

DIFFERENCES IN ENGINE POWER AND NOISE LEVELS OF THREE HONDA VARIO 125 EXHAUST CONFIGURATIONS

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Abstract

This study compares the engine power and noise levels of a 2017 Honda Vario 125 K60 motorcycle when using a standard exhaust, an aftermarket exhaust with a silent decibel valve, and racing mode. The study used an experimental approach on a single motorcycle. Power was measured with a dynamometer at 5,000–8,500 rpm with three repetitions for each rpm and exhaust configuration, while noise levels were recorded using a sound level meter at 1,700–8,500 rpm. Data are presented descriptively and the statistical test results reported in the source are summarized with caution because the unit of analysis and the repetition structure are not yet fully clear. The highest average power recorded in the table occurs in racing mode at 7,000 rpm (11.50 HP), while the peak power value reported from the dynotest graph is 11.66 HP at 7,250 rpm. Racing mode noise increases from 82.1 dB at 1,700 rpm to 102.2 dB at 8,500 rpm. The reported ANOVA test showed $p=0.956$ for power and $p<0$. Descriptively, racing mode produces the highest peak power and the highest noise; silent mode has a noise profile closer to the standard exhaust than racing mode.

Keywords: Exhaust, Engine Power, Noise, Valve Decibel, Dynamometer.

A. INTRODUCTION

The exhaust system is a crucial component of an internal combustion engine because it channels combustion gases and influences noise, gas flow, and performance characteristics. Modifying the exhaust is often perceived as a simple way to increase engine power, but structural changes do not always provide the same benefits at all revs. Exhaust system performance depends on pipe geometry, flow characteristics, pressure waveforms, and the system's compatibility with the engine's characteristics. A review by Murali et al. (2021) states that excessive backpressure can increase flow resistance, and exhaust system optimization must consider both performance and emissions consequences simultaneously. Fernoaga et al. (2020) also show that changes in backpressure are associated with engine power losses, so claims of improved performance cannot be based solely on louder noise.

On motorcycles, stock exhausts are typically designed as part of a vehicle system that considers performance, acoustic comfort, and emissions requirements. Aftermarket exhausts come in a wide variety of designs, ranging from systems with internal silencers to free-flow designs. Replacing the exhaust can alter flow resistance and acoustic characteristics, but the results depend on the actual design and engine compatibility. An experimental study by Huda et al. (2025) on a 110 cc motorcycle demonstrated that muffler designs need to be evaluated based on multiple parameters, including performance, emissions, and noise, rather than a single measure.

Exhaust noise is also an environmental and regulatory compliance issue. Vehicle noise measurements must take into account procedures, instrument position, distance from the source, engine condition, and test cycles. Research on motorcycle noise measurement procedures indicates that stationary measurement results can vary depending on the method

and vehicle configuration; therefore, noise figures must be interpreted according to the measurement conditions (Austin et al., 2011). High-speed values cannot necessarily be directly compared to regulatory thresholds established for specific test procedures. In the Indonesian context, research sources refer to Regulation of the Minister of State for the Environment Number 7 of 2009; the application of threshold figures needs to follow the applicable vehicle category and test method, rather than simply comparing dB figures without confirming the procedure.

One alternative being investigated is a noisy exhaust system equipped with a decibel valve with two operating modes. The silent mode is intended to dampen noise by restricting flow, while the racing mode allows for greater flow to achieve performance characteristics. Technically, this configuration raises questions about whether changing the valve position results in a measurable difference in power and the extent of the accompanying noise compromise. Studies on muffler design confirm that noise reduction and performance are not simply competing goals; system design can manage both, but requires appropriate measurements (Murali et al., 2021; Huda et al., 2025). Ma'arof et al. (2019) also emphasize that manifold geometry, pipe length and diameter, and bends are all parameters that influence backpressure. Therefore, changes in noise with valve mode are not sufficient to confirm changes in backpressure without direct measurements.

Previous studies in Indonesia have examined exhaust variations and their impact on motorcycle performance or noise, for example, Akhya et al. (2019), Wibowo et al. (2020), Rochim et al. (2021), Syaekhu et al. (2022), and Prawira et al. (2023). However, the study on which this article is based placed the decibel valve in silent and racing modes as two configurations on the same aftermarket exhaust, then compared them with the standard exhaust on a 2017 Honda Vario 125 K60. This focus is useful for observing the power profile at various revs and noise changes when the valve mode is changed.

This study aims to: (1) describe the differences in engine power across three exhaust configurations; (2) describe the noise levels across the three configurations; (3) summarize the reported power difference test results; and (4) summarize the reported noise difference test results. Its primary contribution is to present a side-by-side reading of performance and noise, with an emphasis on distinguishing between descriptive findings, inferential test results, and design limitations.

