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The Relationship between Worm Infection and Stunting in Children in Central Lombok Regency, West Nusa Tenggara Province

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A B S T R A C T

Stunting is a condition of weight that is not in accordance with the height for children his age, caused by internal factors, namely low nutrition, inadequate maternal nutritional intake during pregnancy and external factors, namely pregnancy infection in the mother and the presence of infectious diseases in children. Worm infection is one of the most common diseases in children. This study aims to determine the relationship between intestinal worm infection and the incidence of stunting in children and the risk factors associated with intestinal worm infection in Central Lombok district, NTB province. A cross-sectional survey was conducted on 170 children with stunting in Central Lombok Regency, West Nusa Tenggara Province. This research took place from January-March 2021. The sample of this study was children with stunting in 8 Puskesmas in Central Lombok Regency. This study used a purposive sampling method, the independent variable was intestinal worm infection and the dependent variable was stunting. The children's parents were given an informed consent form, a set of personal protective equipment in the form of a mask and a pair of handscones, a stool pot, plastic, and oil paper. Children were also taken blood for ELISA examination, the primary data obtained in this study. Data analysis with SPSS is univariate test. There were 19 (11.17%) of the total 170 subjects infected with intestinal worms in Central Lombok Regency with a mean age of 32.64±13.75. Intestinal worm species include Ascaris lumbricoides 18 (10.59%) and Trichuris trichiura 1 (0.58%). There was no significant risk factor between intestinal helminth infection and stunting in children (95% CI = 33.47-49.36, with p value = 0.695) on blood examination using the ELISA method for levels of IL-4 as a marker of intestinal worm infection and on stool examination by the Lugol method in children in Central Lombok Regency. However, there was a significant relationship between anemia and intestinal worm infection in stunted children (p = 0.029). There is a relationship between intestinal worm infection and stunting in children in Central Lombok Regency, NTB Province. Anemia is a risk factor associated with the incidence of intestinal worm infection. However, the small number of samples and the short time in this study showed insignificant results between the two variables.

BACKGROUND

Stunting is a condition of children's nutritional status that is not related to age. Stunting is also a condition of disproportionate weight and height at a certain age. Stunting vigilance is divided into two groups, namely internal factors and external factors. Internal factors are low intake of children, low intake of pregnant women, etc. External factor is infection in children. Stunting is a nutritional problem that facilitates infection, reduces children's intelligence, and creates stigma in society. This condition will regulate the

psychological condition of the child and his family(Aguayo et al., 2016).

Intestinal parasitic infections continue to be an important public health problem worldwide. Protozoa and helminths are two agents that cause intestinal parasitic infections. The World Health Organization (WHO) classifies intestinal parasitic infections into Neglected Tropical Disease (NTD). This infection will be both an acute and a chronic condition, but a definite diagnosis is rarely made(Shehata and Hassanein, 2015).

Intestinal worm infection usually occurs in school-age children. Symptoms are anemia, malabsorption, malnutrition, chronic inflammation of the intestines, impaired growth and development. And also physical and mental disorders. The prevalence of intestinal worm infection reaches 1.5 billion people in the world. People suffering from symptoms 450 million people. There are 16 million people die from this infection every year in the world. Intestinal worms spread mainly in tropical and subtropical countries. The province of West Nusa Tenggara reported that there were 13.1% intestinal worms in preschool children.

World Health Organization (2020)reported that there are 24% of the world's population suffer from intestinal helminth infections, there are 267 billion preschool children infected with intestinal worms. More than 568 billion school-age children are infected with intestinal worms. Intestinal worm infections are widespread in developing countries, especially in tropical and subtropical countries. According toIndonesian Ministry of Health (2018), the number of under-fives with malnutrition has decreased by 17.7%. Surprisingly, West Nusa Tenggara Province was the runner-up with the most transmissions, namely 29.5% where the winner was East Nusa Tenggara Province.

SUBJECT AND METHOD

The population of this study is stunted children who live in Central Lombok Regency. Research subjects and stool samples were obtained and examined at the Department of Parasitology at Al-Azhar Islamic University, Mataram, West Nusa Tenggara, Indonesia.

The minimum sample size is calculated using the estimated population proportion with the following formula. The expected prevalence of the actual prevalence was ±8% (d=0.08) with a 95% confidence level (z=1.96) and the proportion from the previous study was 24%. From this formula, the minimum sample size of the study is 150 samples.

