



Comparison of Dengue Hemorrhagic Fever (DHF) Cases Between Male and Female in Bandung City

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Abstract

Dengue Hemorrhagic Fever (DHF) is an infectious disease that is a serious health problem in tropical regions such as Indonesia, including Bandung City, which has a high population density and environmental conditions that support the development of the *Aedes aegypti* vector. This study aims to determine the difference in the number of DHF cases between men and women in Bandung City during the period 2023-2024. Secondary data were obtained from two different sources and analyzed using the chi-squared statistical test. The combined results show that the number of DHF cases in men was 1,607 cases, which shows a higher number compared to women, who had 1,590 cases. The calculated value in 2023 was 0.65, and in 2024, it was 0.015. While the combined data in 2023-2024 had a X^2 Value of 0.5708. This shows that the results of the three calculations are smaller than the X^2 Table value of 3.84 ($\alpha = 0.05$; $df = 1$), so the null hypothesis is accepted and the alternative hypothesis is rejected. Thus, it can be concluded that there is no significant difference in the number of dengue fever cases between men and women. This finding suggests that gender is not a determining factor in the spread of dengue fever cases in Bandung City.

Keywords: Chi-Square, Dengue fever, Epidemiology, Gender, Bandung City.

1. Introduction

1.1. Research Background

Dengue Hemorrhagic Fever (DHF) is a viral infection caused by Dengue Virus (DENV) serotypes 1-4 (Nugraheni et al., 2023). This virus is transmitted through the bite of mosquitoes of the *Aedes* genus, particularly *Aedes aegypti*. It continues to be a public health problem in tropical countries with high rainfall, hot, and humid temperatures. Indonesia is one such country that has a high incidence throughout the year (Mahendra et al., 2022). In many cases, dengue infection can be fatal, characterized by plasma leakage, severe bleeding, and organ failure, leading to death (WHO, 2022). According to data from the Indonesian Ministry of Health, in 2024, more than 80,000 cases of DHF were recorded, with more than 500 deaths. This figure indicates that DHF has a significant case fatality rate (CFR), especially in densely populated areas with unequal health infrastructure.

Bandung is a metropolitan city with a high population density and rapid urbanization. According to the Bandung City Health Office, dengue fever is among the top 10 infectious diseases annually, and several sub-districts consistently record high numbers of dengue fever cases. Based on the Annual Report on Infectious Diseases (2024), dense residential areas, low public awareness of health issues, and climate change in the city make Bandung a dengue-prone area. This vulnerability is exacerbated by the finding that children and adolescents are at higher risk of severe dengue infection, especially if not treated early. Research by Miftahuddin & Sumiati (2023) shows that the 5–14 age group dominates the number of dengue cases and has a greater potential for complications.

Meanwhile, findings regarding the influence of gender on dengue incidence still show varying results. Several studies reported no significant relationship between gender and the incidence of dengue fever. Still, other studies stated that male are more likely to contract dengue infection compared to female, which is thought to be related to

differences in immune response, where cytokine production in male is lower, causing the body's resistance to infection to be weaker (Novrita et al., 2017).

1.2. Problem Statement

The identification of problems that can be described based on this background is:

1. There is a difference in the number of DHF cases between males and females in Bandung City during 2023-2024.
2. A statistical test is needed to compare the gender to the number of DHF cases.

1.3. Urgency of Research

Dengue fever is one of the infectious diseases that remains a major problem in the city of Bandung. The city has a high population density and environmental conditions that support the development of *Aedes aegypti* mosquitoes as vectors for transmission. According to data from the Indonesian Ministry of Health in 2024, there were more than 80,000 cases of dengue fever, with more than 500 deaths. Data from the Bandung City Health Department also indicates that dengue fever consistently ranks among the top 10 most prevalent infectious diseases each year. This highlights that dengue fever remains a serious threat, particularly among certain age groups.

This study is important to determine the distribution of DBD cases by gender and to identify differences between male and female in terms of the number of DBD cases in Bandung City. Using secondary data and the Chi-square test method, this study aims to provide a clearer picture of vulnerable groups, thereby serving as a basis for consideration in efforts to prevent and control DBD in Bandung City.

1.4. Objectives of Study

This study aims to determine whether there is a difference in the number of dengue fever cases between males and females.