B. LITERATURE REVIEW

Exhaust systems channel exhaust gases while dampening sound through pipe and muffler design. Their impact on power is influenced by gas flow, backpressure, combustion, friction, and engine speed; larger pipe diameters do not always increase power (Murali et al., 2021). Mufflers dampen sound through reflection, expansion, and absorption, but their effectiveness depends on the design. Research by Huda et al. (2025) supports the evaluation of exhaust systems based on several performance indicators.

The decibel gauge allows for comparison of silent and racing modes. Silent mode aims to reduce noise, while racing mode allows for freer gas flow. However, the causal mechanism cannot be confirmed because backpressure is not measured. Noise measurements also require consideration of units, weighting, microphone distance, calibration, and testing procedures.

This study compares the standard exhaust, silent mode, and racing mode on a Honda Vario 125 through power measurements at 5,000–8,500 rpm and noise. The use of the same vehicle reduces inter-unit variation but limits generalizability. Three replicate measurements do not automatically constitute independent samples; analysis needs to consider repeated measurements and engine speed. Because back pressure, emissions, and fuel consumption were not measured, conclusions are limited to the observed power and noise profiles. B.1. Relationship between the exhaust system and gas exchange processes

The exhaust system not only functions to remove combustion products but also interacts with the gas exchange process within the cylinder. Pressure waves traveling along the pipe can influence the pressure conditions at the exhaust valve and, in certain configurations, facilitate or hinder the exhaust process. The extent of this influence depends on the length and diameter of the pipe, the shape of the bends, the muffler volume, the core geometry, the gas temperature, and the engine speed. Because the pressure waveform changes with speed, system characteristics that are good at high speeds may not necessarily produce the same results at low speeds. A study by Murali et al. (2021) identified backpressure as a critical variable related to the pumping action and power output of an internal combustion engine. However, the study also demonstrated that the relationship between performance and operating conditions and system design cannot be separated.

1. Back Pressure, Power, and Design Compromises

Backpressure is the pressure that exhaust gases must overcome as they leave the cylinder and pass through the exhaust system. Excessive backpressure can increase pumping work and reduce volumetric efficiency, but exhaust systems cannot be designed with the principle of “least drag” without considering wave dynamics, emissions, temperature, and torque characteristics. Ma'arof et al. (2019) describe a number of geometric parameters that can affect backpressure, including pipe diameter, length, shape, and bends. Research by Sahoo et al. (2023) also emphasizes that reducing backpressure needs to be balanced with sound damping capabilities. Thus, exhaust modifications can produce different responses across the rev range; a single-point measurement is insufficient to assess overall performance.

2. Engine Power as a Performance Variable

Power indicates the rate of work produced by an engine. Mechanically, shaft power is related to torque and angular velocity, so power changes across the rev range are a result of the combined characteristics of torque, combustion, cylinder filling, friction, and the transmission system. On a dynamometer, results are also influenced by the test procedure, engine thermal conditions, instrument calibration, load, and rotational stability. Therefore, a good comparison requires maintaining comparable test conditions for all configurations. In muffler research, Kashikar et al. (2021) exemplified a design development process that combines acoustic considerations with engine performance. Deepan Kumar et al. (2021) also combined flow simulation and experimental validation in muffler design to reduce noise and heat. Huda et al. (2025) tested a muffler design on a 110 cc motorcycle through performance, noise, and emissions measurements; this multi-indicator approach is relevant because muffler modifications rarely affect only one characteristic.

3. Sound Damping Mechanisms and Characteristics

Sound dampening can operate through reactive, absorptive, or combined mechanisms. Reactive dampening utilizes changes in cross-sectional area and wave reflection, while absorptive dampening uses porous materials to convert some of the acoustic energy into heat. The duct shape, chamber volume, perforations, absorbent materials, and installation conditions influence transmission loss and resulting sound output. Biswas and Phate (2022) report on motorcycle muffler modifications that reduce sound through geometry changes. Tan et al. (2020) discuss motorcycle muffler noise measurements under field conditions, while a study in *Results in Engineering* (2024) found that modified muffler designs can reduce sound pressure levels and improve transmission loss in small engines. Kashikar et al.'s (2021) study emphasizes that design validation should involve sound measurements, not just flow simulations. This evidence demonstrates that sound is not simply a side effect; it is a measurable and engineerable system output.

4. Vehicle Noise and Measurement Quality

Sound pressure levels are typically expressed in decibels, a logarithmic scale that cannot be treated like a conventional linear scale. A difference of a few decibels can indicate a significant change in acoustic energy, but interpretation must take into account frequency weighting, instrument response time, background noise, microphone distance, angle to the exhaust tip, reflective surfaces, and engine speed. SAE Procedure J2825 describes the method for measuring exhaust noise from stationary motorcycles and emphasizes the importance of standardized test conditions (SAE International, 2020). SAE International (2020) also discusses the development of motorcycle noise testing procedures. Without such information, noise figures are useful for comparing conditions within a single experiment, but they are insufficient for asserting regulatory compliance or for absolute comparison with other studies.

