AL-IQRA MEDICAL JOURNAL : JURNAL BERKALA ILMIAH KEDOKTERAN
e-ISSN : 2549-225X. Vol. 09 No. 1, February 2026, Hal. 59-67

THE RELATIONSHIP BETWEEN THE HISTORY OF FEBRILE SEIZURE AND ATTENTION DEFICIT HYPERACTIVITY DISORDER IN CHILDREN IN MAKASSAR

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Abstract

Background: Febrile seizures are convulsive episodes occurring when body temperature exceeds 38°C due to extracranial causes. Recurrent febrile seizures, particularly those lasting more than 15 minutes, may lead to neuronal damage and potentially affect cognitive development, including attention deficits and hyperactivity. Objective: This study aimed to determine the association between a history of febrile seizures and Attention-Deficit/Hyperactivity Disorder (ADHD) in children. Methods: This analytic descriptive study used a cross-sectional design. The sample consisted of 32 children diagnosed with ADHD who met the inclusion criteria. Primary data were collected through structured questionnaires completed by parents or guardians. Data were analyzed using univariate and bivariate methods, with the Chi-square test used to assess statistical associations. Results: No significant association was found between a history of febrile seizures and Attention-Deficit/Hyperactivity Disorder (ADHD) ($p = 0.64$). In contrast, age was significantly associated with ADHD ($p < 0.05$). Conclusion: No significant relationship was found between febrile seizure history and ADHD in children in Makassar.

Keywords: *Febrile Seizures, Attention Deficit Hyperactivity Disorder, Children*

Abstrak

Latar Belakang: Kejang demam merupakan bangkitan kejang yang terjadi ketika suhu tubuh melebihi 38°C akibat proses ekstrakranial. Kejang demam berulang, terutama yang berlangsung lebih dari 15 menit, berpotensi menyebabkan kerusakan neuron yang dapat memengaruhi perkembangan kognitif anak, termasuk gangguan pemusatan perhatian dan hiperaktivitas. Tujuan: Penelitian ini bertujuan untuk mengetahui hubungan antara riwayat kejang demam dengan gangguan pemusatan perhatian dan hiperaktivitas (GPPH) pada anak. Metode: Penelitian ini menggunakan desain deskriptif analitik dengan pendekatan cross-sectional. Sampel terdiri dari 32 anak yang telah didiagnosis GPPH dan memenuhi kriteria inklusi. Data primer diperoleh melalui kuesioner terstruktur yang diisi oleh orang tua atau wali. Analisis data dilakukan secara univariat dan bivariat menggunakan uji Chi-square. Hasil: Tidak terdapat hubungan yang signifikan antara riwayat kejang demam dengan GPPH ($p = 0,64$). Namun, terdapat hubungan yang signifikan antara usia dengan GPPH ($p = 0,00$). Kesimpulan: Tidak terdapat hubungan antara riwayat kejang demam dan GPPH pada anak di Kota Makassar.

Kata Kunci *: Kejang Demam, Gangguan Pemusatan Perhatian dan Hiperaktivitas, Anak*

INTRODUCTION

According to the International League Against Epilepsy (ILAE), febrile seizures are seizures occurring in children older than one month of age associated with a body temperature exceeding 38.4°C, in the absence of central nervous system infection or acute electrolyte imbalance, and without a prior history of afebrile seizures. Febrile seizures are convulsive events triggered by elevated body temperature (>38°C) due to extracranial processes. They are the most common type of seizure in childhood. The highest incidence occurs in children aged 6 months to 5 years, affecting approximately 2–4% of this population. Around 90% of cases occur before the age of five, with the peak incidence between 6 and 22 months, particularly at 18 months.[1].

According to the World Health Organization (WHO), it is estimated that more than 21.65 million children worldwide experience febrile seizures, and over 216,000 children die each year as a result[2]. In Asia, the incidence of febrile seizures is relatively high, accounting for approximately 80–90% of all simple febrile seizure cases[3]. In Asia, the incidence of febrile seizures is relatively high, accounting for approximately 80–90% of all simple febrile seizure cases. Guam has been reported to have the highest incidence in Asia, reaching 14%[4]. Based on data from Riset Kesehatan Dasar (Riskesdas) 2013, the number of febrile seizure cases in Indonesia was 900,626, representing approximately 3.8% of 23,700,676 children. In South Sulawesi, the reported incidence of febrile seizures was approximately 4,115 cases in 2014, 3,467 cases in 2015, and 3,657 cases in 2016[5].

Recurrent febrile seizures, particularly those lasting more than 15 minutes, may lead to neuronal damage that can affect a child's cognitive development, including attention deficits, hyperactivity, and impairments in hearing, speech, and language[6]. Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most frequently referred conditions to child psychiatrists and pediatric consultants. This disorder significantly impacts the daily functioning of affected children and their families[7]. Risk factors for ADHD include genetic predisposition, sex, history of febrile seizures, and family-related factors. Therefore, children with a history of febrile seizures may exhibit a higher likelihood of behavioral problems compared to healthy children. They are also reported to

demonstrate greater levels of inattention, hyperactivity, and impulsivity[7].

