

## THE RELATIONSHIP BETWEEN NOISE INTENSITY AND BLOOD PRESSURE IN COMMUNITIES AROUND BANGKAL VILLAGE

**Muhammad Shaufi Akbar, Junaidi, Zulfikar Ali As, Abdul Khair**

Banjarmasin Ministry of Health Polytechnic, Department of Environmental Health

Jl. H. Mistar Cokrokusumo No. 1A Banjarbaru South Kalimantan 70714

E-mail: upigafaa@gmail.com

### Article Info

#### Article history:

Received July 31, 2023

Revised June 28, 2024

Accepted July 01, 2024

#### Keywords:

Noise

Blood pressure

Bangkal Village

### ABSTRACT

**The Relationship between Noise Intensity and Blood Pressure in Communities Around Bangkal Village.** Noise is a serious problem because it can have an impact on health, one of which is high blood pressure (hypertension). Noise can come from inside or outside the house. One source of noise from outside the house is traffic. Noise comes from the sound produced by motorized vehicles, especially from the engine, exhaust, and the interaction between the wheels and the road. This research aims to determine and analyze the relationship between noise intensity and blood pressure in the community around Bangkal Village. This research is observational analytic, using a cross-sectional design. Observations were made on 68 people, consisting of 40 people for the cluster on the side of the road and 28 people for the cluster 32 m from the road. Data were analyzed using the gamma correlation test. A sound level meter was used to collect noise data, a blood pressure meter was used to collect blood pressure data, and a questionnaire was used to collect respondent characteristics. The research results show that noise ranges between 46.6 dBA – 72.3 dBA. Twelve people (40%) suffered from high blood pressure, and 28 people (60%) had normal blood pressure. There is no significant relationship between noise intensity and blood pressure. This information is helpful for future researchers conducting further research by considering other variables or carrying out noise measurements in the house (indoors).

*This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.*



### INTRODUCTION

Any sound that is no longer necessary and negatively impacts one's quality of life, health, and well-being is considered noise <sup>(1)</sup>. Noise can come from inside or outside the house. Sources of noise from inside the house include noise originating from activities inside the house, while one source of noise from outside the house is traffic noise. Motorized vehicles, particularly the engine, exhaust, and the interaction between the wheels and the road, produce this noise. Noise sources from outside the home contribute the most to noise disorders. We divide noise disturbances into two categories: auditory disturbances, which disrupt hearing, and non-auditory disturbances, which disrupt communication and lower work morale due to fatigue and stress. <sup>(2)</sup>. Physiologically, high-intensity noise can cause health problems such as increased blood pressure ( $\pm 10$  mmHg), increased pulse, and constriction of peripheral blood vessels, especially the hands and feet. It can also cause pallor, sensory and heart rate disturbances, an increased risk of heart attack, and indigestion <sup>(3)</sup>.

Data In 2015, the World Health Organization (WHO) revealed that 1.13 billion people worldwide suffer from hypertension, indicating that 1 in 3 individuals worldwide have this condition. The number of hypertension patients continues to increase every year. Experts estimate that as many as 1.5 billion people will suffer from hypertension in 2025, and that hypertension and its complications will claim the lives of 10.44 million people annually. <sup>(4)</sup>. 2018 Risdaskes data states that the prevalence of hypertension in people aged  $\geq 18$  years is 34.1%. The highest number of sufferers in South Kalimantan is 44.1%, while in Papua, the lowest is 22%. The estimated incidence of hypertension in Indonesia is 63,309,620, with hypertension being the cause of death for 9.4 million people every year <sup>(4)</sup>. Hypertension is the 2nd most common disease in Banjarbaru City, where the Cempaka Health Center work area is at the top, with a prevalence reaching 27% of the total hypertension sufferers in Banjarbaru City. <sup>(5)</sup>.

