

CORRELATION BETWEEN NUTRITIONAL STATUS AND SIMPLE FEBRILE SEIZURE IN CHILDREN AGED 6 MONTHS – 5 YEARS AT PHC HOSPITAL SURABAYA

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ABSTRACT

Introduction: Around 2 – 3% of children in Indonesia experience febrile seizures. Factors that can increase the risk of febrile seizures is viral infection and nutritional status. Malnourished in children increase the incidence of febrile seizures in children.

Objective: To analyze the relationship between nutritional status and simple febrile seizures in children aged 6 months to 5 years at PHC Hospital in Surabaya.

Method: The study utilized a retrospective observational analytical design with a case control research method on inpatients with fever at PHC Hospital in Surabaya from January 2019 to September 2023, involving a total of 2,464 patients. Data were extracted from medical records and selected based on inclusion and exclusion criteria, resulting in 105 samples in the case group and 758 samples in the control group, meeting the inclusion and exclusion criteria. Thirty-seven samples were randomly selected from each group using simple random sampling. Statistical analysis employed the C contingency coefficient test.

Results: Among patients with simple febrile seizures at PHC Hospital in Surabaya, 8,1% were severe thinness, 29,8% were thinness, 48,6% had normal, 8,1% were at risk of overweight, 2,7% were overweight, and 2,7% were obese. The fever without seizures group showed no severe thinness, 5,4% were thinness, 86,5% had normal, 2,7% were at risk of overweight, 5,4% were overweight, and no obese. Based on the statistical analysis using the C contingency coefficient test, the p-value was 0,008 ($p < 0,05$), indicating a correlation between nutritional status and simple febrile seizures in children aged 6 months to 5 years at PHC Hospital in Surabaya.

Conclusion: There is a correlation between nutritional status and simple febrile seizures in children aged 6 months to 5 years at PHC Hospital in Surabaya.

Keywords: nutritional status, simple febrile seizures

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INTRODUCTION

Febrile seizures are a common neurologic problem in children under 5 years of age.¹ Febrile seizures remain a global health problem in both developed and developing countries. The prevalence of febrile seizures in the United States and Western Europe ranges from 2 – 5%. Asia has a higher prevalence of febrile seizures than America and Europe. The incidence of febrile seizures ranges from 5 – 10% in India, 8.8% in Japan, and 14% in Guam. The latest data from the Ministry of Health Republic of Indonesia in 2013 showed that the incidence of febrile seizures ranged from 2 – 3%.²

Febrile seizures can be divided into two categories, namely simple and complex febrile seizures. Simple febrile seizures last less than 15 minutes and do not recur within 24 hours, while complex febrile seizures last more than 15 minutes and may recur within 24 hours.³ Simple febrile seizures account for 80-85% of the total incidence of febrile seizures.⁴

The exact cause of simple febrile seizures is still not fully understood, but several risk factors have been identified, including body temperature, family history of febrile seizures, perinatal factors, viral infections, and incomplete brain maturity.^{5,6} As many as 80% of simple febrile seizures are associated with viral infections, such as acute respiratory

infections, pharyngitis, otitis media, and gastroenteritis.⁴ In Indonesia, acute respiratory infections are the most common cause of simple febrile seizures, accounting for 85% of the total incidence.²

One of the risk factors of febrile seizures is viral infection, especially in children who are susceptible to infection due to malnutrition.^{7,8} According to the United Nations International Children's Emergency Fund (UNICEF) in 2020, the prevalence of malnourished children in Indonesia ranked 4th in the world.⁸ The results of the National Nutrition Monitoring in 2017 noted that the percentage of children with undernutrition status reached 8.9%, while those with malnutrition status amounted to 3.9%.⁹ Based on the Indonesian Nutrition Status Survey study in 2022, the age group with the most nutritional problems is in the age range of 0 to 59 months.^{10,11}

A study conducted by Borji et al showed that 85.2% of children with febrile seizures were malnourished, while 14.8% were not.¹² In contrast, the results of a study by Oseni et al showed different findings, with febrile seizures being more common in children who were well-nourished compared to those who were malnourished. The differences in the results of these studies are due to the multifactorial nature of the causes of simple febrile seizures.¹³