1.5. Benefits of Research

This study is expected to provide both theoretical and practical benefits, as follows:

- 1) Theoretical Benefits
 - Increasing scientific knowledge regarding the relationship between demographic factors and dengue hemorrhagic fever (DHF).
 - Serving as a reference for further research in the fields of epidemiology and public health.
- 2) Practical Benefits
 - Providing data-based information to health agencies and local governments in formulating more effective dengue prevention and control policies.
 - Helping to identify the most vulnerable age groups and genders, so that interventions can be more targeted.
 - Raising awareness among the public and health workers about the importance of a data-driven approach in addressing infectious diseases such as dengue fever in densely populated urban areas.

2. Literature Review

Dengue Hemorrhagic Fever (DHF) is a contagious disease that remains a serious problem in Indonesia, particularly in tropical regions. This disease is caused by the dengue virus, which is transmitted through the bite of the *Aedes aegypti* mosquito. According to the WHO (2022), DHF can lead to severe complications and even death, especially if not treated properly. In recent years, studies have sought to identify risk factors for DBD, including gender differences.

A study conducted by Sutriyawan & Suherdin (2023) in Bandung City showed that DBD is more commonly found in males. This finding is supported by 2021 DBD case data, which shows that men accounted for the highest number of cases at 1,951, compared to a lower number of cases among women.

Furthermore, the results of a study by Novrita et al. (2017) indicate that males have a lower immune response to dengue virus infection compared to females, which may be due to hormonal differences and cytokine production. According to the book *Immunology and Infection* by Eryanti et al. (2021), there are differences in immune responses between males and females that can influence susceptibility to infection. The female immune system tends to be more responsive to pathogens due to the influence of estrogen, which can enhance T-cell activity and antibody production. Conversely, testosterone in men is often associated with immunosuppressive effects, which may lead to a lower

immune response to viral infections like dengue. This suggests that gender could be a relevant risk factor in the spread of dengue hemorrhagic fever (DHF).

Based on the results of several studies, there is a relationship between male gender and an increased risk of contracting DBD, particularly due to physiological and behavioral aspects. However, there are variations in findings among studies, highlighting the need for further research with more specific control variables to understand this relationship more deeply.

3. Materials and Methods

3.1. Research Design

This study uses a quantitative approach with the chi-squared method. The chi-squared test is a statistical method. The Chi-Square test (χ^2) is a non-parametric statistical test used to test comparative hypotheses between two groups of data or independent samples on a nominal scale. In this study, the Chi-Square test (χ^2) was used as a statistical analysis technique to test whether there was a difference in the number of dengue fever (DF) patients between male and female groups in the city of Bandung. The selection of the Chi-Square test was based on the characteristics of the data used, namely categorical data in the form of gender (male and female) and status as a DBD patient, presented in the form of frequency or number of cases (Setyawan, 2024). The use of the Chi-square Test method in this study is based on the structure of the variables, which consists of one criterion variable (C.V) representing the number of DBD cases in Bandung City from 2023 to 2024 and one predictor variable (P.V) with a level of P.V = 2. The DBD case data used in this study is secondary data from the Bandung City General Hospital, located at Rumah Sakit Street Number 22, Pakemitan, Cinambo District, Bandung City, and Bandung Kiwari Regional General Hospital, located at Jl. Raya Kopo No. 311, RT.03/RW.05, Situsaur, Bojongloa Kidul District, Bandung City. Hypothesis testing in the Chi-Square test was conducted based on the Chi-Square test statistic value compared to the predetermined critical value, with $\alpha = 0.05$ and degrees of freedom (df) of 1. The critical value, $\alpha = 0.05$, was chosen because the research we conducted is still in its early stages, and the data we obtained was limited to secondary data only.

3.2 Methods

The research uses a statistical Chi-Square method, a non-parametric statistical technique commonly used to test comparative hypotheses involving two independent data groups measured on a nominal scale. In this study, the Chi-Square test was applied to determine whether there is a significant difference in the number of dengue fever cases between male and female groups in Bandung City. The decision to employ the Chi-Square test was grounded in the data, which consisted of categorical variables specifically gender (male and female) and dengue fever patient status expressed in frequency or case count form (Setyawan, 2024). The variable structure also justified the use of the Chi-Square test: one criterion variable (C.V), representing the number of dengue fever cases in Bandung from 2023 to 2024, and one predictor variable (P.V) with two levels.

3.2.1 Research Variables

The variables used in this study include:

1) Criterion Variable (CV)

The CV in this study is the number of dengue fever cases in Bandung City. The number of dengue fever cases in Bandung City is the main factor in determining the difference in the number of cases between men and women.

2) Predictor Variable (PV)

The PV in this study is gender, namely male and female. This CV is used to see whether the male and female gender affects the number of Dengue Hemorrhagic Fever (DHF) patients.