Bangkal Village is one of the villages in Cempaka District, Banjarbaru City, with an area of 2,980.0 ha (hectares) and consisting of 13 RTs. Most of the settlements in this sub-district are located along Jalan H. Mistar Cokrokusumo, which is the main road that connects Banjarbaru City with Tanah Laut Regency. Due to the proximity of most residents' houses to the main road, this settlement could potentially experience noise pollution from road traffic.

Wahyu Sandika Putra (2019) <sup>(6)</sup> has conducted research on the impact of noise on hypertension. Goran Belojavic et al. (2015) conducted research that indicates a 4.5 mmHg increase in systolic pressure for every 10 dB increase in noise. <sup>(7)</sup>. Pyoung Jik Lee et al.'s 2019 research reveals a link between long-term exposure to transportation noise and elevated blood pressure in adults residing in multi-story residential buildings <sup>(8)</sup>.

Based on the data above, researchers are interested in conducting research regarding the relationship between noise intensity and blood pressure in the community around Bangkal Village.

## **MATERIALS AND RESEARCH METHODS**

This study measured noise at 10 sample points, consisting of 6 points in settlements on the side of the road and 4 points in settlements 32 m from the road. We measured the community blood pressure of 40 respondents, including 28 from settlements on the side of the road and 12 from settlements 32 m from the road. We determined the respondents based on inclusion criteria, which included being between 25 and 40 years old, not having a family history of hypertension, abstaining from alcohol, exercising at least once a week, maintaining a normal nutritional status, not using hormonal contraception (KB) for female respondents, and being willing to participate in the research. Type This research is an analytical observational study with a cross-sectional approach. This study aims to determine whether people in Bangkal Village settlements have a relationship between noise and blood pressure.

The tools used in this research were a sound level meter to measure noise, a tensimeter to measure blood pressure, a stopwatch, a writing instrument, and a tripod. We conducted a data analysis test to determine the relationship between noise intensity and people's blood pressure after collecting data on road noise and blood pressure. The SPSS program assisted in conducting the gamma correlation analysis test.

## **RESEARCH RESULTS AND DISCUSSION**

Bangkal Village is 3 km from Cempaka District, 12 km from Banjarbaru City, and 43 km from the provincial capital of South Kalimantan. Bangkal Village's area is 2,980.0 ha, with a population of 4,860 people in 2020. Table 1 displays the boundaries of Bangkal Village.

Table 1 Bangkal Subdistrict Area Boundaries

| Limit      | Village/Subdistrict | Subdistrict                         |
|------------|---------------------|-------------------------------------|
| North      | Tiung River         | Cempaka                             |
| South side | Banyu Irang         | Bati-Bati District. Land of the Sea |
| East       | Tiung River         | Cempaka                             |
| West Side  | Plug                | Cempaka                             |

The results of noise measurements in settlements in Bangkal Village are presented in table 2.

Table 2 Noise Levels in Bangkal Subdistrict

| group              | Sample point | Location | Noise Levels | Information |
|--------------------|--------------|----------|--------------|-------------|
| Road side          | TS-1         | RT 13    | 69.1 dB      | TMS         |
| Road side          | TS-2         | RT 2     | 71.8 dB      | TMS         |
| Road side          | TS- 5        | RT 4     | 72.3 dB      | TMS         |
| Road side          | TS-7         | RT 8     | 68 dB        | TMS         |
| Road side          | TS-8         | RT 9     | 69.7 dB      | TMS         |
| Road side          | TS-10        | RT 12    | 67.8 dB      | TMS         |
| 32 m from the road | TS-3         | RT 2     | 48.3 dB      | M.S         |
| 32 m from the road | TS-4         | RT 4     | 53.6 dB      | M.S         |
| 32 m from the road | TS-6         | RT 8     | 47.9 dB      | M.S         |
| 32 m from the road | TS-9         | RT 12    | 46.6 dB      | M.S         |

Information :

M.S : Qualify

TMS: Not eligible

T.S : Sample Point

\*The noise level quality standard is 55 dBA for residential and residential areas according to South Kalimantan Governor Regulation No. 53 of 2007 concerning noise level standards.