A study conducted by Salehi et al. (2021) involving 103 children with a history of febrile seizures demonstrated a significant association between febrile seizure history and Attention-Deficit/Hyperactivity Disorder (ADHD). Furthermore, the study reported that the association was statistically significant among male children with a history of febrile seizures.[7].

Based on the background described above, the researcher was interested in investigating the relationship between a history of febrile seizures and Attention-Deficit/Hyperactivity Disorder (ADHD) in children in Makassar City.

METHODS

This study employed an analytical descriptive design with a cross-sectional approach to determine the association between a history of febrile seizures and Attention-Deficit/Hyperactivity Disorder (ADHD) in children in Makassar City. The study was conducted at Taman Pelatihan Harapan Makassar and Cendekia Berseri from December 2022 to January 2023. The study population consisted of 32 children who had been diagnosed with ADHD. A total sampling technique was applied, in which all eligible subjects were included, resulting in 32 respondents who met the study criteria.

The inclusion criteria were children diagnosed with ADHD by qualified professionals, children with a history of febrile seizures, and parents or primary family members who completed the questionnaire in full. The exclusion criteria included children with a history of intracranial abnormalities and epilepsy.

Primary data were collected using a structured questionnaire completed by parents or guardians. The instrument consisted of 38 items and had been tested for validity (r-value > 0.361) and reliability (Cronbach's alpha = 0.744). Data were processed using SPSS software and analyzed using univariate analysis to describe the distribution of variables, and bivariate analysis using the Chi-square test with a significance level set at $p < 0.05$.

RESULT

Table 1. Characteristics of Respondents

Variable	Frequency (n)	Percentage (%)
Age		
6 years	10	31,3
7 years	7	21,9
8 years	1	3,1
9 years	7	21,9
10 years	6	18,8
11 years	1	3,1
Sex		
Male	22	68,8
Female	10	31,3
Grade Level		
Grade 1	19	59,4

Grade 2	2	6,3
Grade 3	4	12,4
Grade 4	4	12,4
Grade 5	3	9,4
Type of Febrile Seizure History		
Simple Febrile Seizures	14	43,8
Complex Febrile Seizures	18	56,3
ADHD		
Combined Type	25	78,1
Hyperactive-Impulsive Type	6	18,8
Predominantly Inattentive Type	1	3,1
Total	**32**	**100**

Source: Primary Data, 2023

A total of 32 children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) were included in this study. The majority of respondents were 6 years old (31.3%), while the least represented ages were 8 and 11 years (3.1% each). Most participants were male (68.8%), with females accounting for 31.3%. In terms of educational level, more than half of the respondents were in Grade 1 of elementary school (59.4%), followed by Grades 3 and 4 (12.4% each), while Grade 2 had the lowest proportion (6.3%). Regarding febrile seizure history, complex febrile seizures were more prevalent (56.3%) than simple febrile seizures (43.8%). The combined subtype of ADHD was the most common presentation (78.1%), followed by the hyperactive-impulsive subtype (18.8%), whereas the predominantly inattentive subtype was the least frequent (3.1%).

Table 2. The Relationship Between Age and Attention-Deficit/Hyperactivity Disorder (ADHD)

Age	**ADHD**				
	Combined Type (n, %)	Hyperactive-Impulsive Type (n, %)	Predominantly Inattentive Type (n, %)	Total (n, %)	*P value*
6 years	8 (25,0)	2 (6,3)	0	10 (31,1)	
7 years	4 (12,5)	3 (9,4)	0	7 (21,9)	
8 years	1 (3,1)	0	0	1 (3,1)	
9 years	7 (21,9)	0	0	7 (21,9)	0,00
10 years	5 (15,6)	1 (3,1)	0	6 (18,8)	
11 years	0	0	1 (3,1)	1 (3,1)	
Total	25 (78,1)	6 (18,8)	1 (3,1)	32 (100)	

Source: Primary Data, 2023

Based on Table 2, among the 10 respondents (31.1%) aged 6 years, 8 children (25.0%) had the combined type of ADHD, while 2 children (6.3%) had the hyperactive-impulsive type. Among the 7 respondents (21.9%) aged 7 years, 4 children (12.5%) had the combined type and 3 children (9.4%) had the hyperactive-impulsive type. The only respondent aged 8 years (3.1%) presented with the combined type of ADHD. Among the 7 respondents

(21.9%) aged 9 years, all 7 children (21.9%) had the combined type. Of the 6 respondents (18.8%) aged 10 years, 5 children (15.6%) had the combined type and 1 child (3.1%) had the hyperactive-impulsive type. The single respondent aged 11 years (3.1%) presented with the predominantly inattentive type of ADHD.

