

## STATUS GIZI DAN INFEKSI CACING PADA ANAK DI PERDESAAN INDONESIA

### *Nutritional Status and Helminthiasis Infection among Children in Rural Area, Indonesia*

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#### ABSTRAK

**Pendahuluan:** Status gizi merupakan salah satu indikator utama kesehatan pada masa kanak-kanak. Di Indonesia, sebagai salah satu negara sub-tropis, kecacingan merupakan salah satu infeksi yang paling banyak terjadi di daerah pedesaan. Namun, perhatian terhadap penyakit menular yang dapat disembuhkan dan dicegah ini masih kurang.. **Tujuan:** untuk mengetahui hubungan infeksi kecacingan dengan status gizi anak. **Metode:** Desain studi cross-sectional digunakan untuk penelitian ini. Sampel diambil dari 220 anak usia 3-6 tahun di PAUD. Kuesioner digunakan untuk menilai karakteristik dasar partisipan. Pengukuran antropometri diperoleh dengan timbangan dan stadiometer; Z score dihitung berdasarkan hasil antropometri. Infeksi cacing dikonfirmasi oleh laboratorium Puskesmas. Analisis statistik yang digunakan dalam penelitian ini adalah deskriptif, One-Way ANOVA, Independent T-Test dan regresi multiliner yang dirender menggunakan SPSS. **Hasil:** Sebagian besar dari mereka berasal dari keluarga berpendapatan rendah (71,4%). Prevalensi infeksi kecacingan sebesar 22,3% dan 37,7% anak mengalami gizi buruk. Anak yang terkonfirmasi infeksi helminthiasis menunjukkan status gizi lebih rendah secara signifikan berdasarkan analisis statistik uji t independen ( $t=19,48$  dengan  $\alpha=0,000$ ). Anak-anak yang terkonfirmasi terinfeksi secara signifikan lebih tinggi pada anak-anak dari keluarga kurang mampu secara finansial ( $\alpha=0,028$ ). Dari seluruh variabel yang dimasukkan dalam analisis, hanya infeksi kecacingan yang signifikan terhadap status gizi ( $\beta=0.172$ ,  $t=2.562$  dengan  $p\text{-value}=0.049$ ). **Kesimpulan:** Penelitian ini menunjukkan bahwa infeksi kecacingan mempunyai hubungan yang bermakna dengan status gizi anak dan status ekonomi keluarga.

#### ABSTRACT

**Background :** Nutritional status is one of the key health indicators in childhood. In Indonesia, as one of the sub-tropical country, helminthiasis is one of the common infections in rural area. However, less attention given to this curable and preventable infectious disease. **Objective:** investigate the correlation between helminthiasis infection with child's nutritional status. **Method:** Cross-sectional study design occupied for this study. A convenience sampling of 220 children, aged 3-6 years old at the early childhood education center. Questionnaire was utilized in assessing the participant basic characteristic. Anthropometry measurement acquired with weighing scale and stadiometer; Z score calculated based on anthropometry result. Worm infection confirmed by public health centre's laboratory. Statistical analysis used in this study were descriptive, One-Way ANOVA, Independent T-Test and multi-linear regression were rendered using SPSS. **Results:** A largest sum of them were from low-income family (71.4%). The prevalence of helminthiasis infection was 22.3% and 37.7% children were mal-nourished. Children with confirmed helminthiasis infection exhibited significant lower nutritional status confirmed with independent t-test statistical analysis ( $t=19.48$  with  $\alpha=0.000$ ). The confirmed infected children were significantly higher on children from financially disadvantaged family ( $\alpha=0.028$ ).

From all the variables input into the analysis only helminthiasis infection was significant to the nutritional status ( $\beta=0.172$ ,  $t=2.562$  with  $p\text{-value}=0.049$ ). **Conclusion:** This research suggested that helminthiasis infection is significantly related with child's nutritional status and family economy status

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## BACKGROUND

Malnutrition has been becoming one of the leading causes of child death globally. Comparing to the case in 1990 to 2017, the death rate due to malnutrition in Indonesia was progressing slowly from 12.8 to 8.37% in every 100.000 live children. The prevalence of malnutrition on children under 5 years old in Indonesia recent years has decreased from 37% in 2013 to 27.6% in 2019. However, this reduction yet still far from the target of Indonesian Ministry of Health to reduce it into 14% in 2024. The main cause of malnutrition are the inadequate food intake and the disease particularly caused by the poor social and care environment and the poor access to health care as well as unhealthy environment (Sumarmi, 2022).

