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Research Report

## RELATIONSHIP BETWEEN GROWTH RATE AND DIFFERENT TYPES OF INFECTION IN CHILDREN UNDER 5 YEARS ON WEST PAPUA

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### ABSTRACT

*Malnutrition is still a significant problem in the world and in Indonesia. Among the factors underlying it, the role of growth faltering is often underestimated. Considering infection as a factor that affects growth and that Indonesia is endemic to various different infectious diseases, to understand its role, a study on infants is conducted using longitudinal study design in the Sumuri District, Bintuni Bay Regency, West Papua Province. A total of 138 children aged 6 months to 5 years is followed for 6 months in February to August 2014. Weight gain data and frequency of infection is collected, with the infections divided into four category of disease: upper respiratory tract infection, skin infection, gastroenteritis, and malaria. These data are gathered by Puskesmas daily and monthly records followed by home visit. This study found that the prevalence of malnutrition for the area covered by Puskesmas Tanah Merah is 15.9% for moderate malnutrition and 2.9% for severe malnutrition, with the mean SD value in the beginning of the study -1.15 and at the end of study -1.12, with the difference of SD value calculated as weight gain. Total incidence of infections and mean duration of each infection is then compiled and calculated with weight gain data using linear regression method statistical test to understand the difference of role of each infection to weight gain. The result of the study shows that gastroenteritis has a significant negative effect to weight gain and upper respiratory tract infection has a negative effect to weight gain on children in the villages handled by Puskesmas Tanah Merah West Papua.*

**Keywords:** gastroenteritis, upper respiratory tract infection, growth rate, weight gain, malnutrition

### ABSTRAK

*Malnutrisi masih menjadi masalah yang signifikan di dunia dan di Indonesia. Di antara faktor-faktor yang mendasarinya, gagal tumbuh sebagai sebuah faktor seringkali masih diremehkan. Meperetimbangkan infeksi sebagai faktor yang mempengaruhi pertumbuhan dan bahwa Indonesia endemik terhadap berbagai penyakit menular, untuk memahami peran faktor tersebut, penelitian pada anak dilakukan dengan menggunakan desain penelitian longitudinal di Distrik Sumuri, Kabupaten Teluk Bintuni, Provinsi Papua Barat. Sebanyak 138 anak usia 6 bulan sampai 5 tahun diikuti selama 6 bulan pada Februari sampai Agustus 2014. Data penambahan berat badan dan frekuensi infeksi dikumpulkan, dengan infeksi dibagi menjadi empat kategori: infeksi saluran pernafasan bagian atas, infeksi kulit, gastroenteritis, dan malaria. Data ini dikumpulkan dengan catatan harian dan bulanan Puskesmas yang diikuti dengan kunjungan ke rumah. Studi ini menemukan bahwa prevalensi malnutrisi untuk area yang dicakup oleh Puskesmas Tanah Merah adalah 15,9% untuk malnutrisi sedang dan 2,9% untuk malnutrisi berat, dengan nilai SD rata-rata pada awal penelitian -1,15 dan pada akhir penelitian -1,12, dengan selisih nilai SD dihitung sebagai penambahan berat badan. Jumlah kejadian infeksi dan durasi rata-rata setiap infeksi kemudian dikompilasi dan dihitung dengan data penambahan berat badan dengan menggunakan metode statistik regresi linier untuk mengetahui perbedaan peran masing-masing infeksi terhadap penambahan berat badan. Hasil penelitian menunjukkan bahwa gastroenteritis memiliki efek negatif yang signifikan terhadap kenaikan berat badan dan infeksi saluran pernapasan bagian atas memiliki efek negatif terhadap penambahan berat badan pada anak-anak di desa-desa yang ditangani oleh Puskesmas Tanah Merah Papua Barat.*

**Kata kunci:** gastroenteritis, infeksi saluran pernafasan atas, pertumbuhan, penambahan berat badan, malnutrisi

## INTRODUCTION

Infection is one of the key factors regarding the problem of nutrition.<sup>1,2</sup> When an infection happens, the immune system needs various nutrients to maintain immunity against pathogens. Various hypothesis has said that frequent infections may make nutritional interventions may not as effective.<sup>3</sup>

Based on Riskesdas 2010 data the prevalence of malnutrition in infants in Indonesia is still very high at 17,9%.<sup>4</sup> Due to its place in the tropical region, Indonesia is endemic to various different infectious diseases. Considering also various factors such as the lower per capita income and low education rates of rural areas of Indonesia, this contributes a lot to the persistence of malnutrition in Indonesia. Malnutrition is closely linked with risks of infection and infection is the leading cause of child mortality. From worldwide data regarding estimated death in children younger than 5 years in 2008, infectious diseases is the leading cause with 68%, with the leading infectious disease being pneumonia (18%) and diarrhea (15%).<sup>5</sup> In Indonesia, data from Riskesdas 2010 tabulates a total of 276 deaths of children aged 1 month to 4 year with the leading disease being diarrhea (25,2%) and Pneumonia (15,5%).<sup>4</sup>