3.2.2 Hypothesis Testing Techniques

In Chi-Square-based testing, hypotheses are used to test whether there is a significant relationship between the Criterion Variable (C.V.) and the Predictor Variable (P.V.).

- If the calculated X^2 is less than the table X^2 , then there is no significant difference, so H_0 is accepted and H_1 is rejected.
- If the calculated X^2 is greater than or equal to the table X^2 , then there is a significant difference, so H_0 is rejected and H_1 is accepted.

3.2.3 Formula

$$X^2 = \sum \frac{(O - E)^2}{E} \quad (1)$$

Explanation:

X^2 : Chi-Square statistical value

O : Actual observation value (recorded data)

E : Expected value

$$E = \frac{(Total\ Rows) \times (Total\ Columns)}{Total} \quad (2)$$

4. Results and Discussion

The initial data used in this analysis is the number of Dengue Hemorrhagic Fever (DHF) cases in Bandung City during the period 2023-2024, grouped by gender (male and female).

4.1. Data 1 RSUD Kota Bandung

Data 1 is data on the number of dengue fever cases in Bandung City in 2023-2024, sourced from the Bandung City Regional General Hospital, located at Hospital Street Number 22, Pakemitan, Cinambo District, Bandung City, given in Table 1..

Table 1: Data on the Number of Dengue Fever Cases in Bandung City in 2023-2024 from RSUD Kota Bandung (Bandung, 2025)

Number of Cases DHF (Year)	Gender		Total
	Male	Female	
2023	177	163	340
2024	427	408	835

4.2. Data 2 RSUD Bandung Kiwari

Data 2 is data on the number of dengue fever cases in Bandung City in 2023-2024, sourced from Bandung Kiwari Regional General Hospital, located at. Raya Kopo Street Number 311, Bandung City, given in Table 2.

Table 2: Data on the Number of Dengue Fever Patients in Bandung City in 2023-2024 from Bandung Kiwari Regional General Hospital (Kiwari, 2025)

Number of Cases DHF (Year)	Gender		Total
	Male	Female	
2023	244	235	479
2024	759	784	1,543

4.3 Combined Data from Both Sources and Averages

Table 3: Combined Data on the Number of Dengue Fever Patients in Bandung City from 2023-2024

Number of Cases DHF (Year)	Gender	Data 1	Data 2	Averages
2023	Male	177	244	210.5
	Female	163	235	199
2024	Male	427	759	593
	Female	408	784	596

The table above shows the combined average secondary data from Bandung City Hospital and Bandung Kiwari Hospital, indicating the number of dengue fever cases in 2023. The average number of cases among male was 210.5,

while among female it was 199 cases. In 2024, the average number of cases for male was 593, while for female it was 596. This indicates an increase compared to the previous year for both groups.

4.4 Contingency Table

Table 4: Contingency of Dengue Fever Cases in Bandung City in 2023

Number of Cases DHF (Year)	Male	Female
2023	421	398

Table 4 shows the distribution pattern of dengue fever cases (by gender and number of cases) in 2023, which forms the basis of the Chi-square test.

Table 5: Contingency of Dengue Fever Cases in Bandung City in 2024

Number of Cases DHF (Year)	Male	Female
2024	1,186	1,192

Table 5 shows the distribution pattern of dengue fever cases (by gender and number of cases) in 2024, which forms the basis of the Chi-square test.

Table 6: Combined Contingency Plan for the Number of Dengue Fever Cases in Bandung City in 2023-2024

Number of Cases DHF (Year)	Male	Female	Total
2023	421	398	819
2024	1,186	1,192	2,378
Total	1,607	1,590	3,197

Table 6 shows the two-way distribution pattern of dengue fever cases (number of cases and gender) that forms the basis of the Chi-Square test. In 2023, there were 819 cases of dengue fever, consisting of 421 male patients and 398 female patients. Meanwhile, in 2024, there was an increase of 2,378 cases, with 1,186 cases occurring in males and 1,192 cases in females. Overall, the number of dengue fever cases over the two years reached 3,197 cases, which was almost evenly distributed between genders, with 1,607 cases in males and 1,590 cases in females.

4.5 Overall Proportions

$$Male = \frac{1,590}{3,197} = 0.497$$

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$$Female = \frac{1,607}{3,197} = 0.502$$

The overall proportions in men were 0.497 and in women 0.502.

4.6. Expected Value

Expected Value for 2023 from Table 4. Contingency of the Number of Dengue Fever Cases in Bandung City in 2023

$$E = \frac{421 + 398}{2} = 409.5$$

The expected value for 2023 is 409.5. The expected value is an estimate of the number of cases expected if there is no trend.