In some low-middle income country especially in sub tropic area, the poor and unhealthy environment inevitably linked to the soil-transmitted helminthiasis infection that caused nutrition problem for children. Intestinal helminthiasis mentioned as one of the infectious diseases in children under 5 years old which leads to malnutrition (Mantasia & Sumarmi, 2022; Sumbele et al., 2020). Helminthiasis grouped as infectious disease caused by a broad range of organisms including parasitic worm in intestinal organ consequently induced tissue reaction, provoking intestinal obstruction leading to compromising nutritional status (WHO, 2018). Untreated helminthiasis may cause serious problem to children's health, growth, and development.

Worms' infection is one of the main health problems in Indonesia. This happens because of the low level of public awareness of this disease and the symptoms that are not reported, even tend to be ignored (Chang, 2019; Weatherhead & Hotez, 2015). The disease caused by helminthiasis infection is so called as ignored disease since it does not

get enough attention. It is often considered a disease that does not cause epidemics problem or serious effect like death. However, helminthiasis infection is actually one preventable and curable disease which can cause many losses, because slowly the worm infestation in the patient's body will cause further serious health problems. Some problems following the helminthiasis infection are related nutrition, school performance and productivity of work. In addition, worms can also reduce the host body's resistance so that they are susceptible to other diseases including higher risk of getting infected from other viral diseases (Chard et al., 2019; Njoku et al., 2022).

It has been proven that nutritional problems are related to worm infection. Several studies have shown that there is a proven effect of Soil Transmitted Helminths infection on iron status, vitamin A status, anemia, and growth through a variety of mechanisms, including malabsorption, inflammation, and reduced food intake due to lack of appetite (Asfaw et al., 2020; Echazú et al., 2015; Stewart et al., 2020). However, there is still a lack of research that identifies the relationship between worm infection and malnutrition. Furthermore, there is a lack of research examining worm infection with nutritional problems in preschool or early age children (Stewart et al., 2020).

Nutrition is an important determinant of the immune response. Deficiencies in micronutrients such as zinc, selenium, iron, copper, vitamin A, vitamin C, vitamin E, vitamin B-6, and folic acid will affect the immune response (Stewart et al., 2020). Vitamin A deficiency can cause damaged defenses on the epithelial surface caused by damage to the epithelial structure, mucus changes, and decreased IgA secretory, Neurotrophil function, macrophages, and natural deficiency of vitamin A will also change B cell and T cell proliferation, while vitamin C plays a role in migration and

phagytosis of macrophages and neutrophils (Yap et al., 2014).

Some studies conducted in sub-tropical areas confirmed the role of soil-transmitted helminthiasis as the cause of the malnutrition. Malnutrition for children on their first year of life will leave some effect on their later stage of life. Growth and development of preschool children and well as academic performance will be impacted too. As mentioned by Oninla et al 2010, that helminthiasis and other worm infection was the significant factors causing underweight and malnutrition on preschool children (Oninla et al., 2010).

The malnutrition rate in Indonesia is wide in range, and widely gapped between urban and rural areas (Sumarmi et al., 2022). Based on national statistical data center, Sulawesi, Kalimantan, and West Nusa Tenggara were the islands with the highest malnutrition rate. Geographical location on those islands is the challenge for the government to proving the accessible healthcare center and clean and good environment. More studies have elaborated the correlation between helminthiasis with academic performance on school-age children, however limited information about helminthiasis and malnutrition in rural area of Indonesia. Thus, this study is to identify the correlation between malnutrition with the soil-transmitted helminthiasis among early-childhood in rural area of Indonesia.