Table 2 shows that the highest noise is at TS-5, which is one of the settlements on the side of the highway, namely 72.3 dB. This proves that activities on the road, especially motorized vehicles, affect noise in residential areas. Conversely, TS-9 recorded the lowest noise at 46.6 dB due to its distance from the highway, the source of noise.

Furthermore, Table 3 displays the results of blood pressure measurements in the Bangkal subdistrict community.

Table 3 Community Blood Pressure in Bangkal Subdistrict

| No | Blood pressure           | Amount | Percentage (%) |
|----|--------------------------|--------|----------------|
| 1  | Normal                   | 28     | 70             |
|    | Systole: 90 – 139 mmHg   |        |                |
|    | Diastole: 60 – 89 mmHg   |        |                |
| 2  | Tall                     | 12     | 30             |
|    | Systole: $\geq$ 140 mmHg |        |                |
|    | Diastole: $\geq$ 90 mmHg |        |                |
|    | Amount                   | 40     | 100            |

Table 3 shows that the majority of people in the Bangkal sub-district have normal blood pressure, both those living in roadside settlements and those 32 m from the road.

Table 4 displays the characteristics of the Bangkal Village residents who served as respondents.

Table 4 Characteristics of Community Respondents

| No | Confounding Variables            | Amount | Percentage (%) |
|----|----------------------------------|--------|----------------|
| 1. | • Smoking habit                  |        |                |
|    | Do not smoke                     | 9      | 22.5           |
|    | Light Smoker (1-10 cigarettes)   | 5      | 12.5           |
|    | Medium Smoker (11-20 cigarettes) | 5      | 12.5           |
|    | Heavy Smoker (> 20 cigarettes)   | 21     | 52.5           |
| 2. | • Coffee Consumption             |        |                |
|    | No                               | 6      | 15             |
|    | 1-2 glasses/day                  | 14     | 35             |
|    | > 2 glasses/day                  | 20     | 50             |
| 3. | • Excessive Salt Consumption     |        |                |
|    | Yes                              | 27     | 67.5           |
|    | No                               | 13     | 32.5           |
| 4. | • Cholesterol                    |        |                |
|    | Normal                           | 10     | 25             |
|    | Abnormal                         | 2      | 5              |
|    | No Checks                        | 28     | 70             |

The confounding variables in this study were smoking habits, coffee consumption, excess salt consumption, and cholesterol. Meanwhile, the control variables are age, hereditary history of hypertension, alcohol consumption, exercise, nutritional status, and hormonal contraception (KB).

Table 5 presents the distribution of blood pressure sufferers according to the level of noise exposure.

Table 5 Cross Tabulation of Noise Levels and Blood Pressure

| Noise  | Blood pressure |        | Amount | Percentage (%) |
|--------|----------------|--------|--------|----------------|
|        | Tall           | Normal |        |                |
| TMS    | 8              | 16     | 24     | 60             |
| M.S    | 4              | 12     | 16     | 40             |
| Amount | 12             | 28     | 40     | 100            |

Table 5 shows that among people who live on the side of the road and receive noise exposure that exceeds the standard, 8 respondents have high blood pressure, while the other 16 respondents have normal blood pressure. For people who live quite far from the main road (32 m) and do not receive noise exposure above the standard, there are 4 respondents with high blood pressure, while 12 other respondents have normal blood pressure.

Next, we used the gamma correlation test to examine the relationship between the estimated noise intensity and blood pressure, yielding the following results:

#### Symmetric Measures

|                          | Value | Asymptotic<br>Standard<br>Error <sup>a</sup> | Approximate<br>Tb | Approximate<br>Significance |
|--------------------------|-------|----------------------------------------------|-------------------|-----------------------------|
| Ordinal by Ordinal Gamma | ,200  | ,346                                         | ,575              | ,565                        |
| N of Valid Cases         | 40    |                                              |                   |                             |

Figure 1 Statistical test of gamma correlation

The statistical test results show that the significance value of the test is 0.565, or more than the value of  $\alpha = 5\%$ . This means that statistically, there is no significant relationship between noise intensity and blood pressure at the 95% confidence level. A value of  $r = 0.2$  indicates a weak strength of correlation.