Among the key factors identified underlying the higher prevalence of malnutrition in low-income countries is growth faltering.<sup>6</sup> Association between malnutrition, immunodeficiency, incidence of infections and morbidity in children has been shown by various studies.<sup>7-10</sup> However, few studies have tried to link the problem of growth rate itself with the prevalence of different types of infection beside gastroenteritis.<sup>11-13</sup>

A province in the eastern Indonesia, West Papua, hold the distinction of having the lowest population density in Indonesia.<sup>14</sup> The aforementioned low population density makes it replete with problems such as inadequate infrastructure and low economic prowess. In Sumuri District, Bintuni Bay Regency of West Papua, there are three villages in areas handled by Puskesmas Tanah Merah: Tanah Merah Baru, Saengga, and Onar village. These villages are relatively isolated, with no land route and a distance of  $\pm$  35 kilometers by sea from the regency capital. There are no reliable mass transportation method, a small merchant boat comes around every approximately two weeks carrying with a small boat carrying groceries and other necessities becomes the primary mean of villagers without their own boat for transportation. This makes problems such as inadequacy of food, sanitary, and health needs persistent.

By studying the children in the aforementioned villages covered by Puskesmas Tanah Merah, this study attempts to find how much the role of different types of infection affects the growth rate of children in rural Papua.

The purpose of this study is not to examine the direct effect of infection on malnutrition, since it is a broader topic and of which the relationship has been more established, but to determine whether how much the specific factor of prevalence of infection affects growth rate. Between other factors such as the high rate of poverty, low education and inadequate infrastructure, the result of this study may be able to help the policymakers to decide a more effective approach to reducing malnutrition in such regions.

## MATERIAL AND METHOD

### Subjects and Collection Methods

Puskesmas Tanah Merah is located southwest of the regency capital in a small rural peninsular. It can be considered isolated since there are no land routes and no regular transportation to that area.

The sample is all children between 6 months to 5 years in the villages of Tanah Merah Baru, Saengga, and Onar. The datas are collected between February to August 2014. Due to the relatively high growth rate, children under 6 months of age were not included in this study. Data of frequency of infection is gathered by Puskesmas daily records, combined with home visit and inquiries pertaining to duration of infection. Data of nutrition is gathered by Posyandu monthly records or home visit records. Due to the technical difficulty of calibration of measuring tools, height data is not considered in this study.

### Disease Categories

Diseases are divided into four categories of most common type of infection to aid analysis. The four categories are: 1. Upper respiratory tract infection. This covers throat, nose, and ear infections; 2. Gastroenteritis, defined by a history of diarrhea without or with vomiting; 3. Skin infections, regardless of viral or bacterial cause; 4. Malaria, an endemic infection to the region, diagnosed by a positive value on rapid test and confirmed by blood smear examination.

### Statistical Analysis

From a period of 6 months, the weight data is gathered and the Z score of each children during the beginning and the end of the survey is determined. It is then compared by WHO standard and the difference in Z score is considered as weight gain. Frequency of infection data in the same interval is then decided by the relative period of disease, gauged by days of sickness divided by total interval duration. The relative effect of each disease is then measured by linear regression analysis of the difference in Z score and the frequency of infection of each disease with 95% Confidence Interval. A less than 0.05 p values is considered significant.

Data is gathered in Libre Office Calc for Windows and analysed using SPSS 21.0 for Windows

## RESULT AND DISCUSSION

Total number of children data gathered is 138 children, with dropout rate of 3.5% due to relocation to other geographic areas.

### Prevalence of Malnutrition

In the beginning of the study, February 2014, the prevalence of moderate malnutrition, defined by a score of between -2 SD and -3 SD in comparison to standard of WHO is 20 children (14.5%). The prevalence of severe malnutrition, defined by a score of under -3 SD compared to standard of WHO is 6 children (4.3%). The mean SD value of all children at the beginning of the survey is -1.15. In the end of the study (August 2014), the prevalence of moderate malnutrition is 22 children (15.9%). The prevalence of severe malnutrition is 4 children (2.9%). The mean SD mean value in the end of the study is -1.12

### Frequency of Infection

From the results of the data collection, total incidence and mean duration of each infections were calculated as listed in Table 1.

