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An Assessment of School Community Preparedness for Earthquake and Tsunami Disasters at SMA Negeri 1 Peukan Bada Aceh Besar

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ABSTRACT

Earthquakes and tsunamis are natural disasters that can cause significant loss of life and extensive damage, particularly in coastal areas such as Aceh Besar Regency. Schools located in disaster-prone areas need to maintain a high level of preparedness to minimize disaster risks and impacts. This study aimed to assess school community preparedness for earthquake and tsunami disasters at SMA Negeri 1 Peukan Bada, Aceh Besar. This study employed a quantitative method with a descriptive design. The study population consisted of all school community members, including students, teachers, and educational staff. A total of 222 respondents were selected using a stratified random sampling technique. Data were collected using a structured questionnaire and analyzed univariately by presenting frequency distributions and percentages. The results showed that, of the 222 respondents, the majority had a good level of preparedness, comprising 134 respondents (60.4%), while 88 respondents (39.6%) had a moderate level of preparedness. The respondents were predominantly female (60.4%), aged 15–20 years (89.2%), and students (89.2%). Furthermore, most respondents had participated in disaster simulations (76.1%). In conclusion, the school community at SMA Negeri 1 Peukan Bada generally demonstrated good preparedness for earthquake and tsunami disasters. Nevertheless, further efforts are needed to improve preparedness through regular disaster simulations, strengthened disaster education, evaluation of school emergency response plans, and enhanced collaboration with relevant agencies to continuously improve preparedness among all school community members.

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INTRODUCTION

A disaster is an event or series of events that threaten and disrupt the lives and livelihoods of communities, whether caused by natural, non-natural, or human factors, resulting in loss of life, environmental damage, property losses, and psychological impacts (Law of the Republic of Indonesia No. 24 of 2007). Disasters are fundamentally human-centered concepts that are relatively subjective in nature. This term refers to specific events, whether natural or artificial, that are perceived as harmful to humans (Herni Tandi et al., 2019).

The World Health Organization (WHO) states that earthquakes and tsunamis pose global threats, causing substantial loss of life and infrastructure damage. Between 1998 and 2017, tsunamis caused more than 250,000 deaths worldwide, including over 227,000 deaths resulting from the 2004 Indian Ocean tsunami alone (WHO, 2025). WHO data also indicate that earthquakes caused nearly 750,000 deaths globally between 1998 and 2017 and affected more than 125 million people, placing considerable pressure on healthcare services and evacuation systems (WHO, 2025).

Globally, the 2004 Indian Ocean earthquake and tsunami was one of the most devastating disasters ever recorded, claiming more than 227,898 lives across 14 countries, with Indonesia being the most severely affected (WHO, 2024). According to EM-DAT data reported by Our World in Data, 393 natural disaster events occurred worldwide in 2024, resulting in more than 16,753 deaths and affecting 167.2 million people. These figures highlight that disaster threats remain a significant global concern (Our World in Data, 2025).

In Asia, coastal regions frequently face tsunami threats due to the interaction of tectonic plates, making them highly vulnerable to the devastating impacts of earthquakes and ocean waves (Makinoshima et al., 2024). In Southeast Asia and the Indian Ocean region, the coastal areas of Indonesia and neighboring countries have also historically been vulnerable to major earthquakes and tsunamis due to tectonic activity along the Pacific Ring of Fire (Kompas, 2024).

Indonesia is an archipelagic country located at the convergence of three major tectonic plates: the Indo-Australian, Pacific, and Eurasian plates, which remain active. This geological condition makes Indonesia highly susceptible to natural disasters, including earthquakes and tsunamis (Santoso et al., 2023). In demographic terms, Indonesia ranks as the fourth most populous country in the world, with a population of approximately 265 million people. Its geographical, geological, demographic, and hydrological characteristics contribute to its high vulnerability to disasters (Setyorini, 2023). In the national context, earthquakes and tsunamis remain persistent threats, particularly in western Indonesia, including Aceh and Sumatra, which are located along an active subduction zone (Parlina et al., 2025).

The Indonesian National Disaster Management Agency (BNPB) recorded the 2004 Aceh tsunami as a major disaster that caused an

estimated more than 230,000 deaths across the affected regions, with Indonesia accounting for the largest proportion of fatalities (BNPB, 2024). According to the Indonesia Risk and National Disaster Index 2024 published by BNPB, a total of 3,472 disaster events were recorded throughout Indonesia in 2024, affecting more than eight million people, causing 540 deaths, and damaging 81,947 infrastructure units. These disasters included earthquakes, tsunamis, and hydrometeorological events (BNPB, 2024). Aceh Province is exposed to various potential disasters, including earthquakes, tsunamis, floods, landslides, and extreme waves, reflecting its high vulnerability due to geographical and tectonic factors (BPBA, 2025). Statistics from the Central Statistics Agency of Aceh Province (BPS Aceh) also identify Aceh Besar Regency as an area that has consistently experienced various natural disasters, including earthquakes and hydrometeorological events, in recent years (BPS Aceh, 2025). Historically, the most significant earthquake and tsunami event affecting Aceh Besar occurred on December 26, 2004. This catastrophe prompted the development of modern disaster preparedness systems in Indonesia, including the establishment of BNPB, and continues to serve as an important reference for disaster risk mitigation planning (BNPB, 2024).

