Nutritional as a risk factors in child patients with leprosy

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Abstract---Leprosy is a skin disease caused by *Mycobacterium leprae*. Leprosy is still a problem in the world. Based from WHO, the defined age for a child is from the womb until the age of 19 years. The risk factors of leprosy in children are host, agent, and environment. Nutritional is one of the risk factors in child leprosy. This study is an analytical study with a cross-sectional study design to evaluate the correlation of nutritional status of child leprosy patients based from WHO and CDC growth charts. The 10-14 years age group was the largest age group with male patients the most affected. The evaluation

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of the nutritional status of new child leprosy patients at the first visit were found, 8 child leprosy patients with short stature (30%). There were 5 child leprosy patients (19.2%) with an overweight nutritional status, and obesity in 1 child leprosy patient (3.8%). However, there is no correlation between nutritional risk factor and child with leprosy (*p-value* : 0,79).

Introduction

Leprosy is a skin disease caused by *Mycobacterium leprae*. Currently, leprosy is still a problem in various parts of the world (Singal & Chhabra, 2017). The defined age for a child according to the WHO definition is from the womb until the age of 19 years (Kemenkes, 2019). The risk factors of leprosy in children are divided according to the host, agent, and environment. One of the host factors that is considered a risk factor for the incidence of leprosy is nutritional factors. This was proven by a study conducted in a rural area in India, obtained from 70 children with leprosy, 4-15% of children are malnourished (Venkatakrishnan et al., 2020). One of the host factors that influence the occurrence of leprosy is nutrition. A study states that Lepromatous Leprosy (LL) is associated with poor nutritional conditions in patients. *M. leprae* is an intracellular bacterium that is dependent on the CMI (Cellular Mediated Immunity) response and is indispensable for the the human host immunity. Conditions of nutritional disorders in leprosy patients often progress to disability in a few cases (Aithal, 2019). The nutritional status is defined as a condition caused by an imbalance between nutrient intake from food and the nutritional needing for body metabolism. One of the factors that influence nutritional status is the presence of infectious disease (Farhadi & Ovchinnikov, 2018). The purpose of this study is to analyze the correlation between nutritional status profile of child with leprosy in the year of 2017-2019 in the leprosy division of the dermatology and venereology outpatient unit of General Academic Hospital RSUD Dr. Soetomo Surabaya.

Method

The design used in this study is a retrospective cross-sectional study that aims to determine the nutritional status profile of child patients with leprosy in the year 2017-2019. The population of the research are child patients with leprosy who were recorded on the medical record at the leprosy division of Dermatovenereology outpatient unit of Dr. Soetomo General Academic Hospital Surabaya with the range time of 2017-2019. The criteria inclusions including all medical records of new child patients with a diagnosis of leprosy based on Ridley Joppling criteria and receiving an Acid Fast Bacciller (AFB) examination. The exclusions criteria are child patients with reaction of leprosy and new child patient that have been receiving treatment from another center. The analytical data were tested using the SPSS *(Statistical Package for the Social Sciences).* This research has been examined by the Ethics Committee in General Academic Hospital Dr. Soetomo Surabaya (ethical number: 0593/112/III/2021).

Results and Discussion

Distribution of the new child leprosy patients

This study found a total of 365 adult leprosy patients (90.1%) and 36 pediatric leprosy patients (9.9%) who were treated at the Leprosy Division of Dermatovenereology in outpatient unit of Dr. Soetomo General Academic Hospital Surabaya for the period of 2017-2019. There were 10 pediatric leprosy patients who were excluded. Previous study at the same hospital in 2009-2011 showed 37 patients (5,5%) of the total number of 677 new leprosy patients. Although the total number of new leprosy patients were decreasing, however the total of child leprosy patients is still very high in the hospital. This report showed an active transmission case in several area of Surabaya (Wulan et al., 2014;Kemenkes RI, 2020). Based on this study, there were 26 child leprosy patients. The distribution of new child leprosy patients in 2019 was 57.7%% (11 patients), while in 2017 it was 30.7% (8 patients), and in 2018 it was 27.8% (7 patients).
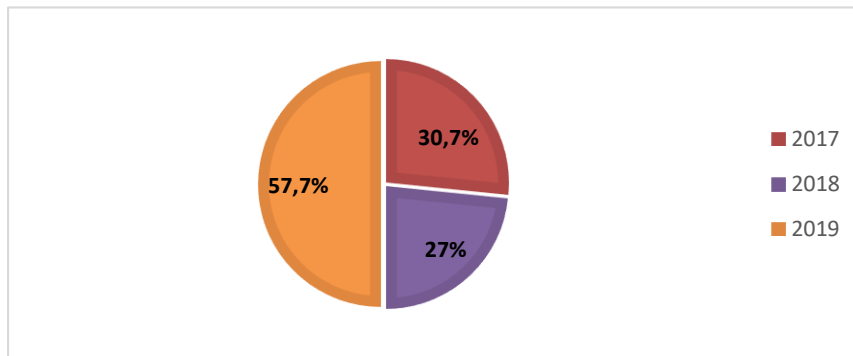