### Relationship between Weight Gain and Infection

Linear regression analysis is done to calculate the relationship between each type of infection and weight gain, to determine the difference in value of each type to growth rate.

The results from Table 2 established that gastroenteritis has a significant negative effect ( $p < 0.001$ ) to weight gain and upper respiratory tract infection has a negative effect ( $p < 0.05$ ) to weight gain. This shows that gastroenteritis

is a very significant factor concerning the growth rate of children.

The most universally used method to determine nutritional status is anthropometry.<sup>15</sup> Yet in a limited public health settings it has many limitations. Growth rate isn't well calculated in those settings in service of nutritional interventions. In addition, other key factors such as infection typically are not prioritized for health interventions because it may not have immediate effects.

Based on Riskesdas 2010,<sup>4</sup> the prevalence of malnutrition according to weight for age in Indonesia is 13% for moderate malnutrition and 4.9% for severe malnutrition. In West Papua province, the prevalence of malnutrition is 17.4% for moderate malnutrition and 6.3% for severe malnutrition. This study founds that the prevalence of Puskesmas Tanah Merah area is 15.9% for moderate malnutrition and 2.9% for severe malnutrition. This shows that the number for moderate malnutrition is higher than national average but lower than provincial average, and the number for severe malnutrition is lower than both provincial and national average. The active role of a local non-governmental organization Yayasan Sosial Agustinus possibly have a big role in this fact, since they are active in giving nutritional interventions for children with severe malnutrition. However, children with less than severe malnutrition doesn't get as much consideration.

Based on Riskesdas 2010,<sup>4</sup> no data is collected about frequency of infection on specific age ranges nor about the average duration of infections. However, from international data and studies, a very strong relationship in both incidence and duration between gastroenteritis and malnutrition has been established.<sup>8,10,16,17</sup> In both incidence and the rate of development into more serious infections, a relation has also been established between upper respiratory tract infections and malnutrition.<sup>7,9,18</sup> For the specific factor of growth rate, some studies have shown a relationship between growth faltering and gastroenteritis.<sup>11-13</sup> A combined analysis of data from nine studies in five countries (Bangladesh, Brazil, Ghana, Guinea-Bissau and Peru) shows that 25% of stunting at 24 months of age was associated with five or more episodes of gastroenteritis in the first 2 years of life.<sup>12</sup> Less clear is the relationship between growth rate and respiratory infections. Some studies have associated growth faltering and febrile respiratory infections.<sup>19,20</sup> No studies were found about these relationship and associations in regard of rural Indonesia.

The result of this study shows that infections such as upper respiratory tract infections and gastroenteritis especially have a negative effect on weight gain in rural Papua. This is in line with previous studies. The result of this study doesn't show that malaria and skin infection to have an effect to weight gain. A possible explanation is because skin infections do not alter dietary intake as much as respiratory infections or gastroenteritis. Other studies have demonstrated a relationship between malaria and nutrition,<sup>21,22</sup> but the low number of children in this study

**Table 1.** Total incidence and mean duration (in days) of each infections

Category of Infection	Total Incidence	Mean Duration (in Days)
Upper Respiratory Tract Infection	188	7.9
Gastroenteritis	29	7.2
Skin infection	54	12.9
Malaria	6	5.7

**Table 2.** Regression coefficients of weight gain from linear regression analysis with four category of infections and their p value

Category of Infection	Regression Coefficients of Weight Gain (-SD difference)	P Value
Upper Respiratory Tract Infection	-0.184	0.01
Gastroenteritis	-0.553	0.000
Skin infection	-0.053	0.448
Malaria	-0.082	0.205

that is diagnosed with malaria, with a total of 5 makes it hard to show a significant effect.

From the result of this study, regarding nutritional status in children, the focus should not be solely on improving the anthropometry status of children, but to also consider the overall health condition, because upper respiratory tract infections and gastroenteritis is caused by many different factors.

Nutritional intervention programs like dietary supplementation should therefore give more attention to children who have long and/or frequent respiratory infections or gastroenteritis. Other than nutritional interventions, methods to control and reduce infection such as education on hygiene, sanitation, water quality, food preparation should not be less prioritized than nutritional intervention

To develop an integrated cost-effective and efficient programs to combine all those priorities, it is recommended to do further research on the efficacy and effectiveness of methods that combine strategies of infection control and prevention with nutritional intervention. This should be considered a high priority to solve the problem of malnutrition in Indonesia.

## CONCLUSION

Gastroenteritis has a significant negative effect to weight gain and upper respiratory tract infection has a negative effect to weight gain on children in the villages handled by Puskesmas Tanah Merah West Papua.

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