METHOD

This study employed a quantitative method with a descriptive research design. The quantitative approach emphasizes the objective measurement of social phenomena through numerical data analyzed using statistical techniques. A descriptive design was selected because this study aimed to systematically and factually describe the level of school community preparedness for earthquake and tsunami disasters without providing any treatment or intervention to the research participants.

According to Sugiyono (2019), quantitative descriptive research is a method used to describe or analyze research findings without drawing conclusions that can be generalized to the broader population. Furthermore, Notoatmodjo (2018) stated that descriptive research aims to describe phenomena occurring in society based on data collected in the field. In this study, the descriptive design was used to assess several aspects of school preparedness, including students' knowledge, school policies, the implementation of disaster simulations, and the availability of facilities and infrastructure to support disaster preparedness.

RESULT AND DISCUSSION

This study involved 222 respondents, comprising students, teachers, and educational staff at SMA Negeri 1 Peukan Bada. The analysis included respondents' characteristics based on sex, age, status, and experience participating in disaster simulations; the distribution of knowledge levels; the distribution of preparedness levels; and the

analysis of the relationship between knowledge levels and school community preparedness for earthquake and tsunami disasters.

Table 1. Distribution of Respondents' Characteristics by Sex, Age, and Status (n = 222)

Respondent Characteristics	Frequency (n)	Percentage (%)
Sex		
Male	88	39,6%
Female	134	60,4%
Total	222	100%
Age		
15–20 years	198	89,2%
21–35 years	10	4,5%
36–45 years	10	4,5%
46–60 years	4	1,8%
Total	222	100%
Status		
Student	198	89,2%
Teacher	14	6,3%
Educational staff	10	4,5%
Total	222	100%
Previous Participation in Disaster Simulations		
Yes	169	76,1%
No	53	23,9%
Total	222	100%

Table 2. Frequency Distribution of School Community Preparedness for Earthquake and Tsunami Disasters at SMA Negeri 1 Peukan Bada, Aceh Besar (n = 222)

Preparedness Category	Frequency (n)	Percentage (%)
Good	134	60,4%
Moderate	88	39,6%
Total	222	100%

Based on Table 4.1, this study involved 222 respondents, comprising students, teachers, and educational staff at SMA Negeri 1 Peukan Bada. The majority of respondents were female, totaling 134 (60.4%), while 88 (39.6%) were male. In terms of age, most respondents were aged 15–20 years (198; 89.2%), followed by those aged 21–35 years and 36–45 years, with 10 respondents each (4.5%), and those aged 46–60 years, with 4 respondents (1.8%). Regarding status, the majority were students (198; 89.2%), while 14 (6.3%) were teachers and 10 (4.5%) were educational staff. These findings indicate that the respondents were predominantly female, aged 15–20 years, and students.

Table 4.2 presents the distribution of respondents' preparedness levels for earthquake and tsunami disasters at SMA Negeri 1 Peukan Bada. The results showed that, out of 222 respondents, 134 (60.4%)

had a good level of preparedness, while 88 (39.6%) had a moderate level of preparedness. These findings indicate that the majority of respondents demonstrated a good level of preparedness for earthquake and tsunami disasters.

The respondents' characteristics included sex, age, status, and experience participating in disaster simulations. Of the 222 respondents, the majority were female (134; 60.4%), while 88 (39.6%) were male. In terms of age, most respondents were aged 15–20 years (198; 89.2%), followed by those aged 21–35 years and 36–45 years, with 10 respondents each (4.5%), and those aged 46–60 years, with 4 respondents (1.8%). Regarding status, most respondents were students (198; 89.2%), while 14 (6.3%) were teachers and 10 (4.5%) were educational staff. Furthermore, the majority had participated in disaster simulations (169; 76.1%), whereas 53 respondents (23.9%) had never participated in such simulations. These findings indicate that the respondents were predominantly female, aged 15–20 years, students, and had previous experience participating in disaster simulations.

The distribution of knowledge levels regarding preparedness for earthquake and tsunami disasters at SMA Negeri 1 Peukan Bada showed that, of the 222 respondents, 134 (60.4%) had a good level of knowledge, while 88 (39.6%) had a moderate level of knowledge. These findings indicate that the majority of respondents had good knowledge of earthquake and tsunami preparedness. This distribution provides an overview of the school community's understanding of disaster preparedness and serves as a basis for analyzing the relationship between knowledge levels and school community preparedness.

CONCLUSION

This study involving 222 respondents at SMA Negeri 1 Peukan Bada, Aceh Besar, found that most respondents had a good level of preparedness for earthquake and tsunami disasters (134; 60.4%), while 88 respondents (39.6%) had a moderate level of preparedness. These findings indicate that the school community generally demonstrates good disaster preparedness, supported by disaster education, evacuation simulations, disaster preparedness teams, and supporting facilities. However, further improvements are needed through regular simulations, updated disaster education, periodic evaluation of emergency response plans, and stronger coordination with relevant agencies to ensure an effective and coordinated response during disasters.

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