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NOISE LEVELS AND COMFORT LEVELS OF POPULATIONS LIVING AROUND MISTAR COKROKUSUMO, BANGKAL DISTRICT

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ABSTRACT

Noise Levels and Comfort Levels of Populations Living Around Mistar Cokrokusumo Bangkal District. Today, many houses are located on the edge of highways, potentially exposing these homes to additional noise from the traffic flow. This study aims to determine the relationship between noise levels and the comfort levels of residential homes in the Bangkal sub-district. This observational study, which has a cross-sectional design, includes 12 sample points for noise measurement and 77 houses directly adjacent to the road for comfort level sampling. Noise levels were measured using a sound level meter, while traffic density was measured using a compass and counter. The relationship between the two variables was analyzed using the Spearman correlation test. Results showed that the volume of traffic flow ranged from 334 pcu/hour to 402 pcu/hour. The highest noise level was recorded at TS-7 (65.7 dBA) and the lowest at TS-9 (61.7 dBA). According to the South Kalimantan governor's regulation number 53 of 2007, all 12 sample points of noise measurement exceed the quality standard. The average correlation between noise level and comfort level indicated that 88% of households reported being less comfortable, 12% felt uncomfortable, and none felt comfortable. Houses can reduce road traffic noise by installing thick curtains on their windows and doors, planting trees and ornamental plants in pots, and constructing artificial walls.

INTRODUCTION

Noise is an unwanted sound from certain activities at a specific level and time [1]. It can also be defined as any sound that is no longer needed and has adverse effects on the quality of life, health, and welfare [2]. Noise is described as any unwanted sound or sound that disrupts hearing, potentially lowering an individual's hearing threshold when exposed to it [3]. Factors that influence noise levels include distance, temperature, wind, and barriers. The further away from the sound source, the weaker the sound, and vice versa. High temperatures cause sound to propagate faster, while low temperatures slow it down. Wind affects the speed of sound propagation, and barriers can block the sound source [4].

Comfort is a state where there is individual and holistic fulfillment of basic human needs. Fulfillment of comfort can create a sense of well-being in individuals [5]. Previous research shows that wind direction moves to the northeast and southwest during the day and to the

southwest and west at night. With traffic density ranging from 1106 to 1468 vehicles, the highest noise level occurred at TS-4 at 71.9 dBA, and the lowest at TS-10 at 65.4 dBA. Of the 12 sample points, all measured noise levels exceeded the quality standards set by the South Kalimantan Governor's Regulation Number 53 of 2007 [6]. The average lighting intensity in the respondents' houses was 82.89 Lux, the average temperature was 28.54°C, and the average humidity was 64.5%. On average, 57% of occupants felt comfortable living in wetland settlements [7].

Natural vegetation, if tall enough, wide enough, and dense enough, can decrease roadway traffic noise [8]. Through minimal to moderate planting intensity of vegetation, traffic noise could be reduced by 50%, while no enhancement in noise reduction was observed with denser vegetation [9]. Vegetation plays an essential role in cities, such as gardens, green areas, riverbanks, sports fields, and cemeteries, through visual control, physical barriers, climate control, erosion control, and aesthetic values [10]. This study aims to determine the relationship between noise levels and the comfort level of residential homes in Bangkal sub-district.

Noise pollution can significantly impact public health, causing both physiological and psychological problems [11]. For instance, exposure to noise can lead to hearing loss, cardiovascular diseases, sleep disturbances, and stress [12]. Additionally, excessive noise can decrease the quality of life and disrupt daily activities [13]. In urban areas, where traffic is a major source of noise, mitigating strategies such as sound barriers and vegetation are often employed [14]. However, the effectiveness of these strategies can vary based on several factors, including the type of vegetation and the design of the barriers [15]. Furthermore, understanding the relationship between noise levels and comfort in residential areas is crucial for urban planning and public health policies [16].

MATERIALS AND RESEARCH METHODS

We use observational and analytical research methods. This research investigates the potential correlation between noise levels and the comfort levels of residential homes in Bangkal Village settlements. The research design is cross-sectional, as it simultaneously measures or collects the independent variables (risk factors) and dependent variables (effects) or cases that occur within the research object. We used a non-parametric statistical test, the Spearman rank correlation test, to determine the relationship between the independent variable (noise) and the dependent variable (occupant comfort).