Table 3. The Relationship Between History of Febrile Seizures and Attention-Deficit/Hyperactivity Disorder (ADHD)

Type of Febrile Seizure History	ADHD				
	Combined Type (n, %)	Hyperactive-Impulsive Type (n, %)	Predominantly Inattentive Type (n, %)	Total (n, %)	*P value*
Simple Febrile Seizures	11 (34,4)	3 (9,4)	0	14 (43,8)	0,64
Complex Febrile Seizures	14 (43,8)	3 (9,4)	1 (3,1)	18 (56,3)	
Total	25 (78,1)	6 (18,8)	1 (3,1)	32 (100)	

Source: Primary Data, 2023

Based on Table 3, among the 14 respondents (43.8%) with a history of simple febrile seizures, 11 children (34.4%) had the combined type of ADHD, while 3 children (9.4%) had the hyperactive-impulsive type. Among the 18 respondents (56.3%) with a history of complex febrile seizures, 14 children (43.8%) had the combined type, 3 children (9.4%) had the hyperactive-impulsive type, and 1 child (3.1%) presented with the predominantly inattentive type of ADHD.

DISCUSSION

History of Febrile Seizures in Children

Based on the analysis of febrile seizure history, 14 respondents (43.8%) had a history of simple febrile seizures, while 18 respondents (56.3%) had a history of complex febrile seizures. Therefore, it can be concluded that the majority of respondents had a history of complex febrile seizures.

This finding is consistent with a study conducted by Hardika (2022), which reported that 38 participants (33.9%) of the total sample had a history of complex febrile seizures. Children who experienced their first febrile seizure before the age of one year were found to have a 2.73-fold higher risk of recurrent febrile seizures compared to those whose first episode occurred after one year of age. This may be explained by the fact that children under one year of age have not yet achieved full brain maturation, which may predispose them to recurrent febrile seizures[8,14].

Attention-Deficit/Hyperactivity Disorder

In this study, the distribution of ADHD subtypes showed that the combined type was the most prevalent, identified in 25 respondents (78.1%). This was followed by the hyperactive-impulsive type in 6 respondents (18.8%) and the predominantly inattentive type in 1 respondent (3.1%). Therefore, it can be concluded that the majority of respondents presented with the combined subtype of ADHD.

These findings are consistent with the study by Purwandari (2022), which reported that the combined type was the most common ADHD subtype, followed by the hyperactive-impulsive type and the predominantly inattentive type[15]. The combined subtype accounts for approximately 50–70% of ADHD cases, followed by the hyperactive-impulsive type (20–30%) and the predominantly inattentive type (around 15%)[9,15].

The Relationship Between Age and Attention-Deficit/Hyperactivity Disorder

The results showed that most respondents were within the 6–7-year age range, with the highest proportion at 6 years of age (31.1%). In this age group, the most frequently identified ADHD subtype was the combined type, followed by the hyperactive-impulsive type. These findings are consistent with the literature indicating that ADHD symptoms generally begin to emerge and are recognized before the age of seven, particularly when children enter school and face increasing demands for sustained attention and behavioral regulation (Aprilia & Oktaria, 2021). The predominance of the combined subtype across various age groups in this study suggests that most children experienced impairments in both attention and hyperactivity-impulsivity simultaneously. Furthermore, the presence of ADHD subtypes among older children, such as those aged 9 and 10 years, indicates that symptoms may persist throughout the school years and potentially affect academic performance and social functioning if not addressed early. Therefore, early detection and intervention during the preschool period are essential to prevent long-term psychosocial consequences[9,10].

The Relationship Between History of Febrile Seizures and Attention Deficits

The results showed that the majority of children with ADHD had a history of complex febrile seizures (56.3%), while 34.4% had a history of simple febrile seizures. Theoretically, complex febrile seizures—particularly those lasting more than 15 minutes or recurring within 24 hours—may increase the risk of neurological impairment due to potential damage to the frontal cortex and

frontosubcortical pathways, which are involved in attention regulation and impulse control (Sukiandra, 2022)[11]. Several respondents with hyperactive-impulsive and predominantly inattentive subtypes also had a history of complex febrile seizures, supporting the hypothesis that dysfunction of dopaminergic neural circuits may contribute to the development of hyperactivity and attention deficits (Itania, 2021; Sari, 2013)[16,17]. Although descriptively a considerable proportion of children with ADHD had a history of febrile seizures, bivariate analysis using the Chi-square test showed no statistically significant association between febrile seizure history and ADHD ($p = 0.64$; $\alpha = 0.05$). These findings are consistent with a study by Melissa N. Visser (2022), which reported no significant relationship between febrile seizures and behavioral problems in children[7]. However, they differ from the findings of Bahman Salehi (2021), who reported a significant association. These discrepancies may be explained by other contributing factors in the etiology of ADHD, including genetic predisposition, environmental influences, as well as differences in sample characteristics and research methodology. Therefore, a history of febrile seizures cannot be considered the sole determinant of ADHD in children[12-15].

CONCLUSION

Based on the study findings, the most common type of febrile seizure history was complex febrile seizures. The majority of respondents presented with the combined subtype of Attention-Deficit/Hyperactivity Disorder (ADHD), followed by the hyperactive-impulsive subtype and the predominantly inattentive subtype. There was no significant association between a history of febrile seizures and ADHD in children. However, a significant association was found between age and ADHD.

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