Anxiety levels among children affected by flash flood natural disaster (*galodo*) in Tanah Datar Regency, West Sumatra

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Abstract. This study aims to evaluate emotional and behavioral problems in children affected by the "Galodo" flash flood in Nagari Parambahan, Tanah Datar Regency, in May 2024. A total of 45 children aged 6-17 years were assessed using the PSC-17 and SDQ instruments to identify psychological disorders and analyze the relationship between age and gender with the level of disorders. The results showed that most children were in the normal category across nearly all domains of the PSC-17 and SDQ, with internalizing disorder scores in younger children showing significance (p=0.01). However, no significant relationship was found between gender and disorder scores on both instruments. These findings indicate that most children demonstrated good resilience post-disaster, but younger children require greater attention due to their vulnerability to hidden emotional disorders. This study emphasizes the importance of psychological screening and early post-disaster interventions targeting the most vulnerable groups of children.

1 Introduction

Indonesia is an archipelagic country geographically situated at the convergence of major tectonic plates, namely the Australian, Pacific, Eurasian, and Philippine plates [1]. This position renders Indonesia highly vulnerable to diverse geological activities. West Sumatra, one of the provinces with distinctive natural and cultural wealth, also possesses considerable susceptibility to natural disasters due to its location along the Pacific Ring of Fire. This geographical condition makes the region particularly prone to earthquakes and secondary hazards such as volcanic mudflows, locally known as *galodo*. One such *galodo* event, which resulted in significant material losses and casualties, occurred in Tanah Datar Regency, West Sumatra, on May 11, 2024 [2].

The impacts of natural disasters such as *galodo* are not limited to physical destruction but also extend to the psychological well-being of survivors, particularly children. Children are more psychologically vulnerable than adults, as they have limited capacity to understand, regulate, and express emotions following traumatic events. Direct exposure to disasters may trigger various emotional reactions, including fear, sadness, and anxiety. Without appropriate intervention, these emotional responses may develop into long-term psychological disorders that affect children's mental health and behavioral development [3].

The detection of emotional and behavioral disturbances among disaster-affected children requires the use of valid screening instruments. The Pediatric Symptom Checklist-17 (PSC-17) is one such tool, proven effective in identifying internalizing problems such as anxiety and depression that may arise following disaster-related trauma [4]. In addition, the Strengths and Difficulties Questionnaire (SDQ) provide a more comprehensive assessment. The SDQ not only evaluates emotional and behavioral difficulties but also measures prosocial strengths, which may serve as indicators of resilience [5].

Therefore, this study aims to identify the emotional and behavioral characteristics of children affected by *galodo* through screening using the PSC-17 and SDQ instruments.

2 Method

This study was conducted in May 2024 using a cross-sectional design. Sampling was carried out through purposive sampling among children affected by the *galodo* flood disaster in Nagari Parambahan, Lima Kaum District, Tanah Datar Regency, West Sumatra, in May 2024.

The study population consisted of children aged 6–17 years who were affected by the galodo disaster in Nagari Parambahan, Lima Kaum District, Tanah Datar Regency. The study sample comprised individuals from this population who met the inclusion and exclusion criteria. Consecutive sampling was applied to collect participants.

The research site was selected purposively, as Nagari Parambahan was among the most severely affected areas. Inclusion criteria were children aged 6–17 years at the time of the disaster, while exclusion criteria were refusal to undergo examination or to complete the questionnaire.

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Two validated screening instruments were employed: the Pediatric Symptom Checklist-17 (PSC-17) and the Strengths and Difficulties Questionnaire (SDQ), both widely recognized for detecting emotional and behavioral disorders. The PSC-17 consists of 17 items divided into three subscales: internalizing (5 items: anxiety and depression), externalizing (7 items: behavioral problems), and attention (5 items: concentration difficulties and hyperactivity). Each item is scored 0 (never), 1 (sometimes), or 2 (often). Subscale scores are summed to obtain a total score. Unanswered items are scored as 0, but if ≥4 items are left unanswered, the questionnaire is deemed invalid. Psychosocial problems are suspected if the internalizing score ≥5, externalizing score ≥7, attention score ≥7, or total score ≥15 [4, 5]. Previous studies reported that approximately 68% of children identified as positive by PSC-17 were also diagnosed with disorders by physicians, while 95% of children identified as negative showed no further problems, demonstrating the PSC-17's effectiveness as a screening tool [6].

