling, information, and education to mothers of toddlers in both areas due to the low level of education they have. It is also important to leverage the participation of government officials especially in the rural and coastal area to increase the latrine availability in households.

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