METHOD

This study used an observational retrospective analytic research design with a case control research method. The samples used were taken from medical record data of paediatric patients with fever who were hospitalised at PHC Surabaya Hospital from January 2019 to September 2023 who met the inclusion and exclusion criteria. From 2,464 patients, 105 samples of simple febrile seizures and 758 samples of fever without seizures were obtained that met the

inclusion and exclusion criteria. Samples in each group were carried out simple random sampling and obtained a minimum sample of 37 in each group. The researcher recorded patient data including the initials of the patient’s name age, gender, cause of fever, weight, and length/height. The data was recorded in the Microsoft Excel application in tabular form, then analyzed using the C Contingency Coefficient test with the help of the Statistical Product and Service Solutions (SPSS) 26 series application.

RESULTS

Table 1. Distribution of Patients by Gender from January 2019 – September 2023 at PHC Surabaya Hospital

Gender	Simple Febrile Seizures n (%)	Fever Without Seizures n (%)
Male	28 (75.6)	21 (56.7)
Female	9 (24.4)	16 (43.4)
Total	37 (100)	37 (100)

Table 1 shows that there are more male patients than female patients (75,6%).

Table 2. Distribution of Patients by Age from January 2019 – September 2023 at PHC Surabaya Hospital

Gender	Simple Febrile Seizures n (%)	Fever Without Seizures n (%)
Male	28 (75.6)	21 (56.7)
Female	9 (24.4)	16 (43.4)
Total	37 (100)	37 (100)

Table 2 shows that the age group with the simplest febrile seizures ranged from 13 to 24 months (45.9%), while the age group with the least simple febrile seizures ranged from 49 to 60 months (8,2%).

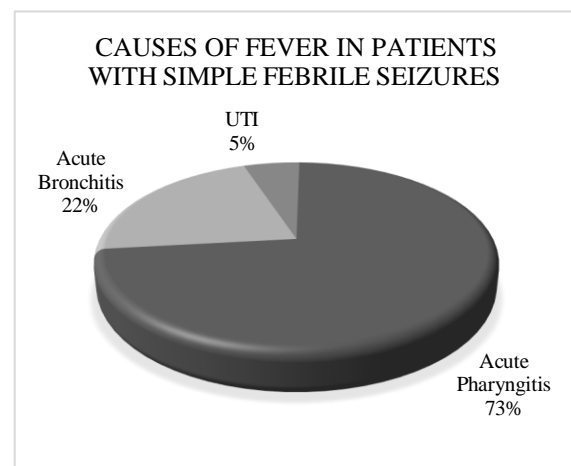


Figure 1. Percentage of causes of Fever in Simple Febrile Seizures of Children aged 6 months - 5 years January 2019 - September 2023 at PHC Surabaya Hospital

Figure 1 shows that the most common cause of fever in simple febrile seizures at PHC Surabaya Hospital was caused by acute pharyngitis (73%), followed by acute bronchitis (22%), and urinary tract infection (5%).

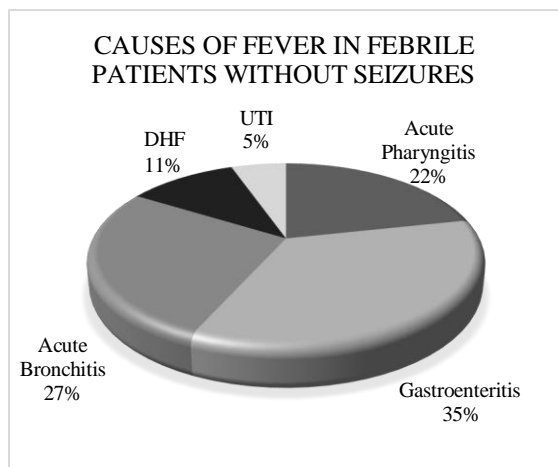


Figure 2. Percentage of Causes of Fever without Seizures in Children aged 6 months - 5 years from January 2019 - September 2023 at PHC Surabaya Hospital

Based on Figure 2, the most common cause of fever without seizures at PHC Surabaya Hospital was caused by gastroenteritis (35%), followed by acute bronchitis (27%), acute pharyngitis (22%), dengue hemorrhagic fever (11%), and urinary tract infection (5%).