Study Design

This cross-sectional study was conducted in eight health centers in Central Lombok Regency, West Nusa Tenggara, namely; Aikbukak, Aikdareq, Bonjeruk, Batujai, Batunyala, Mantang, Ubung, and Pengadang. This research was conducted from January to April 2021

Population and Sample

target population is children under five with stunting in the district of Central Lombok, the source population is children under five with stunting who are toddlers who are cared for by the puskesmas, at eight health centers where the incidence of stunting is highest in Central Lombok Regency which is the locus of stunting. The technique of taking stunting is by consecutive sampling. The minimum sample size is calculated using the estimated population proportion with the following formula. The expected prevalence of the actual prevalence was ±8% (d=0.08) with a 95% confidence level (z=1.96) and the proportion from the previous study was 24%. From this formula, the minimum sample size of the study is 150 samples. The addition of 10% to anticipate drop outs, the total sample is at least 165 samples.

Research variable

The dependent variable in this study was stunting, while the independent variable was intestinal worm infection. Intestinal worm infection: the condition of children under five experiencing intestinal worm infection as evidenced by the presence of worm eggs on microscopic stool examination using the Lugol method. Stunting: the condition of children under five with height for age lower than -2 SD whose information was obtained from the puskesmas.

Study Instrument

Intestinal worm infection was measured in 2 ways, namely; 1) the presence or absence of worm eggs in the feces of children by microscopic examination of the Lugol method and 2) by elisa examination by measuring the increase in IL-4 levels as a marker of intestinal worm infection.

Stunting was obtained from data on measurements of weight and TB carried out by the puskesmas at the same time as taking blood samples. Other variables were collected by questionnaire.

Research Flow Summary

Subjects were selected using consecutive sampling. Oral and written research information and consent requests were given to parents. Inclusion criteria were children aged 0-5 years in the study area at the time of sampling. Subjects were excluded if they had or were receiving treatment for intestinal parasites, such as metronidazole, within two weeks of the interview. The exclusion of these children is important to avoid misinterpretation during examination of stool specimens.

The risk factors for intestinal worms were obtained through interviews with the subject's parents using a questionnaire that had been tested for validity and reliability prior to fieldwork. Age was calculated based on the date of birth given by interviewing the parents. Gender was recorded as male and female. Social status, parental education level, economic status and hygiene habits were assessed by questionnaire. Interviews were conducted by the principal investigator.

To ensure maximum cooperation of the research subjects, we informed the health workers at the Puskesmas about the study and the data collection flow from interviews and collection of stool specimens. We provide a stool specimen package for the elderly: a sheet of A5 size oil paper to use as a base for defecation, a pre-labeled 60 ml stool container; personal protective equipment (a pair of gloves and a surgical mask) and instructions on how to collect stool samples and to avoid contamination with sand or other materials, details of the number of stool specimens (approximately 40mL) how to ensure that containers are properly sealed, how to dispose of all equipment except the

container with plastic wrap after collection, and the appropriate time to return the container.

All specimens were preserved in 10% formalin at the Puskesmas before being brought to the Parasitology Laboratory for identification. Intestinal worms were identified from stool specimens by light microscopy examination using the iodine method and the Kato Katz method according to World Health Organization standard procedures. The identified species were confirmed directly by a senior laboratory technician. Blood tests (phlebotomy) are performed on children at a health facility. Blood is taken to the laboratory. This examination was performed to identify interleukin-4 (IL-4) as a marker of helminthiasis.

Data analysis

All data analyzes were performed using SPSS® version 25 (IBM Corp., Chicago). The prevalence and types of intestinal worms were obtained from the results of stool examination using descriptive statistics. Questionnaire data without available stool specimens were excluded. The relationship between age and intestinal worms was measured by the Mann-Whitney test. The relationship between stunting and intestinal worms was measured by the chi-square test. P value < 0.05 was considered statistically significant. The relative risk between risk factors and intestinal helminthiasis was estimated as a prevalence ratio with a 95% confidence interval.

Research Ethics

The research protocol was approved by the medical and health research ethics committee of the Islamic University of Al-Azhar's Faculty of Medicine with certificate No. 81/EC/FK-06/UNIZAR/XII/2020, on 18 December 2020.

RESULTS

A total of 200 children from eight puskesmas were registered, but 30 children did not submit stool specimens and were not analyzed. Among the 170 participants, the mean age of participants was 32.64±13.75 months ranging from 6-62 months. The basic characteristics of the subjects are listed in table 1.

Among the 170 participants, 19 children (11.17%) were infected with the single intestinal helminths listed in table 2. There were only two helminth species that infected children in this study. The most common worm found was Ascaris lumbricoides (Table 3). Based on light microscopic observations, all intestinal worms were identified as egg-shaped. There was no significant correlation between all the variables studied with intestinal worms observed (Table 4).