Figure 1. 1. Data on child leprosy patients in the Leprosy Division of Dermatovenereology in outpatient unit at General Academic Hospital RSUD Dr. Soetomo Surabaya on the period of 2017-2019

Gender Distribution

Among the children, male patients were higher than female. The number of male patients were 15 patients (57.7%), while the female patients were 11 patients (42.3%). This study is in line with the previous study in the same hospital during the year of 2009-2011. It was reported that 22 male patients (57,5%) and 15 female patients (40,5%) were attended to the outpatient unit. In the 2012, study in Brazil also reported the total of child leprosy patients, especially in male group (1163 cases) were higher than female group (1.123) (De Oliviera & Diniz, 2014). The reasons why the total of male patients were higher, it's because male patients tend to do more outdoor activities, therefore the risk of exposure to *M. leprae* were higher (Wulan et al., 2014;De Oliviera & Diniz., 2014)

Age Distribution

Age 10-14 year's old were the largest group found in this study with 13 patients (50%), followed by the age 15-18 year's old group with 10 patients (38.5%). The

age group of 5-9 years were found with 2 patients (7.7%), and the last is the age group 0-4 years with a total of 1 patient (3.85%). This finding was also supported by the review study conducted in Brazil (Vieira et al., 2018). It was reported the group of age 10-14 years old were the group with the highest incidence of child leprosy. Previous study in the same hospital during the year of 2009-2011 was also reported that the group of age 10-14 years old were the most affected. Leprosy is a chronic granulomatous disease, hence the incubation time for *M. leprae* to develop a symptom is 5-11 years. Most parents were late in seeking of the treatment because of the long incubation time of leprosy (Wulan et al.,2014 ; Barreto, J.G. et al., 2017).
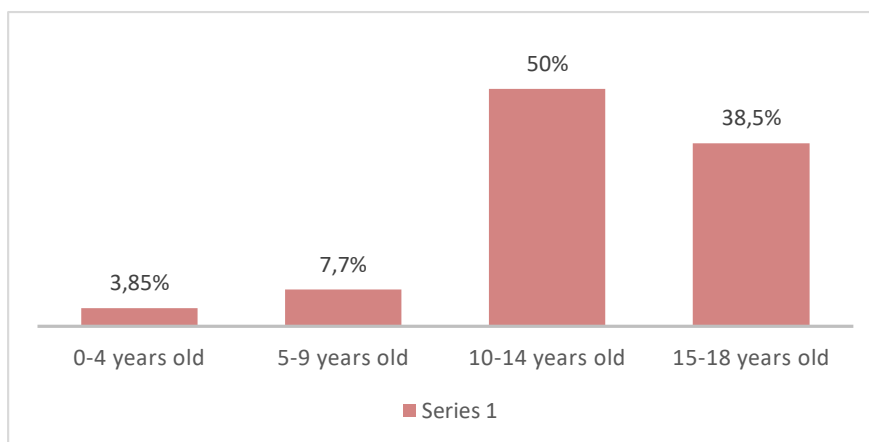

Figure 1. 2. Distribution of Age Group in Child Leprosy

Distribution Based on Leprosy Classification

The classification of leprosy types according to WHO in this study, showed MB type was the highest with a total 20 child leprosy patients (77%), followed by PB type as many as 6 child leprosy patients (23%). BB type was the common type of MB in this study with a total of 10 cases (38.4%), meanwhile the BT type of leprosy was the most common type of leprosy found in PB type of leprosy, with a total of 5 patients (19.2%). Previous study of child leprosy patients in 2009 – 2011 at the same hospital also showed that BB type was the most common type of child leprosy with the total of 59.5% patients. Interesting report were found that that TT type leprosy was the most common type with 16.2% meanwhile previous study the same hospital in 2009 – 2011 stated that BT type leprosy is the most common type (Wulan et al., 2014).