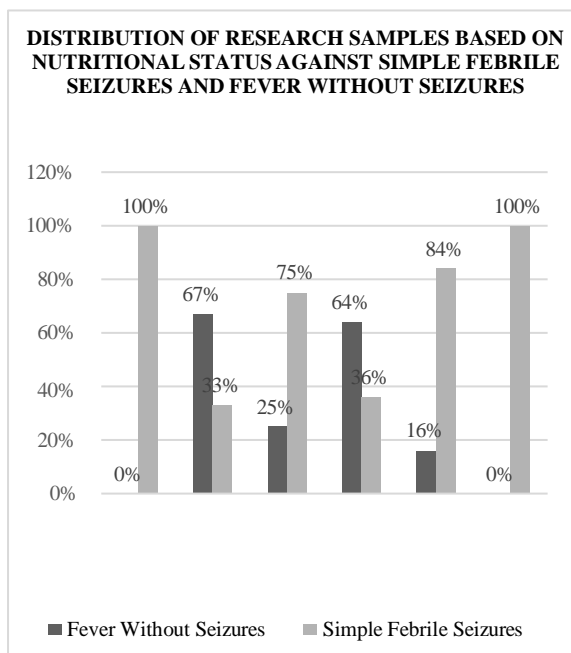


Figure 3. Percentage of Nutritional Status of Simple Fever Seizure Group and Fever Group without Seizure in Children aged 6 months - 5 years Period January 2019 - September 2023 at PHC Surabaya Hospital

Figure 3 shows that out of a total of 3 severe thinness patients, 3 patients had simple febrile seizures (100%). In the thinness group, out of a total of 13 patients, 11 patients had simple febrile seizures (84%) and 2 patients had fever without seizures (16%). In the normal nutritional status group, out of a total of 50 patients, 18 patients had simple febrile seizures (36%) and 32 patients had fever without seizures (64%). In the risk of overweight group, out of a total of 4 patients, 3 patients had simple febrile seizures (75%) and 1 patient had fever without seizures (25%). In the overweight group, out of a total of 3 patients, 1 patient had simple febrile seizures (33%) and 2 patients had fever without seizures (67%). Out of a total of 1 obese patient, 1 patient had simple febrile seizures (100%).

Table 3. Results of Contingency Coefficient Test Analysis of C Patients with Simple Febrile Seizure and Fever without Seizure Period January 2019 - September 2023 at PHC Surabaya Hospital

Nutritional Status	Simple Febrile Seizures n (%)	Fever Without Seizures n (%)	p-value
Severe Thinness	3 (8.1)	0 (0.0)	0.08
Thinness	11 (29.8)	2 (5.4)	
Normal	18 (48.6)	32 (86.5)	
Risk of Overweight	3 (8.1)	1 (2.7)	
Overweight	1 (2.7)	2 (5.4)	
Obese	1 (2.7)	0 (0.0)	
Total	37 (100)	37 (100)	

Among patients with simple febrile seizures at PHC Hospital in Surabaya, 8,1% were severe thinness, 29,8% were thinness,

48,6% had normal, 8,1% were at risk of overweight, 2,7% were overweight, and 2,7% were obese. The fever without seizures group showed no severe thinness, 5,4% were thinness, 86,5% had normal, 2,7% were at risk of overweight, 5,4% were overweight, and no obese. Based on the statistical analysis using the C contingency coefficient test, the p-value was 0,008 ($p < 0,05$), indicating a correlation between nutritional status and simple febrile seizures in children aged 6 months to 5 years at PHC Hospital in Surabaya. The results of the analysis also obtained a value of 0,416, which means that there is a weak correlation value between the two variables of this study.