Table 1. Sample characteristics

Characteristic	Category	Frequency	Percentage
Sex	Male	91	53.5%
	female	79	46.5%
Education	No school	3	1.76%
	SD	36	21.18%
	JUNIOR HIGH SCHOOL	58	34.12%
	SENIOR HIGH SCHOOL	55	32.35%
	Diploma	6	3.53%
	Bachelor	12	7.06%
Hemoglobin	<11 mg/dl	72	42.35%
	11 mg/dl	98	57.65%
Work	Student	1	0.59%
	ASN	6	3.53%
	Private employees	12	0.71%
	Trader	14	8.23%
	Farmer	137	80.59%
exclusive breastfeeding	Yes	159	93.53%
	Not	11	6.47%
Parent's income	Tall	70	41.18%
	low	100	58.82%

Table 2. baseline characteristics

no	*Type of infection*	*intestinal worms*	*Total n*	*(N=170) %*
1	Single	*Ascaris lumbricoides*	18	10.59
		Trichuris trichiura	1	0.58
	Amount		19	11.17

Bivariate Analysis

The bivariate analysis in this study was to find the relationship between helminth infections and stunting, the results showed that there was no relationship between helminth infections and stunting (p>0.05). There was no relationship between anemia and helminth infections (p>0.05), there was no relationship between age and helminth infections (p>0.05), there was no relationship between eosinophilia and helminth infections (p>0.05), and there was no there was a relationship between IL-4 and helminth infection (p>0.05).

Table 4. Determinants of Periodontal Disease (Chi Square analysis)

Variable	Intestinal Worm Infection				p
	Infected		Not infected		
	N	%	n	%	
Gender					
Man	10	5.88	66	50.77	0.77
Woman	9	5.29	49	37.69	
Wash hands after defecation					
Routine	18	94.70	148	98	0.38
Not a routine	1	5.30	3	2	
Wash hands before eating					
Routine	17	89.50	133	88,10	1.00
Not a routine	2	10,50	18	11.90	
Cutting nails					
Routine	19	100	144	95,40	1.00
Not a routine	0	0	7	4.60	
Nail biting habit					
Routine	6	31.60	36	23.80	0.57
Not a routine	13	68,40	115	76,20	
Using footwear					
Routine	15	76.90	130	86.10	
Not a routine	4	21.10	21	13.90	0.49

In the analysis between several risk factors and the incidence of stunting, it was found thatthere is no relationship between hemoglobin and the incidence of stunting(p>0.05),There is no relationship between eosinophilia and the incidence of stunting(p>0.05), There is no relationship between interleukin-4 with the incidence of stunting(p>0.05), howeverthere is a relationship between gender and stunting (p=0.007) boys are more prone to stunting than girls. These results are in line with other studies conducted byTitaley et al. (2013)who said that gender had a correlation with stunting. So boys are more at risk of suffering from stunting than girls. There is a significant relationship between anemia / low hemoglobin levels with intestinal worm infection (p = 0.029) this is in line with research conducted byDjuardi et al. (2021)that anemia is significantly associated with intestinal worm infection in malnourished children at preschool age in Nangapanda District, NTT Province. These results are also in line with research conducted byAhmed et al. (2012)that there is a significant relationship between anemia and intestinal worm infection in school children in Malaysia.

Multivariate analysis

Multivariate analysis was carried out for IL-4, hemoglobin and eosinophil variables and all three were not associated with stunting with p values respectively (p = 0.999, 0.240, and 1.000). This shows that high levels of IL-4, increased levels of eosinophils, and low hemoglobin are not associated with stunting.

Table 7. Results of Multiple Logistics Regression Analysis

Independent Variable	OR	95% CI		p
		Lower limit	Upper limit	
IL-4	0.000	-		0.999
Hemoglobin	0.063	1,998		0.240
eosinophilia	0.000	-		1,000

DISCUSSION

In this study, the prevalence of intestinal worms in stunted children in Central Lombok Regency was 11.17%. The prevalence of intestinal worms in children with stunting in other provinces is 34.1% in South Sulawesi, Indonesia(Muslimah, Salimo and Dewi, 2020). The prevalence of intestinal worms in East Nusa Tenggara in pre-school children is 58.8%(Djuardi et al., 2021).

No significant correlation between stunting and intestinal worms was reported in this study (p>0.05). These results are in line with previous research byDjuardi et al. (2021) which showed that stunting had minimal effect on intestinal worms. However, another study conducted byMuslimah, Salimo and Dewi (2020)showed that the risk of stunting increased with the presence of worms. The difference in the results may be due to the small number of samples, and perhaps because almost the children were already taking anti-worm medicine.

There was no relationship between interleukin-4 and intestinal worms in this study (p>0.05). This result is not in accordance with previous research byEgholm et al. (2019)which indicates that IL-4 increases helminth infection.Turner et al. (2018)also has research that shows a relationship between levels of IL-4 with intestinal worms. The prevalence of intestinal worm infection in stunted children obtained in this study was different from previous studies. Intestinal worm infections in stunted children that

occurred in Denpasar, Bali Province, amounting to 62.97%(Abdulhadi, Swastika and Sudarmaja, 2019). These varied differences can be caused by differences in awareness about clean and healthy living behavior, sociodemographic conditions, and differences in environmental sanitation and hygiene of the children.