This study's lack of a significant correlation between noise intensity and blood pressure primarily stems from the measurement of noise outside the home, when most people are

either at home or away from the road at work. Good house construction can reduce noise from outside. The presence of house walls can reduce quite a lot of noise, depending on the type and thickness of the walls. The presence of curtains on windows, as well as the dimensions, shape, and direction of window openings, influence noise in the house. Therefore, despite the high noise levels on the roadside, these factors contribute to a reduction in noise within the house. From a psychological perspective, most people are also used to the noise produced by traffic activities, so psychological disturbances due to noise that may have an impact on blood pressure are not that big. Anggraini's (2012) research reinforces this, indicating no significant correlation between traffic noise levels and the risk of hypertension.

---

## CONCLUSIONS AND RECOMMENDATIONS

Noise in settlements on the side of the road does not meet the requirements ( $>55$  dB), while in settlements 32 m from the road it all meets the requirements ( $<55$  dB). A total of 12 respondents (30%) had high blood pressure, and 28 respondents (70%) had normal blood pressure. Based on statistical tests, it can be concluded that there is no significant relationship between noise intensity and blood pressure with a value of  $p = 0.565$  or more than the value of  $\alpha = 5\%$ . Future researchers should consider other variables and measure indoor noise for further research.

---

## REFERENCES

1. Kajianpustaka.com. kajianpustaka.com. 2022. No Title. Available from: <https://www.kajianpustaka.com/2022/07/kebisingan.html>
2. Appadurai A. Jurnal Keling. Mod large Cult Dimens Glob [Internet]. 1996;00(1980):3–41. Available from: <http://dx.doi.org/10.1016/j.cirp.2016.06.001><http://dx.doi.org/10.1016/j.powtec.2016.12.055><https://doi.org/10.1016/j.ijfatigue.2019.02.006><https://doi.org/10.1016/j.matlet.2019.04.024><https://doi.org/10.1016/j.matlet.2019.127252><http://dx.doi.org>
3. Dinkes.ntbprov.go.id. dinkes.ntbprov.go.id. 2021. Secara fisiologis, kebisingan dengan intensitas tinggi dapat menyebabkan gangguan kesehatan seperti, meningkatnya tekanan darah ( $\pm 10$  mmHg), peningkatan nadi, konstiksi pembuluh darah perifer terutama tangan dan kaki, serta dapat menyebabkan pucat, gangg. Available from: <https://dinkes.ntbprov.go.id/berita/datin/kebisingan-dan-pengaruhnya-terhadap-pedengaran/>
4. Kemkes.go.id. kemkes.go.id. 2019 [cited 2023 Aug 31]. Data World Health Organization (WHO) tahun 2015 menunjukkan sekitar 1,13 Miliar orang di dunia menyandang hipertensi, artinya 1 dari 3 orang di dunia terdiagnosis hipertensi. Jumlah penyandang hipertensi terus meningkat setiap tahunnya, diperkirakan pada . Available from: <https://www.kemkes.go.id/article/view/19051700002/hipertensi-penyakit-paling-banyak-diidap-masyarakat.html>
5. Abdurrachim R, Libri O, Gz S, Mariana D. PENDAHULUAN Hipertensi atau tekanan darah tinggi merupakan masalah yang sangat besar dan serius . Menurut data WHO pada tahun 2012 hampir 1 milyar penduduk dunia atau lebih dari 26 % menderita hipertensi dengan prevalensi 29 , 2 % pria dan 24 , 8 % wanita. Vol. 2. 2015. p. 103–9.
6. Sandika Putra W, Heriyani F, Djallalluddin. Hubungan Kebisingan Rumah Dengan Kejadian Hipertensi. Homeostasis. 2020;3(1):91–6.