## **METHODS**

Cross-sectional study design as occupied for this study. Expected sample size was calculated using G Power 3.1.9.2 version through F-Test, with  $\alpha = 0.05$ , power level; 0.8 and effect size 0.36 which yielding 66 participants. Attrition rate 10% was anticipated for chance of drop out or incomplete data thus total targeted participants was 73. The population of this study are the children aged 3-6 years old at the early childhood education center in Takalar regency, South Sulawesi as one of the rural areas with high number of malnutrition. Questionnaire was utilized in

assessing the participant basic characteristic comprising age, gender, and parents' economic status. To measure the anthropometry, calibrated weighing scale and stadiometer were used, and Z score were calculated based on anthropometry result. Laboratory analysis was done by the University laboratory technician to confirm the worm infection on children participated in this study.

Data collection rendered from June to October 2020 in the early childhood education center after receiving ethical clearance from the Muhammadiyah Yogyakarta University permission from the head of childhood education center and parents of the children involved in this study. The questionnaire, informed consent form for the parents and specimen pot were distributed to the children during parents meeting at the school. The parents brought the specimen pot home then the next day the child brought the labelled stool specimen pot to the school and handed over to the researchers.

Statistical analysis of frequency distribution means comparison of Independent T test and One-Way ANOVA, as well as Pearson correlation test and linear regression were executed using SPSS 23 Version.

## **RESULTS**

### **1. Characteristics of respondents**

Table 1. Characteristics of respondents

Variable	<i>n</i>	%
<b>Sex</b>		
Male	106	48.2
Female	114	51.8
<b>Age</b>		
3 years	73	33.2
4 years	59	26.8
5 years	51	23.2
6 years	37	16.8
<b>Economic Status</b>		
Low-income family	157	71.4
Middle-income family	27	12.3
High-income family	36	16.4
<b>Worm infection</b>		
Negative	171	77.7
Positive	49	22.3
<b>Nutritional status</b>		
Severe malnutrition	8	3.6
Moderate malnutrition	22	10.0
Mild malnutrition	53	24.1
Normal	134	60.9
Over weight	3	1.4

*Primary Data Sources 2020*

From 248 questionnaire, informed consent and specimen pot distributed, 220 stool samples of children collected (88.7%) return rate. Most of the participants were girls occupying 51.8% of total and one third of them were at the age of three. Based on the family economy status, a largest sum of them were from low-income family covering 71.4%, followed by high-income family and middle-income family with 16.4% and 12.3% respectively as seen on table 1. The prevalence off soil-transmitted helminthiasis infection among early childhood was 22.3%. In addition, 37.7 children were malnourished ranging from severe malnutrition (3%), moderate malnutrition (10.0%) and mild malnutrition (24.1%).

## 2. Pearson correlation between variables.

Table 2 Pearson correlation between variables

Nutrit ional status	Age	Sex	Econ omic	Wo rm infe
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	statu s ctio n				
Nutritiona l status	1				
Age	0.08	1			
Sex	-0.03*	0.05	1		
Economic status	0.08	-0.01**	-0.03*	1	
Worm infection	0.17	0.05	0.08	0.03*	1

\* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$

*Primary Data Sources 2020*

Means comparison from the participants background characteristics to their nutritional status found out that most of malnutrition prevalence were likely seems to be significantly higher on male children than female. In addition, children with confirmed helminthiasis infection exhibited significant lower nutritional status confirmed with Independent T-test statistical analysis receiving  $F=19.48$  with  $\alpha = 0.000$  (described on table 2). While other characteristics like age and economical status were found not significantly related to children's nutritional status. Correlational analysis using Pearson correlation test revealed that gender was significantly correlated with nutritional status, when girls were significantly had lower nutritional status than boys. The prevalence of soil-transmitted worm infection was significantly higher on children from financially disadvantaged family with  $\alpha = 0.028$ , see table 3.

## 3. Regression models to examine the factors influence nutritional status.

Table 3 Regression models to examine the factors influence nutritional status.