Distribution of Hb

The distribution of Hb evaluation based on this study is 26 child patients were evaluated. The distribution of the hemoglobin (Hb) status for the child leprosy showed 13 patients (68.4%) with normal Hb status. The results of anemia were showed in 6 patients (31.6%) with 3 child anemia patients were founded in LL type. The results of the Hb examination were found normal in this report, however previous cross - sectional study which conducted in Tuban city targeting a pair of mother and her child in an endemic area to be compared with a pair of

mother and her child in a non-endemic area, found a normal Hb results did not always show a picture of good nutrition in child leprosy. Additional examination to determine iron levels in the blood should be done. Iron deficiency in leprosy patients is common due to disturbances in iron-transport protein metabolism. Proinflammatory cytokines such as interferon-γ (IFN-γ) in leprosy can stimulate the production of divalent metal transporter-1 (DMT-1) which then increases iron storage in intracellular tissues. High concentrations of cytokines result in a decrease in Ferroportin-1 (Fpn-1) which acts as an iron transporter from reticuloendothelial cells to erythroid progenitors. Both processes can reduce iron function in erythroid cell-lines and prevent Hb formation (Prakoeswa et al., 2021;Amalia et al., 2017). However, in this study we didn't do the iron levels examination, therefore iron deficiency couldn't be detected.

Nutritional as a risk factor in child patients

The nutritional status results were counted and plotted in WHO growth chart, for patients under 5 years old and the CDC growth chart for patients over 5 years old. The results of the distribution of child leprosy patient with normal stature were found in 17 patients (65.3%), the short stature were found in 8 patients (30%). Child patient with tall stature was found in 1 patient (3.8%). An observational pilot study in the India to assess the nutritional status and morbidity profile showed 9 boys (23%) and 2 girls (7%) with leprosy showed short stature. This report is in line with the results of this study where there were 8 child leprosy patients (30%) who tended to have short stature, however there was no correlation between stature and degree of leprosy (*p-value*: 0,44). The direct relationship between leprosy and child growth is currently unknown, but there are factors that influence child growth, including heredity, environment, gender, hormones, geographical conditions, and socio-economic status (De Oliviera & Diniz, 2014;Vazquez et al., 2014).

The distribution of nutritional status in child leprosy was calculated based on the body weight compared to age (weight-for-age) or (BMI/U). The nutritional status in 17 child leprosy patients (65,3%) were showed normal, while 5 patients (19.2%) were found with an overweight status. Obesity status was showed in 1 patient. (3.8%). Child patients with an underweight status were showed by 3 patients (11.5%). Underweight nutritional status was found mainly in BL type leprosy with the total of 2 patients (66.6%) and BB type leprosy in 1 patient (33.3%). Child patients with an overweight status were showed by 5 patients (19.2%) each obtained in TT type leprosy as many as 1 patient (20%) and type BL as many as 4 patients (80%). According to the Indonesia ministry of health, the definition of nutritional status is a condition caused by an imbalance between nutrient intake from food and the nutritional needed for the metabolism of body (Thamaria et al., 2017).

Nutritional studies of leprosy in children are not widely carried out, however a cross-sectional study in Brazil reported the relationship between leprosy and overweight or obesity in adult patients with 60.1% of adult leprosy patients were overweight (Teixeira et al., 2019). A review studies stated the relation between overweight or obesity and leprosy was caused by an empty caloric diet. Low quality of diet also representing a low antioxidant concentration. All of these

factors will cause an uncontrolled replication of *M.leprae* (Vazquez., 2014; Azzini., 2011). In this study, underweight conditions were found in child leprosy patients as many as 3 patients (11.5%) with each of it was found in leprosy with type BL as many as 2 patients (66.6%) and leprosy type BB as many as 1 patient (33.3%). Based on this study, there was no correlation between nutritional status and the degree type of leprosy (*p-value* : 0,79).