DISCUSSION

In the result of research conducted at PHC Surabaya Hospital in the period January 2019 – September 2023, it was found that there were more male simple febrile seizure patients than female, with 28 male patients (75.6%) and 9 female patients (24.4%). This difference is influenced by the immune system, where female cellular and humoral immune responses tend to be stronger against infections compared to male. Male are more susceptible to infection due to the influence of the hormone testosterone. This hormone has a suppressive effect on the immune system by

reducing the secretion of interferon gamma (IFN- γ) and interleukin 4 (IL-4). In addition, male also have shorter airways than female, thus increasing potential susceptibility to respiratory infections.^{14,15}

Based on the distribution by age group, the largest age group with simple febrile seizures was found in the 13–24 months age group, while the least age group with simple febrile seizures was the 49–60 months age group. This study indicates that this age range is a developmental window. In this phase, there is rapid development of the brain with hyperpolarization activated cyclic nucleotide-gated hyperactivity, which increases neuronal excitability. Therefore, children in this age range tend to be more prone to febrile seizures.¹⁶⁻¹⁸

This study found that the most common cause of fever in simple febrile seizures in children aged 6 months - 5 years at PHC Surabaya Hospital was acute pharyngitis, with 27 of 37 patients (73%). Respiratory tract infection is the most common cause of fever in simple febrile seizures, because respiratory tract infections are most often caused by viral infections, which can be a predisposing factor for simple febrile seizures.⁶

This study shows that most patients who experience simple febrile seizures are patients with good nutritional status, as many as 18 respondents (48,6%). This study

is in line with research conducted by Annisa et al (2023), where 19 patients with simple febrile seizures had good nutritional status (50%). The study also found that 68% of patients with simple febrile seizures had a family history of seizures. The study states that a family history of seizures can affect the occurrence of simple febrile seizures.¹⁴ This is related to mutations in the α -subunit of the sodium channel (SCN1A and SCN1B). Mutations in both ion channels cause excessive intracellular entry of sodium ions, resulting in increased intracellular sodium levels. This leads to prolonged depolarization and seizures in children.¹⁹ This study is also in line with research conducted by Amalia et al (2019), found that 28 of 31 febrile seizure patients had good nutritional status (90,3%). The study also examined hemoglobin levels in febrile seizure patients and found a relationship between hemoglobin levels and febrile seizures in children, which can be concluded that anemia can be a precipitating factor for febrile seizures in children.²⁰ In conditions of low hemoglobin levels, the ability of erythrocytes to bind oxygen will decrease. When oxygen decreases, the energy for active transport of sodium and potassium ions generated from metabolic products in the body will also decrease. The instability of the active transport of sodium and potassium ions can cause membrane potential disorders and

facilitate the occurrence of seizures in children.^{16,21} This study is also in line with research conducted by Pamela et al (2021), which found that 71.54% of febrile seizure patients had good nutritional status. The study also examined the relationship between serum zinc and magnesium levels in children with febrile seizures aged 6-60 months. The study found hypozincaemia and hypomagnesemia in the febrile seizure group.²²

Through the C contingency coefficient test conducted using SPSS, a significance value of p was obtained of 0,008. The significance value of $p < 0,05$ indicates that there is a correlation between nutritional status and simple febrile seizures in children. In this study, when compared between groups of simple febrile seizures and fevers without seizures, patients with thinness were more common in simple febrile seizure patients with a percentage of 84% than febrile patients without seizures with a percentage of 16%. Thinness in children can reduce the child's immune system and increase the risk of infection. When infection occurs, macrophages release IL-1 β , IL-6, and TNF- α , which then stimulate the activation of cyclooxygenase

2 (COX-2) and microglia. COX-2 is responsible for catalyzing the formation of prostaglandin-E2 (PGE2), while microglia activation leads to the release of IL-1 β and

IL-1Ra. IL-1 β and IL-1Ra have an important role in the interaction of glutamate with AMPA receptors. The imbalance between glutamate and GABA then causes febrile seizures in children.²³

The value was 0,416, which means there is a weak correlation between the two variables. The weak correlation indicates that changes in nutritional status do not consistently lead to simple febrile seizures. The weak correlation also suggests that there are other factors that can influence the occurrence of simple febrile seizures. Nonetheless, nutritional status still plays an important role in the occurrence of simple febrile seizures in children. Therefore, meeting the nutritional needs of children is an important step in preventing the occurrence of simple febrile seizures.

CONCLUSION

Patients with simple febrile seizures were mostly male with a percentage of 75,6% and aged 13 - 24 months with a percentage of 45,9%. Meanwhile, the cause of fever in simple febrile seizures was mostly caused by acute pharyngitis with a percentage of 73%. The results of the analysis of the correlation between the two variables showed that there was a correlation between nutritional status and simple febrile seizures in children aged 6 months - 5 years at PHC Surabaya Hospital.

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