The noise population is the noise along Jalan H. Mistar Cokrokusumo, which is in Bangkal Village, Cempaka District, Banjarbaru City. Population The comfort level measurement is the number of houses that are directly adjacent to the main road in Bangkal Village, totaling 337 houses, consisting of 193 houses on the right side of the road and 144 houses on the left side of the road. There are 12 noise measurement sample points, divided into 6 points to the east of the road and 6 points to the west of the road. The distance between measurement points is 600 meters. This distance divides the average length of the road that passes through Bangkal Village, which is ± 3.6 km. The comfort level measurement sample included 77 houses directly adjacent to the main road. Thus, the sample to express the level of residential comfort in Bangkal Village consists of 6 to 7 heads of families at each noise measurement sample point.

We conducted noise measurements using a simple method, which involved using an ordinary sound level meter to measure the sound pressure level for 10 minutes, taking a reading every 5 seconds, resulting in a total of 120 data points for each measurement. We conducted 7 noise measurements at each sample point, which corresponded to 4 day periods and 3 night periods. These periods are in accordance with South Kalimantan Governor Regulation Number 053 of 2007 concerning noise standards. We conducted observations to determine traffic density, counting the number of vehicles using a counter and measuring the time and duration of noise. We measure the community's comfort level using a questionnaire. A computer processes the

data. The data that has been processed is then analyzed using non-parametric statistical tests, which use the Spearman rank correlation statistical test at a confidence level of 95% ($\alpha = 0.05$). The tools used in this research are a sound level meter, questionnaire, compass, roll meter, counter, tripod, and stationery.

RESULTS OF RESEARCH AND DISCUSSION

Noise Level

We conducted noise measurements for 24 hours, dividing the daytime period at 07.00, 10.00, 15.00, and 20.00 WITA and the nighttime period at 23.00, 01.00, and 04.00 WITA. Table 1 displays the results of the noise measurements.

Table 1 Noise Level in Bangkal Subdistrict

No	Sample point	Noise levels	Note.
1	TS-1	65.3	TMS
2	TS-7	65.7	TMS
3	TS-2	64.4	TMS
4	TS-8	63.2	TMS
5	TS-3	63.1	TMS
6	TS-9	61.7	TMS
7	TS-4	64.1	TMS
8	TS-10	62.8	TMS
9	TS-5	63.5	TMS
10	TS-11	63.9	TMS
11	TS-6	64.4	TMS
12	TS-12	64.8	TMS

Table 1 shows that the noise on JL. HM Cokrokusumo in Bangkal Village ranges from 61.7 to 65.7 dBA (63.6 dBA ± 1.1 dBA). The lowest noise measured was 61.7 dBA on the TS-9, and the highest was 65.7 dBA on the TS-7. Point-7 is at a T-junction, which causes vehicle volume and mobility to be relatively higher. These results show that the noise level on the road is relatively the same because the main source is also the same, namely motorized vehicles.

This study utilizes observational and analytical research methods to investigate the potential correlation between noise levels and the comfort levels of residential homes in Bangkal Village settlements. The research design is cross-sectional as it simultaneously measures or collects the independent variables (risk factors) and dependent variables (effects) or cases that occur within the research object. A non-parametric statistical test, the Spearman rank correlation test, was used to determine the relationship between the independent variable (noise) and the dependent variable (occupant comfort).

The noise population is the noise along Jalan H. Mistar Cokrokusumo, which is in Bangkal Village, Cempaka District, Banjarbaru City. The comfort level measurement population includes houses directly adjacent to the main road in Bangkal Village, totaling 337 houses consisting of 193 houses on the right side of the road and 144 houses on the left side of the road. There are 12 noise measurement sample points divided into 6 points to the east of the road and 6 points to the west of the road. The distance between measurement points is 600 meters, dividing the average length of the road that passes through Bangkal Village, which is approximately 3.6 km. The comfort level measurement sample included 77 houses directly adjacent to the main road. Thus, the sample to express the level of residential comfort in Bangkal Village consists of 6 to 7 heads of families at each noise measurement sample point.

