

## Research Article

# Relationship Between Drinking Water Sources, Drinking Water Treatment And Sewage Management With Stunting In Two-Years-Old Children In Mamuju Regency

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**Abstract:** One of the chronic nutrition problems in Indonesia is stunting, which is a risk marker for bad child development. This study aims to determine the relationship between drinking water sources, drinking water treatment and sewage management to the incidence of stunting in two-year-old children in Mamuju Regency. This type of research is observational analytic using cross-sectional study. Samples of this study were all mothers of two-year-old children who live in Mamuju Regency. The total sample in this study were 191 respondents. The sampling technique by using the Proportional Random Sampling technique. Data were analyzed by bivariate analysis using chi-square test to assess the relationship between independent variables (drinking water sources, drinking water treatment and sewage management) and dependent variables (stunting). The results showed that there was a relationship between drinking water sources (PR 1,394, 95% CI, 0,970-2,003, p=0,042), drinking water treatment (PR 1,332, 95% CI, 1,048-1,693, p=0,038) and sewage management (PR 2,743, 95% CI, 1,265-5,948, p=0,000) with the incidence of stunting in 2-year-old children in Mamuju Regency. Therefore, it is expected that the public will consume drinking water from protected sources and treat drinking water before consumption for the prevention of water-borne diseases. In addition, it is also necessary to implement waste management that is safe for health and the environment.

**Keywords:** Children, Stunting, Drinking Water, Sewage.

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## INTRODUCTION

One of the chronic nutrition problems found in Indonesia is stunting, which is a risk marker for bad child development. In 2015, WHO reported that one in four toddlers (23% or 156 million children) were stunted. A total of 155 million children were stunted in 2016 and 225 or 151 million children in 2017. In 2018, globally the stunting prevalence decreased to 21.9% or 149 million children (WHO, 2018).

Based on the results of Riskesdas 2010, 35.6% of children experience stunting. The prevalence of stunting then increased in 2013 to 37.2%. Nationally, the stunting prevalence rate in Indonesia has decreased to 30.8% in 2018 (Kemenkes, 2018).

West Sulawesi is one of the provinces with the highest prevalence of stunting in Indonesia. In 2010 the prevalence of stunting in West Sulawesi was 41.6% and increased in 2013 to 48%. In 2018, the results of Riskesdas put West Sulawesi Province in the second

place for the highest stunting prevalence in toddlers, which was 42.2% (Kemenkes, 2018).

Mamuju Regency is one of the districts in West Sulawesi Province with a high prevalence of stunting. Based on data from the Mamuju District Health Office, the prevalence of short toddlers in 2015 was 42.9%. In 2016, the prevalence of stunting decreased to 39.6%. PSG data for 2017 shows the tendency of short toddlers in Mamuju Regency is 38.2% (Kemenkes, 2017a). These results are relevant to data from the 2017 West Sulawesi Provincial Health Indicator Book.

Family conditions and the environment that affect the family can have an impact on the nutritional status of children. This is because toddlers are still very dependent on their mother/ family (Trihono *et al.*, 2015). Low sanitation and environmental hygiene will trigger digestive disorders. If this condition occurs, the energy that should be used for growth, will be diverted to the body's resistance to infection. This condition will cause disruption to children's nutrition and cause opportunities to experience stunting (Cahyono *et al.*,

2016). A study estimates that hygiene and sanitation interventions implemented with 99% coverage will reduce the incidence of diarrhea by 30%, which in turn has an impact on reducing the prevalence of stunting by 2.4% (Ngunjiri *et al.*, 2014).

Research conducted by Bubile Mzumara (2018) states that children with good drinking water sources (33.7%) are less likely to experience stunting than children with bad drinking water sources (47.7%) (Mzumara *et al.*, 2018). Regarding drinking water treatment, a study shows that household sanitation and drinking water treatment are strong predictors of stunting in the population of children aged 0-23 months in Indonesia (Torlesse *et al.*, 2016). Based on research conducted by Lulu'ul Badriyah and Ahmad Syafiq (2017), bad sewage management is associated with the incidence of stunting in children (Badriyah *et al.*, 2017). Other research also shows that improved sanitation is associated with a reduction in stunting of 4-37% in rural areas and 20-46% in urban areas (Dangour *et al.*, 2013). Therefore, this study aims to determine the relationship between drinking water sources, drinking water treatment and sewage management to the incidence of stunting in toddlers 2 years in Mamuju Regency.