7. Belojevic G, Zivojinovic JI, Paunovic K, Jakovljevic B. The relationship between exposure to traffic noise and resting blood pressure in children and adolescents from Belgrade [Internet]. Available from: <http://nccd>.
8. Lee PJ, Park SH, Jeong JH, Choong T, Kim KY. Association between transportation noise and blood pressure in adults living in multi-storey residential buildings. *Environ Int* [Internet]. 2019;132(April):105101. Available from: <https://doi.org/10.1016/j.envint.2019.105101>
9. Stockholm et al. "Occupational Noise Exposure and the Risk of Hypertension" *Epidemiology* (2013) doi:10.1097/ede.0b013e31826b7f76
10. Järup et al. "Hypertension and Exposure to Noise Near Airports: the HYENA Study" *Environmental health perspectives* (2008) doi:10.1289/ehp.10775
11. "Environmental ergonomics" (2013) doi:10.1201/b14391-42
12. Méline et al. "Road, rail, and air transportation noise in residential and workplace neighborhoods and blood pressure (RECORD Study)" *Noise and health* (2015) doi:10.4103/1463-1741.165054
13. Tessier-Sherman et al. "Occupational noise exposure and risk of hypertension in an industrial workforce" *American journal of industrial medicine* (2017) doi:10.1002/ajim.22775
14. D'Souza et al. "Long-Term Exposures to Urban Noise and Blood Pressure Levels and Control Among Older Adults" *Hypertension* (2021) doi:10.1161/hypertensionaha.121.17708
15. Cao "Relationship amongst Noise Sensitivity, Burnout and Psychological Resilience in Community Workers" *Noise and health* (2023) doi:10.4103/nah.nah\_40\_23
16. Souza et al. "Noise exposure and hypertension: investigation of a silent relationship" *Bmc public health* (2015) doi:10.1186/s12889-015-1671-z
17. Kempen et al. "Noise exposure and children's blood pressure and heart rate: the RANCH project" *Occupational and environmental medicine* (2006) doi:10.1136/oem.2006.026831
18. Li et al. "Effect of Traffic Exposure on Sick Building Syndrome Symptoms among Parents/Grandparents of Preschool Children in Beijing, China" *Plos one* (2015) doi:10.1371/journal.pone.0128767
19. Lepore et al. "Associations between Chronic Community Noise Exposure and Blood Pressure at Rest and during Acute Noise and Non-Noise Stressors among Urban School Children in India" *International journal of environmental research and public health* (2010) doi:10.3390/ijerph7093457
20. Stansfeld and Matheson "Noise pollution: non-auditory effects on health" *British medical bulletin* (2003) doi:10.1093/bmb/ldg033
21. Nserat et al. "Blood Pressure of Jordanian Workers Chronically Exposed to Noise in Industrial Plants" *The international journal of occupational and environmental medicine* (2017) doi:10.15171/ijoem.2017.1134
22. Kempen and Babisch "The quantitative relationship between road traffic noise and hypertension" *Journal of hypertension* (2012) doi:10.1097/hjh.0b013e328352ac54
23. Zamanian et al. "Investigation of the Effect of Occupational Noise Exposure on Blood Pressure and Heart Rate of Steel Industry Workers" *Journal of environmental and public health* (2013) doi:10.1155/2013/256060
24. Mclean and Tarnopolsky "Noise, discomfort and mental health:A review of the socio-medical implications of disturbance by noise" *Psychological medicine* (1977) doi:10.1017/s0033291700023138

25. Münzel et al. "Cardiovascular effects of environmental noise exposure" European heart journal (2014) doi:10.1093/eurheartj/ehu030
26. Suryadi et al. "The Influence of Traffic Noise And Work Stress on The Blood Pressure of Tirtanadi Bus Station Workers" (2022) doi:10.4108/eai.29-3-2020.2314912