We conducted noise measurements using a simple method that involved using an ordinary sound level meter to measure the sound pressure level for 10 minutes, taking a reading every 5 seconds, resulting in a total of 120 data points for each measurement. We conducted 7 noise measurements at each sample point, corresponding to 4 day periods and 3 night periods, in

accordance with the South Kalimantan Governor Regulation Number 053 of 2007 concerning noise standards. Observations to determine traffic density were conducted by counting the number of vehicles using a counter and measuring the time and duration of noise. The community's comfort level was measured using a questionnaire. Data were processed using a computer and analyzed using non-parametric statistical tests with the Spearman rank correlation statistical test at a confidence level of 95% ($\alpha = 0.05$).

Noise measurements over 24 hours showed that the noise levels on Jalan H. Mistar Cokrokusumo in Bangkal Village ranged from 61.7 to 65.7 dBA (63.6 dBA ± 1.1 dBA). The lowest noise measured was 61.7 dBA at TS-9, and the highest was 65.7 dBA at TS-7, which is located at a T-junction causing higher vehicle volume and mobility. These results indicate that the noise level on the road is relatively consistent, as the primary source is motorized vehicles.

Traffic Flow

We conduct traffic flow measurements concurrently with noise measurements. The results of traffic flow measurements can be seen in Table 2.

Table 2 Traffic Flow and Vehicle Types in Bangkal Subdistrict

Sample Point	2 wheels (smp = 0.2)	4 wheels (smp = 1)	Wheels > 4 (smp = 1.3)	Total (junior high school/hour)
TS-1	567	175	72	382
TS-2	492	190	76	387
TS-3	541	166	77	374
TS-4	510	140	86	354
TS-5	452	171	60	339
TS-6	446	164	72	347
TS-7	580	169	71	377
TS-8	490	199	81	402
TS-9	466	132	84	334
TS-10	521	154	84	367
TS-11	500	200	72	394
TS-12	492	157	92	375

Traffic flow measurements conducted concurrently with noise measurements showed vehicle flow on Jalan H. Mistar Cokrokusumo in Bangkal Village ranged from 334 to 402 pcu/hour (369.3 pcu ± 21.7 pcu). The lowest flow measured at TS-9 was 334 pcu/hour, which correlates with the lowest noise measurement at TS-9. Road conditions at this point are straight, wide, and have a smooth surface. However, noise measurement results at TS-8, with the highest vehicle flow of 402 pcu/hour, did not correspond to the highest noise levels, indicating that noise is influenced not only by vehicle flow but also by vehicle condition, especially the engine and exhaust, as well as road surface conditions.

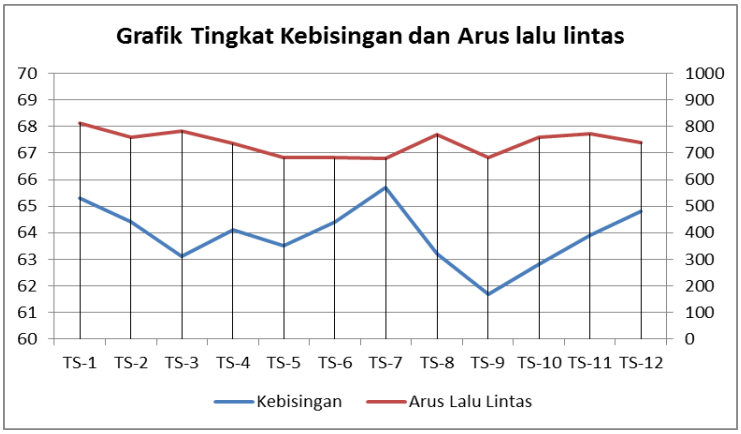

Figure 1 Graph of Noise Levels and Traffic Flow

Figure 1 shows similarities in current and noise patterns, but they are not always parallel. This proves that vehicle flow has an impact on noise, but there is still the influence of other factors.

Community Residential Comfort Level Due to Noise

The level of residential comfort in Bangkal Village can be seen in table 6.