## METHODS

### Research Design

This type of research is observational analytic using cross-sectional study. This research was

conducted in Puskesmas Bambu and Puskesmas Keang, Mamuju Regency.

### Population and Sample

Respondents in this study were all mothers of toddlers aged 2 years who live in Mamuju Regency. The total sample in this study were 191 respondents. The sampling technique is done by using the Proportional Random Sampling technique.

### Collecting Data

Data collection was carried out through observation and direct interviews by researchers against respondents using a questionnaire. Determination of nutritional status is obtained based on the measurement of Height by Age (TB / U) using microtoise based on the Decree of the Minister of Health of the Republic of Indonesia Number: 1995 / Menkes / SK / XII / 2010 concerning Anthropometry Standards.

### Data Analysis

Data processing is performed using the SPSS program. Data were analyzed by bivariate analysis using chi-square test to assess the relationship between independent variables (drinking water sources, drinking water treatment and sewage management) and dependent variables (stunting).

## RESULTS

### Characteristics of a Toddler Family

**Table 1.** Distribution of Characteristics of Children Families

Characteristics	Total (n)	Percent (%)
<b>Number of Family Members</b>		
≤ 4 person	84	50,0
5-6 person	66	39,3
≥ 7 person	18	10,7
<b>Mother's Age</b>		
17-25 years old	66	39,3
26-35 years old	73	43,5
36-45 years old	29	17,3
<b>Household Income per Month</b>		
< Rp 2.571.328	153	91,1
≥ Rp 2.571.328	15	8,9

Based on table 1, it can be seen that as many as 84 respondents (50.0%) who have family members ≤ 4 people and 18 respondents (10.7%) with family members number ≥ 7 people. Regarding maternal age, 73 respondents (43.5%) were 26-35 years old and 29

respondents (17.3%) were 36-45 years old. Furthermore, there were 153 people (91.1%) with household income <Rp 2,571,328 per month and 15 people (8.9%) with household income ≥ Rp 2,571,328 per month.

**Toddler Characteristics**

**Table 2** Distribution of Children Characteristics

Characteristics	Total (n)	Percent (%)
<b>Children Sex</b>		
Boy	95	56,5
Girl	73	43,5
<b>Birth Weight</b>		
< 2.500 gram	11	6,5
≥ 2.500 gram	157	93,5
<b>Stunting Event</b>		
Stunting	101	60,1
No Stunting	67	39,9
<b>History of Diarrhea</b>		
Yes	66	39,3
No	102	60,7
<b>History of ARI</b>		
Yes	84	50,0
No	84	50,0

Table 2 shows the number of children of male sex are 95 toddlers (56.5%) and female sex is 73 children (43.5%). Children born with a weight of ≥ 2,500 grams are 157 children (93.5%) and 11 other children (6.5%) have birth weight <2,500 grams. From the measurement of Height by Age (TB / U), there are

101 children (60.1%) included in the stunting category and 67 children (39.9%) included in the non-stunting category. Based on a history of infectious diseases, there were 66 children (39.3%) had suffered diarrhea and 84 children (50.0%) had a history of ARI.

**Research Variables**

**Table 3.** Distribution Based on Research Variables

Variable	Total (n)	Percent (%)
<b>Drinking Water Source</b>		
Protect	39	23,2
Unprotect	129	76,8
<b>Drinking Water Treatment</b>		
Treated	129	76,8
Untreated	39	23,2
<b>Sewage Management</b>		
Good	21	12,5
Bad	147	87,5

Table 3 shows that as many as 129 people (76.8%) with unprotected drinking water sources. In the drinking water treatment variable, there were 129 people (76.8%) who did the treatment before consuming

drinking water. Of the 168 respondents, 147 people (87.5%) were in the bad category for sewage management.