Independent Variables	Dependent Variable: Nutritional status	
	Model 1 Beta (t)	Model 2 Beta (t)
Age		0.07 (1.10)
Gender		-0.05 (-0.69)

Economic status		0.07 (1.11)
Worm infection	0.17*** (2.61)	0.17*(2.56)
R <sup>2</sup>	0.03	0.04
F- value	6.82	2.42
p-value	0.01	0.05
Durbin Watson	1.40	1.42

\* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$

*Primary Data Sources 2020*

Further analysis using multi linear regression to examine the correlation between nutritional status on children with other variables. The predicting variables affecting the child's nutritional status. In the model of multi linear regression we included age, gender, economic status and helminthiasis infection. From all the variables input into the analysis only helminthiasis infection was significant factor to child's nutritional status explained by  $\beta = 0.172$ ,  $t = 2.562$  with  $p\text{-value} = 0.049$ . this variable explained 43% of the variance in child's malnutrition.

## DISCUSSION

Looking at the broader picture of prevalence of soil transmitted helminthiasis infection in rural areas of Indonesia, we found that this highly prevalence disease in tropical country indeed impacted the child's nutritional status which highly possible to affect their health status. This study provided the data related helminthiasis prevalence in South Sulawesi Indonesia. The prevalence off soil-transmitted helminthiasis infection among early childhood was 22.3%. This number is much lower than what other's researchers found in Sudan on 2019. The prevalence of soil transmitted helminthiasis infection was 35.6% (Lee et al., 2019). This result also found to be lower compared to Thailand with 28, 57% (Adisakwattana et al., 2020). While comparing to Philippines the result yielded from the recent study was higher since the prevalence of helminthiasis is Philippine in 2019 was 24.9% (Delos Trinos et al., 2019). The availability data is useful to guide the prospective action in dealing with treatable infectious disease to prevent further serious health problems.

The prevalence of malnutrition on children aged 3-6 years old in North Sulawesi found as of 37.7% ranging from severe malnutrition (3%), moderate malnutrition (10.0%) and mild malnutrition (24.1%). This finding is similar to the previous study done in Indonesia by Rachmi on 2016 with 36.7% (Rachmi et al., 2016). The prevalence of under nourished children were higher on population living in rural areas and family with lower financial status.

The recent study explained that most of malnutrition prevalence were likely seems to be significantly higher on male children than female. This finding supported the previous study which has similar result explaining that malnutrition is more prevalent on male children (Almeida et al., 2020; Bah et al., 2018; Kim et al., 2020). This study also revealed that children with confirmed helminthiasis infection exhibited significant lower nutritional status. Congruently, from all the variables input into the multi linear regression analysis only helminthiasis infection was significant factor to child's nutritional status This result echoes the earlier studies correlating helminthiasis infection with the nutritional status done by Lee at all on 2019 (Lee et al., 2019; Ohuche et al., 2020).

Nutritional status is one of the important indicators of child's health requiring serious attention. While soil transmitted helminthiasis is a curable and preventable infectious disease. Knowing that cause and effect of this infection, should become one consideration to reduce the helminthiasis infection by deworming the children.

Another data found from this study was the prevalence of soil-transmitted worm infection was significantly higher on children from financially disadvantaged family. This is unsurprising findings owing to the earlier study related soil transmitted helminthiasis were mostly highly found in the low-income country and family with low social economy status as found by Montresor et all and Almeida et all (Almeida et al., 2020; Montresor et al., 2020). Low-income

families are hardly fulfilling their daily need including preserving the clean and healthy environment.

## CONCLUSION

This research suggested that children with confirmed helminthiasis infection exhibited significant lower nutritional status. The confirmed infected children were significantly higher on children from financially disadvantaged family.

Soil transmitted helminthiasis infection is a high prevalent curable infectious disease in the sub-tropical areas requiring more serious attention as it may lead to child's health problem. The prevalence of helminthiasis infection in South Sulawesi is still high especially male children aged 3-6 years old. Children from financially disadvantaged were more likely to have higher risk to get infected from helminthiasis. Helminthiasis infection was confirmed to affect the child's nutritional status where the children with confirmed positive infected has were showing to be malnourished.

This research suggested that helminthiasis infection among children required more serious attention as proven it may impact the child's nutritional status. Another attention to be given to those children from low-income family who are vulnerable to this disease.

Further examination focusing on children from lower economic status might be needed to be able to draw necessary possible support for them using the available resources.

Early education center is suggested to provide routine screening and deworming to children at school would likely to help to reduce the prevalence of helminthiasis infection to promote better nutritional status for children under growth period.

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