Table 3 Distribution of residential comfort levels in people's houses in Bangkal Village

No	Comfort level	amount	Percentage %
1	Less comfortable	68	88 %
2	Uncomfortable	9	12 %
	amount	77	100%

Table 1 shows that none of the Bangkal Village residents feel comfortable with the presence of vehicle traffic on Jalan HM Cokrokusumo. As many as 88% of residents felt uncomfortable, and another 12% felt uncomfortable. If broken down by gender, of the 68 respondents who felt uncomfortable, 36 were male respondents, and the other 32 were female respondents. Likewise, of the 9 respondents who felt uncomfortable, 5 were male respondents, and the other 4 were female respondents. This even distribution suggests that gender does not influence the comfort level response. If we look at the age group, in the 26–35 year age range, there were 8 respondents who felt uncomfortable and 2 respondents who felt uncomfortable. In the age range of 36–45 years, there were 20 respondents who felt uncomfortable and 4 respondents who felt uncomfortable. In the age range of 46–55 years, there were 28 respondents who felt uncomfortable and 3 respondents who felt uncomfortable. The remaining 12 respondents in the age range of 56–65 felt less comfortable. Age is not a factor that directly influences complaints due to noise, but those aged over 40 years are very vulnerable to trauma, and people aged 40 years are more likely to experience disturbances. Some physical capacities, such as vision, hearing, and reaction speed, decline after age 40 or more.

Furthermore, if we look at the distribution of education, in the elementary school education group, there were 20 respondents who felt uncomfortable and 3 respondents who felt uncomfortable. In the junior high school education group, there were 35 respondents who felt uncomfortable and 2 respondents who felt uncomfortable. In the SMA/SMK-educated group, there were 12 respondents who felt uncomfortable and 3 respondents who felt uncomfortable. In the undergraduate group, there were two people who felt uncomfortable.

Environmental conditions, especially noise from the highway, greatly influence the comfort level of people's homes. Houses directly adjacent to the main road in Bangkal Village expose residents to noise levels exceeding 55 dBA, the standard noise level for residential areas. Most houses do not have barriers to the road, such as walls, fences, or vegetation, that can reduce noise entering the house.

Residential comfort level data indicated that none of the residents in Bangkal Village felt comfortable with the presence of vehicle traffic on Jalan H. Mistar Cokrokusumo. Of the residents, 88% felt less comfortable, and 12% felt uncomfortable. Gender and age distribution among the respondents showed that comfort levels were not significantly influenced by these factors, although those aged over 40 were more vulnerable to noise disturbances. Education level distribution also showed no significant influence on comfort levels. Environmental conditions, particularly noise from the highway, significantly affect residential comfort.

The statistical test results did not show a significant relationship between noise and comfort variables, with a p-value of 0.576, which exceeds the α value of 5%. This does not mean that noise does not cause comfort disturbances; rather, all locations had high noise levels, and all respondents felt uncomfortable, with 88% feeling less comfortable and 12% feeling

uncomfortable. These results indicate that road noise has caused comfort disturbances for residents living along the roadside.

CONCLUSIONS AND RECOMMENDATIONS

According to Governor Regulation No. 053 of 2007 concerning Ambient Air Quality Standards and Noise Level Standards, the noise level in Bangkal Village, specifically in the settlements on the highway side, has exceeded the standard. The primary cause of the noise is motorized vehicles passing by on Jalan H. Mistar Cokrokusumo. Among the 77 respondents in the settlement, 88% reported feeling less comfortable, and 12% reported feeling uncomfortable due to the noise.

The statistical analysis did not show a significant relationship between noise levels and comfort levels, with a p-value of 0.576, which exceeds the α value of 5%. This indicates that while noise is a major disturbance, its ubiquitous presence across all sample points prevents a clear statistical correlation. However, it is evident that the noise generated by road traffic has caused discomfort among residents living close to the highway.

To mitigate the impact of noise, residents living near the main road are encouraged to adopt several noise-reducing measures are installation of barriers (construct fences or walls between the house and the road to block noise), vegetation (plant trees and other forms of vegetation that can act as natural sound barriers), window treatments (use thick curtains and ensure windows are kept closed, especially during peak traffic hours, to minimize noise penetration) and home layout adjustments (design homes in such a way that living and sleeping areas are situated further from the road).

Further research is necessary to explore the effectiveness of various noise mitigation strategies and materials in reducing noise levels in residential areas. Studies on different media and their capabilities to absorb or deflect noise should be conducted to find optimal solutions for noise reduction in settlements along busy highways.

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