**Bivariate Results**

**Table 4.** Bivariate Analysis of Research Variables

Variable	Stunting		No Stunting		PR	CI 95%		p-value
	n	%	n	%		Lower	Upper	
<b>Drinking Water Source</b>								
Unprotect	83	82,2	46	68,7	1,394	0,970	2,003	0,042
Protect	18	17,8	21	31,3				
<b>Drinking Water Treatment</b>								
Untreatment	29	28,7	10	14,9	1,332	1,048	1,693	0,038
Treatment	72	71,3	57	85,1				
<b>Sewage Management</b>								
Bad	96	95,0	51	76,1	2,743	1,265	5,948	0,000
Good	5	5,0	16	23,9				

Table 4 shows that there is a relationship between drinking water sources and the incidence of stunting (PR 1.394, 95% CI, 0.970-2.003,  $p = 0.042$ ). Unprotected drinking water sources were higher in stunted children (82.2%) than those who were not stunted (68.7%). There is a relationship between drinking water treatment and the incidence of stunting (PR 1.332, 95% CI, 1.048-1.693,  $p = 0.038$ ). Households who did not treat drinking water were higher in children who were stunted (28.7%) than those who did not stunted (14.9%). There is a relationship between sewage management and stunting (PR 2.743, 95% CI, 1.265-5.948,  $p = 0.000$ ). Bad sewage management was higher in children who were stunted (95.0%) than those who were not stunted (76.1%).

## DISCUSSION

The results showed that the majority of respondents had unprotected sources of drinking water. Based on the results of the analysis, it is known that the source of drinking water is related to the incidence of stunting in Mamuju Regency (PR 1.394, 95% CI, 0.970-2.003,  $p = 0.042$ ). This is in line with research conducted in Ethiopia by Bancha Batiro (2017) which states that drinking water sources have a statistically significant relationship with stunting. Toddlers with families who consume drinking water from unprotected drinking water sources, have a risk of seven times (AOR = 7.06 (95% CI; 4.40-20.42) stunting when compared to those who consume drinking water from protected water sources (Batiro *et al.*, 2017).

The source of drinking water is one of the important facilities and is related to the incidence of diarrhea. Some infectious germs that cause diarrhea are transmitted through the oral faecal pathway, so that germs can get into the mouth, liquid or contaminated objects (Nurpauji *et al.*, 2015). This can be due to the fact that unprotected water sources can be contaminated and increase the risk of infections such as diarrhea (Mzumara *et al.*, 2018). One of the microorganisms that cause diarrhea in the water is the bacterium *Escherichia coli* (*E.coli*) (Utami *et al.*, 2016). A study states that levels of *E.coli* in water significantly influence the incidence of stunting. Increasing *E. coli* levels by 1 CFU / 100 ml will increase the risk of stunting by 5,817 times (Ihsan *et al.*, 2020).

Although the causes of chronic malnutrition vary, an estimated 13.5% prevalence of global stunting is caused by diarrheal disease (Brander *et al.*, 2019). The interaction between malnutrition and infection will create a dangerous cycle that has the potential to worsen disease conditions and nutritional status. This is caused by loss of fluid and electrolytes, loss of appetite, the body has difficulty absorbing nutrients, causing stunted growth (Ilma *et al.*, 2019).

Based on the cross tabulation performed to determine the relationship between the history of

diarrhea and the incidence of stunting, the results obtained that there is a relationship between the history of diarrhea with the incidence of stunting in infants 2 years in Mamuju Regency ( $p = 0.041$ ). This result is reinforced by the statement that if a child suffers from indigestion, it will make the energy for growth diverted to the body's resistance to infection. In the end, this condition will have an impact on nutritional problems and have the opportunity to experience stunting (Cahyono *et al.*, 2016).

The results showed that the majority of respondents treated drinking water before consumption. Based on the results of the analysis, it is known that the drinking water treatment variable is related to the incidence of stunting in Mamuju District (PR 1.332, 95% CI, 1.048-1.693,  $p = 0.038$ ). This is in line with research conducted by Harriet Torlesse (2016) which states that drinking water treatment is a strong factor in causing stunting in children aged 0-23 months in Indonesia. There is a significant relationship between families that treat clean water before consumption (cooking, filtering or hot disinfection) with the occurrence of stunting ( $p=0,019$ ) (Torlesse *et al.*, 2016).

Clean water according to Permenkes Number 416/ MENKES/ PER/ IX/ 1990 is water used for daily needs whose quality meets health requirements and can be drunk when cooked. Cooking or boiling clean water to boiling is an effective way and we often do it before consuming it into drinking water. This method is very effective to kill all pathogens in water such as viruses, bacteria, spores, fungi and protozoa (Kemenkes, 2017b). 76.8% of respondents process their water before consumption. This result is supported by observations showing the presence of drinking water storage containers (a type of teapot, flask or drink jar) owned by respondents. It can be assumed that respondents treat water before consumption because the water reservoir is different from the drinking water storage container that will be consumed.