Previous cross-sectional study targeting a pair of mother and her child with and without leprosy. The study did not find a low BMI in a child with leprosy group, however low BMI results were found in group B (child without leprosy and mother with leprosy in endemic area) and group E (the control group ; both child and mother without leprosy living in the non-endemic area). The BMI status amongst the child subjects in the study showed no significance (*p-value* : 0,127), meaning that there is no correlation between nutritional status and leprosy, therefore both of the study defined that poor nutrition doesn't have a relation with the development of leprosy in child (Prakoeswa et al., 2021)

The nutritional status at the time of birth indicates the quality of nutrition obtained by the mother during pregnancy. Inadequate nutrition will affect the development of the fetus in the womb. The distribution of nutritional status at birth showed 1 patient (3.8%) was overweight and 1 patient (3.8%) was obese in the calculation of weight of age and weight for length. A total of 26 child leprosy patients were in accordance with the inclusion criteria, there were 4 patients with complete nutritional status who were successfully traced, while 22 child leprosy patients there were no data regarding body weight and length at birth. The reason is because the nutritional status data is incomplete and the patient's family phone number data listed on the status cannot be contacted (lost contact).

Table 1. The demographics and analytical study of child leprosy patients in the leprosy divisions of outpatient un it in RSUD Dr. Soetomo General Academic Hospital Surabaya 2017-2019.

	Leprosy Type						p value	r
Gender	TT	BT	BB	BL	LL	Jumlah		
Boys	0	3 (20%)	7 (46,7%)	3 (20%)	2 (20%)	15 (57,7%)	0.6	0.11
Girls	1 (9,1%) (25.0%)	1 (9,1%) (25.0%)	3 (27.3%) (30.0%)	5 (45,5%) (62.5%)	1 (9,1%) (33.3%)	11 (100%) (42.3%)		
Total	1 (3.8%)	4 (15.4%)	10 (38.5%)	8 (30.8%)	3 (11.5%)	26 (100.0%)		
Age								
0-4 years old	0	0	1 (100%) (10%)	0	0	1 (100%) (3.8%)		
5-9 years old	0	0	1 (50%) (10.0%)	1 (50.0%) (12.5%)	0	2 (100.0%) (7.7%)		
10-14 years old	0	3 (23.1%)	3 (23.1%)	6 (46.2%)	1 (7.7%)	13 (100.0%)	0.72	0.74

		(75%)	(30.0%)	(75.0%)	(33.3%)	(50.0%)		
15-18 years old	1 (10%) (100%)	1 (10.0%) (25.0%)	5 (50.0%) (50.0%)	1 (10.0%) (12.5%)	2 (20.0%) (66.7%)	10 (100.0%) (38.5%)		
Total	1 (3.8%)	4 (15.4%)	10 (38.5%)	8 (30.8%)	3 (11.5%)	26		
Hb profile								
Anemia	0	1 (16.7%) (100.0%)	1 (16.7%) (12.5%)	1 (16.7%) (16.7%)	3 (50.0%) (50.0%)	6 (100.0%) (31.6%)	0.15	0.35
Normal	1 (7.7%) (100.0%)	0	7 (53.8%) (87.5%)	5 (38.5%) (83.3%)	0	13 (100.0%) (68.4%)		
Total	1 (5.3%) (100.0%)	1 (5.3%) (100.0%)	8 (42.1%) (100.0%)	6 (31.6%) (100.0%)	3 (15.8%) (100.0%)			
Nutrtional status								
Underweight	0	1 (33,3%) (25.0%)	0	2 (66.7%) (25.0%)	0	3 (100.0%) (11.5%)	0.79	0.05
Normal	0	3 (17.6%) (25.0%)	9 (52.9%) (90.0%)	2 (11.8%) (25.0%)	3 (17.6%) (100.0%)	17 (100.0%) (65.4%)		
Overweight	1 (20.0%) (100.0%)	0	0	4 (80.0%) (50.0%)	0	5 (100.0%) (19.2%)		
Obese	0	0	1 (100.0%) (10.0%)	0	0	1 (100.0%) (3.8%)		
Total	1	4	10	8	3	26		
Stature status								
Short	0	2 (25%)	1 (12.5%)	4 (50%)	1 (3.25%)	8 (30%)	0.44	0.15
Normal	1 (5.8%)	2 (11.7%)	8 (47%)	4 (23.5%)	2 (11.7%)	17 (65.3%)		
Tall	0	0	0	1 (100%)	0	1		
Total	1	4	9	8	3	26		

Conclusion

The nutritional status as a risk factor in child patient with leprosy in this study doesn't have a correlation, however the study of nutritional status as a risk factor of leprosy is multifactorial. Because this study was conducted retrospectively therefore more detailed research should be done. Specific nutritional column to evaluate a complete nutritional status should be added in the leprosy medical record.

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