Expected Value for 2024 from Table 5. Contingency of the Number of Dengue Fever Cases in Bandung City in 2024

$$E = \frac{1,186 + 1,192}{2} = 1.189$$

The expected value for 2024 is 1,189. The expected value is an estimate of the number of cases expected if there is no trend.

Expected Value from Table 6. Combined Contingency of the Number of Dengue Fever Cases in Bandung City in 2023-2024

Number of Cases in 2023

1. Male

$$E = \frac{819 \times 1,607}{3,197} = \frac{1,316,133}{3,197} = 411.67$$

2. Female

$$E = \frac{819 \times 1,590}{3,197} = \frac{1,302,210}{3,197} = 407.32$$

Number of Cases in 2024

1. Male

$$E = \frac{2,378 \times 1,607}{3,197} = \frac{3,820,867}{3,197} = 1,195.32$$

2. Female

$$E = \frac{2,378 \times 1,590}{3,197} = \frac{3,781,020}{3,197} = 1,182.67$$

The combined expected value for 2023 is 411.67 for male and 407.32 for female. Meanwhile, the combined expected value for 2024 is 1,195.32 for male and 1,182.67 for female. The expected value is an estimate of the number of cases expected if there is no trend.

4.7 Chi-Square Testing

Chi-Square Test of the Number of Dengue Fever Cases in Bandung City in 2023

$$X^2 = \frac{(427 - 409.5)^2 + (398 - 409.5)^2}{409.5} = \frac{264}{409.6} = 0.65$$

Based on the results of testing the number of dengue fever cases in Bandung City in 2023 using Chi-Square, the result was 0.65.

Chi-Square Test of the Number of Dengue Fever Cases in Bandung City in 2024

$$X^2 = \frac{(1,186 - 1,189)^2 + (1,192 - 1,189)^2}{1,189} = \frac{18}{1,189} = 0.015$$

Based on the results of testing the number of dengue fever cases in Bandung City in 2024 using Chi-Square, the result was 0.015.

Chi-Square Test of the Total Number of Dengue Fever Cases in Bandung City in 2023-2024

Number of Cases in 2023

1. Male

$$X^2 = \sum \frac{(421 - 411.67)^2}{411.67} = \frac{87.0489}{411.67} = 0.2114$$

2. Female

$$X^2 = \sum \frac{(398 - 407.32)^2}{407.32} = \frac{86.8624}{407.32} = 0.2132$$

Number of Cases in 2024

1. Male

$$X^2 = \sum \frac{(1,186 - 1,195.32)^2}{1,195.32} = \frac{86.8624}{1,195.32} = 0.0726$$

2. Female

$$X^2 = \sum \frac{(1,192 - 1,182.67)^2}{1,182.67} = \frac{87.0489}{1,182.67} = 0.0736$$

Table 7: Combined Chi-Square Calculation of Dengue Fever Cases in Bandung City in 2023-2024

Number of Cases DHF (Year)	Gender	O (Observed)	E (Expected)	(O-E) ² /E
2023	Male	421	411.67	0.1059
	Female	398	407.32	0.1066
2024	Male	1,186	1,195.32	0.0338
	Female	1,192	1,182.67	0.0046

Combined Chi-Square Value for 2023–2024

$$X^2 = 0.2114 + 0.2132 + 0.0726 + 0.0736 = 0.5708$$

Based on the results of calculations using the combined Chi-Square test of the total number of dengue fever cases in Bandung City in 2023-2024, the χ^2 value for 2023 was 0.4246 and for 2024 was 0.1462. Meanwhile, the combined value for 2023-2024 was 0.5708, which is the sum of the squared differences between the observed frequency and the expected frequency for each category of gender and year of occurrence.

4.8 Degrees of Freedom (df)

Degrees of Freedom in 2023

$$df = 2 - 1 = 1$$

With the X^2 value obtained, the degree of freedom for 2023 is 1.

Degrees of Freedom in 2024

$$df = 2 - 1 = 1$$

With the X^2 value obtained, the degree of freedom for 2024 is 1.

Combined Degree of Freedom from 2023-2024

$$df = (2 - 1) \times (2 - 1) = 1$$

With the X^2 value obtained, the combined degrees of freedom for 2023-2024 are 1. This calculation determines the population parameters of dengue fever data in Bandung City.