Gender is not a risk factor for intestinal worm infection in stunted children, but gender is a risk for stunting, namely boys are found to be at risk for stunting (p = 0.007). This is in line with research byTitaley et al. (2013) which states that gender is significantly related to the incidence of stunting, namely in the male sex.

The social status of stunted children was observed from the water sources used in the household and drinking water sources. Sources of water that come from wells contaminated with human feces if consumed can be a source of transmission of intestinal worm infection. Household water sources in this study were not a risk factor for intestinal protozoal infection (p>0.05). This is in line with research byNovianty et al. (2018)which stated that household water sources had no significant relationship with intestinal worm infection. Source of drinking water is also not a risk factor for intestinal protozoa infection (p>0.05). This is in line with research byNovianty et al. (2018)which stated that drinking water sources did not have a significant relationship with intestinal worm infection in pre-school age children.

The education level of the parents of the stunted child is observed from the education level of the mother of the stunted child. This variable is not a risk factor for intestinal worm infection because the mother's education level has a p>0.05. This is in line with researchNovianty et al. (2018)which states that the education level of parents does not have a significant relationship with intestinal worm infection in pre-school age children.

There is a significant relationship between anemia and intestinal worm infection in stunted children in Central Lombok Regency, NTB Province (p = 0.029), this is in line with research conducted byDjuardi et al. (2021) which states that anemia is associated with the incidence of intestinal worm infection in malnourished children of pre-school age. However, in contrast to the results of research conducted bySari et al. (2020)which states that there is no significant relationship between anemia and intestinal worm infection in school-age children. This shows that children who are malnourished also have anemia. The condition of anemia can be caused by an intestinal worm infection in the child's body.Intestinal worms take food extracts and can cause intestinal bleeding in the intestines, resulting in a decrease in hemoglobin levels in sufferers(Siagian and Maryanti, 2020).

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

AUTHOR'S CONTRIBUTION

Ananta Fittonia Benvenuto generates ideas and formulates research. Fahriana Azmi contributed in data collection, Velia Maya Samodra contributed in writing the proposal and I Gede Angga Adnyana contributed in data processing.

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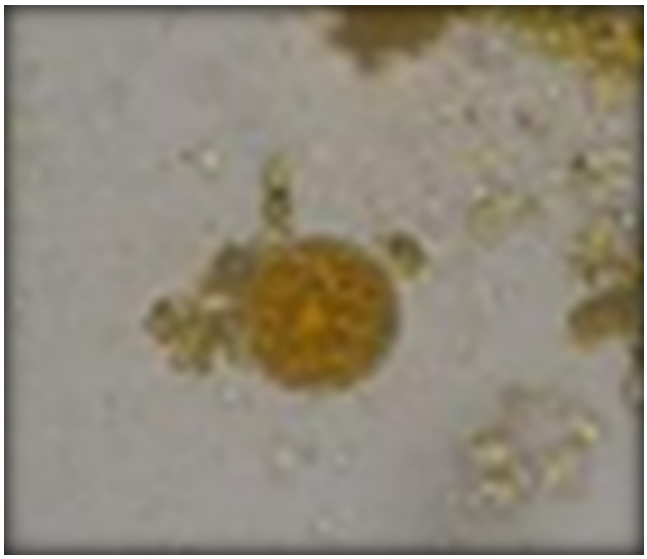
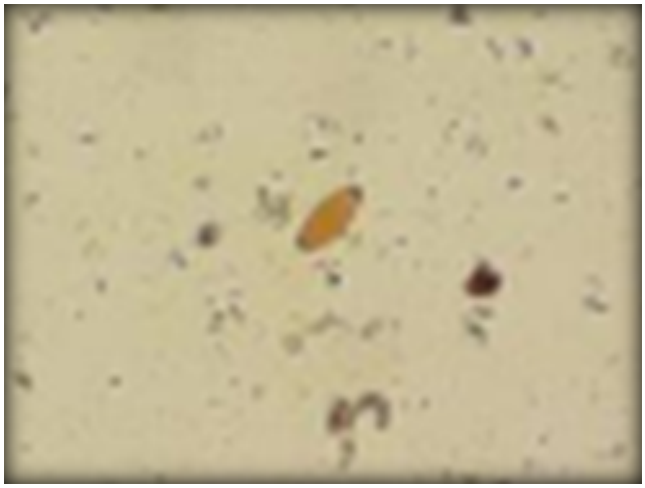


Worm eggs A. lumbricoides 400X . magnification



Eggs of T. trichiura worm 400X . magnification