The SDQ, developed by Robert Goodman in 1997, is a psychological instrument for early detection of emotional and behavioral health in children aged 4–17 years. It has two versions based on age groups: 4–10 years and 11–18 years. The questionnaire consists of 25 items divided into five subscales: four "difficulty" subscales (emotional symptoms, conduct problems, hyperactivity/inattention, peer problems) and one "strength" subscale (prosocial behavior). Each subscale contains five items, scored as 0 (not true), 1 (somewhat true), or 2 (certainly true). Subscale scores range from 0 to 10. The SDQ has demonstrated satisfactory reliability, with a Cronbach's alpha of 0.773, indicating good internal consistency [5]. Cross-national studies (e.g., in the Netherlands, Germany, China, and Spain) have consistently shown its reliability. Validity testing using Principal Axis Factoring (PAF) revealed six structural factors: emotional symptoms, prosocial behavior, conduct problems, peer problems, hyperactivity, and inattention, confirming the SDQ's capacity to measure relevant dimensions of childhood emotional and behavioral disorders [5].

Data were cleaned and coded prior to analysis. Tests of normality and homogeneity were performed before univariate and bivariate analyses. Descriptive analyses of categorical variables were presented as frequencies and percentages.

3 Result

A total of 45 study participants were included, consisting of 16 boys (35.6%) and 29 girls (64.4%). The age range was 6–17 years. The most common age group was 8 years old, with 11 participants (24.4%), followed by 10 and 12 years old, each with 8 participants (17.8%). The least represented age group was 17 years, with only one participant (2.2%). This distribution indicates that the majority of participants were of primary school age. Such a distribution is consistent with the predominance of children and pre-adolescents in the sample, thereby reinforcing the relevance of the findings to age groups most vulnerable to emotional and behavioral impacts of disasters. Participant characteristics are presented in Table 1.

Table 1. Baseline characteristics of sample.

Characteristics	Frequency (n)	Percentage (%)
Age (Year)		
=<6	4	8.9
7-12	33	73.3
13-18	8	17,8
Gender		
Male	16	35.6
Female	29	64.4
Educational Background		
SD	36	80.0
SMP	7	15.6
SMA	2	4.4

Based on the distribution of PSC-17 scores (Table 2), which assessed emotional and behavioral problems during the galodo disaster, most respondents were within the normal category across the three domains: internalizing, attention, and externalizing. A total of 71.1% of children scored within the normal range for internalizing problems, while 28.9% exhibited disturbances. For the attention domain, 95.6% of children scored in the normal range, with only 4.4% showing disturbances. In the externalizing domain, 97.8% of children were classified as normal, with only 2.2% showing behavioral problems. Overall, the total PSC-17 score indicated that 97.8% of children did not experience significant emotional or behavioral disorders, while 2.2% were identified as having disturbances. These findings strengthen the validity of the study in describing the post-disaster psychological condition of children.

Table 2. Distribution of PSC-17 score

	Internalization		Attention		Externalization		Total	
	F (n)	%	F (n)	%	F (n)	%	F (n)	%
Normal	32	71.1	43	95.6	44	97.8	44	97.8
Impairment	13	28.9	2	4.4	1	2.2	1	2.2
Total	45	100	45	100	45	100	45	100

Table 3. Distribution of SDQ score

	SDQ-Difficulty										SDQ-Strength	
	Emotional		Behavior		Hyperactivity		Peers		Total		Prosocial	
	F (n)	%	F (n)	%	F (n)	%	F (n)	%	F (n)	%	F (n)	%
Normal	38	84.4	37	82.2	35	77.8	34	75.6	37	82.2	40	88.9
Borderline	5	11.1	6	13.3	6	13.3	8	17.8	3	6.7	3	6.7
Abnormal	2	4.4	2	4.4	4	8.9	3	6.7	5	11.1	1	2.2
Total	45	100.0	45	100.0	45	100.0	45	100.0	45	100.0	44	97.8

The distribution of SDQ scores (Table 3) similarly demonstrated that the majority of children fell within the normal category across most subscales. In the emotional subscale, 84.4% were classified as normal, 11.1% as borderline, and 4.4% as abnormal. In the conduct subscale, 82.2% were normal, 13.3% borderline, and 4.4% abnormal. In the hyperactivity subscale, 77.8% were normal, with 13.3% borderline and 8.9% abnormal. For peer relationship problems, 75.6% were normal, 17.8% borderline, and 6.7% abnormal. The total SDQ difficulties score showed that 82.2% of children were in the normal range, 6.7% borderline, and 11.1% abnormal. In the prosocial behavior subscale, which measures strengths, the majority (88.9%) demonstrated normal levels of prosocial behavior, while 6.7% were borderline and 2.2% abnormal