4.9 Hypothesis Testing

Table 8: X^2 Distributions

df	$\alpha = 0.10$ ($p = 0.20$)	$\alpha = 0.05$ ($p = 0.10$)	$\alpha = 0.025$ ($p = 0.05$)
1	2.71	3.84	6.64
2	4.61	5.99	9.21
3	6.25	7.81	11.334
4	7.78	9.49	13.28
5	9.24	11.07	15.09

Number of Cases in 2023

$$df = 1 ; \alpha = 0.05 ; X^2 = 0.65$$

Critical value = 3.84

$0,65 < 3,84$ H_0 is accepted

Number of Cases in 2024

$$df = 1 ; \alpha = 0.05 ; X^2 = 0.015$$

Critical value = 3.84

$0,015 < 3,84$ H_0 is accepted

Combined from 2023-2024

$$df = 1 ; \alpha = 0.05 ; X^2 = 0.5708$$

Critical value = 3,84

$0,5708 < 3,84$, H_0 is accepted

The determination of critical values aims to set limits for decision-making in hypothesis testing. In this study, a significance level of $\alpha = 0.05$ was used, which represents a tolerance level of error of 5%. The X^2 distributions table shows critical values for various significance levels (α) and degrees of freedom (df). At a significance level of $\alpha = 0.05$ with degrees of freedom (df) = 1, a critical value of 3.84 is obtained.

This critical value is used as the threshold for decision-making in Chi-Square. If the Chi-Square value obtained is less than 3.84, then the null hypothesis (H_0) is accepted and the alternative hypothesis (H_1) is rejected. This indicates that there is no significant difference between the two groups being compared.

The calculation results yield a Chi-Square value for the number of DBD cases in Bandung City in 2023 of 0.65. Then, in 2024, the Chi-Square value was 0.015. Since both values are less than 3.84, the null hypothesis (H_0) is accepted, meaning that the difference in the number of dengue fever cases between male and female in 2023 and 2024 is not significant. Meanwhile, the calculation results yielded a combined Chi-Square value for 2023–2024 of 0.5708, which is also smaller than the X^2 table value. Thus, overall, no significant difference was found between the number of dengue fever (DF) cases between men and women during 2023–2024.

These results contradict the literature stating that there are differences in susceptibility to DBD based on gender. Previous studies, such as those reported by Novrita, Mutahar, & Purnamasari (2017) and Eryati, Dwitya & Eka Fithra (2021), indicate that males have a weaker immune response to dengue virus infection due to the immunosuppressive effects of testosterone. Conversely, females are believed to have stronger immunological protection, influenced by estrogen hormones that enhance T-cell activation and antibody production.

Theoretically, these hormonal differences between male and female should contribute to differences in the number of cases between the two groups. However, in this study, the number of cases among men (1,607 cases) and women (1,590 cases) during the 2023-2024 period did not show a significant difference. This inconsistency suggests that gender factors do not adequately explain the distribution pattern of dengue cases in Bandung City.

5. Conclusion

Based on the results of the Chi-square test analysis of the number of dengue fever (DF) cases in Bandung City, the X^2 value was 0.65 in 2023 and 0.015 in 2024. Both values are below the critical X^2 table value of 3.84 at a significance level of 5% ($df = 1$). According to the decision-making criteria, which is to accept the null hypothesis (H_0) if the calculated X^2 value is less than the X^2 table value, the alternative hypothesis (H_1) is rejected. This result indicates that there is no statistically significant difference between the number of DBD cases in males and females.

The results of the Chi-square test on the combined data for 2023–2024 show a X^2 value of 0.5708, which is also lower than the X^2 table threshold of 3.84 (at a significance level of 5%, $df = 1$). Based on the same criteria, the null hypothesis is again accepted, and the alternative hypothesis is rejected. This indicates that the difference in the number of DBD cases between men and women over the two years is not statistically significant.

Although the literature suggests that differences in the number of DBD cases may be influenced by hormonal differences between males and females, the results of this study do not support such an influence. This indicates that gender is not proven to be a determining factor in the distribution of DBD cases based on the analyzed data.

6. Recommendations

- 1) The Bandung City Government has to improve dengue fever prevention education by actively involving both men and women in the community. This includes introducing early symptoms, the importance of medical examinations, and regular mosquito breeding site eradication (PSN).
- 2) Future dengue fever data collection and analysis needs to include more detailed information on gender, age, and location. This aims to map vulnerable groups more accurately and support data-driven policy-making.
- 3) Further research with a longer timeframe and additional variables such as immunological status, frequency of outdoor activities, and environmental sanitation conditions is needed to provide a more comprehensive understanding of dengue fever risk factors.

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