Water that is not guaranteed cleanliness can cause diarrhea that affects one's nutritional status. Acute diarrhea adversely affects the nutritional state through 4 mechanisms, namely (1) Reduction of food due to anorexia, habit of reducing / eliminating feeding, (2) Absorption of food is reduced due to intestinal mucosal damage, villi become short and atrophy and reduction in lactase enzymes and disaccharides others, (3) metabolic and endocrine functions are disrupted in conditions of systemic infection, (4) direct loss of fluid and electrolytes and loss of nitrogen through feces and the release of plasma proteins and blood due to intestinal tissue damage (Suandi, 2012).

Drinking water must be maintained so that it is not easily polluted by hazardous materials. If drinking water is doubtful its safety, it should be cooked until it boils (Hidayat *et al.*, 2019). A study shows that cooking

/ boiling water to boiling has a strong and significant protective effect against diarrheal disease (Cohen *et al.*, 2017). Communities that are reached by the provision and treatment of water that is truly clean, have a smaller risk of suffering from diarrhea than those who do not get clean water (Kemenkes, 2011). Diarrhea contributes to decreased food intake and nutrient absorption which leads to malnutrition, reduced resistance to infection, and impaired physical growth and cognitive development (Clasen, 2015).

The results showed that the majority of respondents had bad sewage management. Based on the results of the analysis, it is known that the sewage management variable is related to the incidence of stunting in Mamuju District (PR 2,743, 95% CI, 1,265-5,948,  $p = 0,000$ ). This is in line with research conducted by Yuliana Soeracmad (2019) which showed a significant influence between the management of household SPAL on the incidence of stunting ( $p = 0,000$ ) (Soeracmad *et al.*, 2019). Another study also stated that children with families whose effluent discharge was other than through SPAL, were positively associated with stunting (AOR = 5.95, 95% CI, 1.83-16.97) (Girma *et al.*, 2019).

According to the Republic of Indonesia Decree No. 829 / MENKES / SK / VII / 1999 concerning housing health requirements, housing requirements that meet health requirements in waste disposal, that is, liquid waste from households that does not pollute water sources, does not cause odor, and does not pollute the surface of the land. As for solid waste, it must be managed well so that it does not cause odors, does not pollute the soil surface and ground water (Kemenkes, 1999).

The analysis showed that 87.5% of respondents had bad sewage management. Open sewerage ownership allows inundation and clogging so that it becomes a den of disease vectors, such as flies, mice, cockroaches and others (Ikhwan, 2013). Open sewerage that do not drain their wastewater into drains but directly into the ground, can not only pollute the soil and trigger disease vectors such as diarrhea, but also cause inundation that causes odor (Putra *et al.*, 2017). This is supported by the results of observations in the field which show that more respondents do not have SPAL. Wastewater produced by households flows directly to the ground so that it sometimes causes puddles and odors around the stream.

Sewage water is waste water that comes from households, industries and other public places which generally contain substances or substances that are harmful to health and disturb the environment (Yadin *et al.*, 2017). Vectors such as flies tend to like dirty and smelly breeding sites, such as stagnant water and waste that emits an unpleasant odor (Pebriyanti *et al.*, 2017).

SPAL puddles where flies breed can affect the incidence of diarrhea. Indirect transmission can occur through vectors that multiply in open sewage disposal facilities so that they can contaminate water and soil surface. Vectors/ insects then contaminate food and beverages consumed by humans, so that it can cause diarrhea (Yadin *et al.*, 2017). Infection that occurs can be a cause of stunted growth and development of children (Hafid *et al.*, 2017).

The limitation in this study is the number of samples that meet the inclusion and exclusion criteria as many as 168 respondents (87.9%) of the minimum sample size is 191 respondents. This is because the address listed in the register is not the domicile address (the respondent only arrives during the posyandu schedule). In addition, the distance is far enough to reach several villages.

## CONCLUSION

Drinking water sources, drinking water treatment and sewage management are factors that influence the incidence of stunting in 2-year-old children in Mamuju Regency. Therefore, it is expected that the public will consume drinking water from protected sources and treat drinking water before consumption for the prevention of water-borne diseases. In addition, it is also necessary to implement waste management that is safe for health and the environment.

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