Table 4. Distribution of PSC-17 and SDQ score frequency

SDQ	PSC	Internalization		Externalization		Attention	
		Normal	Impairment	Normal	Impairment	Normal	Impairment
Emotional	Normal	29	9	37	1	36	2
	Borderline	3	2	5	0	5	0
	Abnormal	0	2	2	0	2	0
Behavioral Problem	Normal	28	9	36	1	35	2
	Borderline	2	4	6	0	6	0
	Abnormal	2	0	2	0	2	0
Hyperactivity	Normal	25	10	34	1	34	1
	Borderline	3	3	6	0	6	0
	Abnormal	4	0	4	0	3	1
Problem with Peers	Normal	23	11	33	1	34	0
	Borderline	6	2	8	0	7	1
	Abnormal	3	0	3	0	2	1
Total Score of Difficulty	Normal	27	10	36	1	35	2
	Borderline	2	1	3	0	3	0
	Abnormal	3	2	5	0	5	0
Prosocial Behavior	Normal	29	11	39	1	39	1
	Borderline	2	1	3	0	3	0
	Abnormal	0	1	1	0	1	0

The distribution of PSC-17 and SDQ scores (Table 4) revealed a correspondence between the two instruments in identifying emotional and behavioral problems. Children with normal emotional SDQ scores predominantly also had normal PSC-17 scores, especially in the externalizing (37 children) and attention domains (36 children), although 9 children still showed internalizing problems. Among children categorized as borderline or abnormal on the emotional SDQ scale, the prevalence of internalizing disturbances on the PSC-17 was higher, indicating an association between increased emotional difficulties and elevated PSC-17 scores. Similar patterns were observed in conduct problems, hyperactivity, and peer relationship subscales: children with normal SDQ scores tended to have normal PSC-17 results, whereas increases in SDQ disturbances were accompanied by elevated scores in one or more PSC-17 domains.

Regarding the total SDQ difficulties score, children in the normal category largely showed normal PSC-17 scores, especially in the externalizing (36 children) and attention domains (35 children), though 10 children continued to show internalizing disturbances. Children in the borderline and abnormal SDQ categories were more likely to present with PSC-17 internalizing disturbances. Conversely, in the prosocial subscale of the SDQ, children with normal prosocial scores generally had normal PSC-17 results across all three domains, suggesting that higher prosocial behavior may be associated with greater emotional and behavioral stability. Overall, these findings highlight the consistency between the SDQ and PSC-17, demonstrating that children identified with emotional and behavioral problems using the SDQ also tended to show similar disturbances on the PSC-17.

Bivariate analysis of age and PSC-17 scores revealed a significant difference in the internalizing domain between children below and above the mean age ($p = 0.01$; Table 5). In contrast, gender showed no significant association with emotional and behavioral disturbances as measured by the PSC-17 ($p > 0.05$; Table 6). For the SDQ, neither age nor gender demonstrated significant associations with emotional and behavioral outcomes (Tables 7, 8, 9 and 10).

Table 5. Distribution of PSC-17 score based on age

	Age Group				p value
	Below average		Above average		
	f	%	f	%	
Internalization					
Normal	11	52.4%	21	87.5%	0.01
Impairment	10	47.6%	3	12.5%	
Attention					
Normal	21	100.0%	22	91.7%	0.18
Impairment	0	0.0%	2	8.3%	
Externalization					
Normal	21	100.0%	23	95.8%	0.34
Impairment	0	0.0%	1	4.2%	
Total					
Normal	21.00	100.00	23.00	0.96	0.34
Impairment	0.00	0.00	1.00	0.04	

Table 6. Distribution of PSC-17 score based on gender

	Gender				p-value
	Male		Female		
	f	%	f	%	
Internalization					
Normal	12	75.0	20	69.0	0.669
Impairment	4	25.0	9	31.0	
Attention					
Normal	16	100.0	27	93.1	0.283
Impairment	0	0.0	2	6.9	
Externalization					
Normal	16	100.0	28	96.6	0.453
Impairment	0	0.0	1	3.4	
Total					
Normal	16	100.0	28	96.6	0.453
Impairment	0	0.0	1	3.4	

Table 7. Distribution of SDQ score based on age from subscale of difficulty and strength

	Age Group				p value
	Below average		Above average		
	f	%	f	%	
Difficulty Scale					
Normal	17	81	20	83.3	0.749
Borderline	2	9.5	1	4.2	
Abnormal	2	9.5	3	12.5	
Strength Scale					
Normal	20	95.2	20	87.0	0.537
Borderline	1	4.8	2	8.7	
Abnormal	0	0.0	1	4.3	

Table 8. Distribution of SDQ score based on age from subscale of difficulty

	Age Group				p value
	Below average		Above average		
	f	%	f	%	
Emotional scale					
Normal	16	76.2	22	91.7	
Borderline	3	14.3	2	8.3	0.228
Abnormal	2	9.5	0	0.0	
Behavioral scale					
Normal	19	90.5	18	75.0	
Borderline	2	9.5	4	16.7	0.286
Abnormal	0	0.0	2	8.3	
Hyperactivity					
Normal	17	81.0	18	75.0	
Borderline	3	14.3	3	12.5	0.66
Abnormal	1	4.8	3	12.5	
Peers					
Normal	17	81.0	17	70.8	
Borderline	4	19.0	4	16.7	0.245
Abnormal	0	0.0	3	12.5	

Table 9. Distribution of SDQ score based on gender from subscale of difficulty and strength

	Gender				p value
	Male		Female		
	f	%	f	%	
Difficulty Subscale					
Normal	15	93.8	22	75.9	
Borderline	0	0.0	3	10.3	0.275
Abnormal	1	6.3	4	13.8	
Strength Subscale					
Normal	14	87.5	26	92.9	
Borderline	2	12.5	1	3.6	0.408
Abnormal	0	0.0	1	3.6	

Table 10. Distribution of SDQ score based on gender from subscale of difficulty

	Gender				p-value
	Male		Female		
	f	%	f	%	
Emotional scale					
Normal	14	87.5	24	82.8	
Borderline	1	6.3	4	13.8	0.692
Abnormal	1	6.3	1	3.4	
Behavioral scale					
Normal	13	81.3	24	82.8	
Borderline	1	6.3	5	17.2	0.102
Abnormal	2	12.5	0	0.0	
Hyperactivity					
Normal	11	68.8	24	82.8	0.224
Borderline	2	12.5	4	13.8	
Abnormal	3	18.8	1	3.4	
Peers					
Normal	10	62.5	24	82.8	0.212
Borderline	5	31.3	3	10.3	
Abnormal	1	6.3	2	6.9	

4 Discussion

The use of comprehensive instruments such as the Pediatric Symptom Checklist-17 (PSC-17) and the Strengths and Difficulties Questionnaire (SDQ) provides a robust framework for understanding children's psychological responses to disaster exposure. These tools capture key patterns of resilience, vulnerability, and developmental differences in adaptation [7]. One of the most striking findings of this study is the high level of psychological resilience demonstrated by the majority of children. Based on the PSC-17, 71.1% scored within the normal range for internalizing problems, 95.6% demonstrated normal attentional functioning, and 97.8% showed no externalizing disturbances.

These results suggest that children possess considerable adaptive capacity in the face of disaster. Findings from the SDQ supported this pattern, with 75–88.9% of children scoring within the normal range across subscales assessing emotional symptoms, conduct problems, hyperactivity, peer relationships, and prosocial behavior. The predominance of resilience aligns with contemporary perspectives on children's adaptive potential during crises [8]. Children's ability to maintain psychological stability in stressful environments is thought to be influenced by protective factors such as family support, community resources, and developmental resilience mechanisms [8]. The predominance of children maintaining normal psychological functioning in this

study suggests that many were buffered by adequate protective systems. This is consistent with multisystem resilience models, which emphasize the interplay of individual characteristics, family dynamics, and community supports in shaping psychological outcomes during disasters. When these systems function effectively, children are able to sustain balance despite substantial environmental stressors [8].

Importantly, the findings also suggest that flood disasters, while severe in impact, do not inevitably result in widespread psychological disturbance among children if adequate support systems are in place.

A notable developmental pattern emerged with respect to internalizing problems. Younger children displayed significantly higher levels of internalizing symptoms (47.6%) compared with older children (12.5%), a difference that reached statistical significance ($p = 0.01$). This was the only domain in which age demonstrated a significant association with psychological outcomes. The pattern reflects fundamental developmental differences in how children process and respond to trauma. Research in developmental trauma highlights that younger children are more prone to anxiety, depression, and withdrawal, owing to their less mature cognitive and emotional regulation capacities [9]. Their limited ability to contextualize traumatic experiences renders them more vulnerable to internal distress [10].

Interestingly, these age effects were restricted to internalizing problems; no significant age-related differences were observed in attention or externalizing domains. This suggests that developmental vulnerability is more pronounced in emotional regulation than in behavioral or attentional functioning. These findings align with neurodevelopmental research indicating that brain regions responsible for emotion regulation are still developing throughout childhood and adolescence [9]. The relative immaturity of these systems in younger children may increase susceptibility to stress and anxiety. Conversely, the stability of attentional and behavioral domains across ages suggests that children, regardless of developmental stage, are able to maintain relatively stable external functioning during disasters. This has important implications for post-disaster interventions, which may need to prioritize emotional regulation strategies for younger children [11].

No significant differences were observed between boys and girls across psychological outcomes as measured by both the PSC-17 and SDQ. While minor variations were noted with girls showing slightly higher internalizing scores (31.0% vs. 25.0% in boys) and boys exhibiting somewhat higher hyperactivity, these differences were not statistically significant.

This contrasts with some previous studies reporting gender-based differences in disaster response, particularly findings that girls are more vulnerable to internalizing problems post-trauma [12]. However, the present findings are consistent with research suggesting that gender differences may be less pronounced when factors such as disaster exposure intensity and social support are considered [13]. One possible explanation is that acute flood disasters create shared circumstances where gendered socialization patterns are less relevant compared with the collective need to cope and adapt. In such contexts, both boys and girls may draw upon similar coping strategies and benefit from comparable levels of family and community support, reducing gender disparities in psychological outcomes. Moreover, equitable access to relief services in the aftermath of the disaster may also have contributed to balanced psychological outcomes between genders [13].

The clinical distributions of PSC-17 and SDQ scores provide valuable insights for practice and intervention planning. Although most children were within normal functional ranges, approximately 28.9% showed clinically significant internalizing problems, highlighting a subgroup in need of targeted intervention. This is particularly important since internalizing problems are often less visible than externalizing behaviors and therefore at greater risk of remaining undetected.

The SDQ results complemented the PSC-17 findings by offering a broader picture of children's socio-emotional functioning. While proportions of children in the borderline or abnormal categories were relatively low (12–25% depending on subscale), the results nonetheless emphasize the importance of monitoring children at risk. Importantly, the dual use of PSC-17 and SDQ allowed for a balanced assessment of both difficulties and strengths, enabling identification of children who, despite challenges in one domain, retained strengths in another—an essential consideration for individualized intervention strategies [5, 14].

A key strength of this study lies in the use of two widely validated instruments, PSC-17 and SDQ, which enabled both cross-validation of findings and a comprehensive assessment of psychological outcomes. By capturing both difficulties and strengths, this study offers a nuanced perspective on children's post-disaster functioning. The focus on age and gender also provided important insights into differential vulnerabilities across groups. Furthermore, the ecological validity of the findings is strengthened by data collection in a real disaster context, allowing the study to capture authentic psychological responses relevant for crisis intervention and disaster preparedness.

However, several limitations must be acknowledged. The cross-sectional design restricts generalizability and precludes conclusions regarding long-term outcomes. Without longitudinal follow-up, it remains uncertain whether the observed symptoms represent transient stress responses or enduring psychological problems. Additionally, reliance on screening questionnaires rather than in-depth clinical interviews may have limited diagnostic precision. Self-report or parent-report measures, such as those used in this study, are subject to reporting biases, including underreporting due to stigma or misunderstanding of questionnaire items. Finally, findings are context-specific, reflecting the characteristics of the community, cultural context, and disaster severity. Results may differ in settings with varying disaster responses, levels of social support, or preexisting vulnerabilities such as socioeconomic disadvantage or parental mental health difficulties.

5 Conclusion

Most children affected by the *galodo* flood disaster were able to maintain normal psychological functioning, both in emotional and behavioral aspects. This finding suggests a high level of resilience among children in coping with crisis situations, particularly when adequate support from family and community is available. However, a subset of children, especially those of younger age, demonstrated vulnerability to internalizing problems such as anxiety and sadness. No significant differences were observed between boys and girls in terms of psychological impact. The use of two validated instruments, namely the PSC-17 and the SDQ, enabled a comprehensive evaluation of children's emotional and behavioral conditions in the context of disaster exposure. Nevertheless, limitations such as the cross-sectional design and reliance on self-report questionnaires should be considered when interpreting the results.

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