5. Conceptual Framework and Research Position

The conceptual framework of this study places the exhaust configuration as the treatment variable, engine speed as the operating condition, and power and noise levels as the two outputs. Conceptually, exhaust type can affect power through exhaust flow dynamics and affect noise through transmission and damping characteristics. Engine speed is treated as an important context factor because changes in speed affect gas flow rate, exhaust pulse frequency, and sound intensity. The model does not state that backpressure has been measured; it describes the theoretical relationships underlying the comparison. The research gap addressed is the comparison of three conditions including standard exhaust, silent mode, and racing mode on a single 2017 Honda Vario 125 K60 with the two outputs reported simultaneously. The results are an experimental case study and are not generalizable to all motorcycles.

C. METHOD

The study used an experimental quantitative approach by comparing three treatments on one 2017 Honda Vario 125 K60 motorcycle: (1) standard K59 exhaust; (2) aftermarket exhaust with silent mode decibel valve; and (3) aftermarket exhaust with racing mode decibel valve. The vehicle used Shell Super RON 92 fuel as stated in the source. The same vehicle unit was used to reduce variations originating from differences in engine conditions between units. However, because only one vehicle was tested, the results cannot be directly generalized to all Honda Vario 125 or other types of motorcycles.

Power was measured using a dynamometer at 5,000, 5,500, 6,000, 6,500, 7,000, 7,500, 8,000, and 8,500 rpm. Each combination of speed and configuration had three repetitions. Noise levels were measured with a sound level meter at 1,700, 2,000, 3,000, 4,000, 5,000, 6,000, 7,000, and 8,500 rpm. The source table contains one noise figure for each combination of speed and configuration; the number of repetitions for noise measurements is not explicitly stated.

The independent variables were exhaust configurations with three categories, while the dependent variables were power (HP) and noise level (dB, as reported by the source). Power data were summarized using the average of three repetitions in each run. The average was calculated using the formula:

$$\bar{x} = (\sum x_i)/n$$

with x_i as the measurement value and $n=3$. The mean difference between configurations is calculated as

$$\Delta = \bar{x}_A - \bar{x}_B$$

For noise, since the source provides one number per condition, the values are shown as is and no standard deviation is provided where this is not available.

Normality tests were performed using the Shapiro–Wilk test, homogeneity test, one-way ANOVA, and Bonferroni's further test for noise. The significance criterion used was $\alpha=0.05$. For ANOVA, the null hypothesis is that the means of the compared groups are equal; a p value <0.05 is treated as evidence of a statistical difference. In general, the F statistic is calculated as $F=MS_{\text{between}}/MS_{\text{within}}$. However, a typical one-way ANOVA assumes independent observations. Because power measurements were performed on the same vehicle across multiple runs, the data structure is potentially repetitive and engine speed factors need to be considered. This article reports the inferential figures as stated in the source, but does not consider them revalidated without the full data output.

Noise assessments against regulatory thresholds are provided for context only. The source cites Regulation of the Minister of State for the Environment No. 7 of 2009, which mentions a threshold of 80 dB in one section and 83 dB in another. Because of these inconsistencies and the insufficiently detailed description of the measurement procedures used, this article does not conclude definitive legal compliance based solely on numerical comparisons. Measurement values are presented descriptively to allow readers to see trends between modes.

1. Research Design and Variables

The research design is a comparative experimental one with three exhaust configurations on a single 2017 Honda Vario 125 K60. The treatment factor is the exhaust configuration (standard, aftermarket silent mode, aftermarket racing mode). The first output is engine power (HP), measured at eight rev points from 5,000–8,500 rpm with three repetitions per configuration and rev point. The second output is the noise level recorded at eight rev points from 1,700–8,500 rpm; based on the source table, only one figure is available for each combination of configuration and rev point. Unmeasured variables—such as back pressure, torque, emissions, fuel consumption, gas temperature, and frequency spectrum—are not treated as research outcomes.

2. Descriptive Data Processing

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad (1)$$

$$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}} \quad (2)$$

$$\Delta_{AB} = \bar{x}_A - \bar{x}_B \quad (3)$$

$$R_{AB} = \frac{\bar{x}_A - \bar{x}_B}{\bar{x}_B} \times 100\% \quad (4)$$

Figure 1. Descriptive processing equation for power measurement data

The power average was recalculated from the raw repeat values listed in the source, because some of the means in the source table were not arithmetically consistent with their repeat values. For n repeats, the average was calculated using the equation

$$(1): \bar{x} = (1/n) \sum_{i=1}^n x_i$$

The sample standard deviation can be calculated using the equation

$$(2): s = \sqrt{[\sum_{i=1}^n (x_i - \bar{x})^2 / (n-1)]}$$

However, standard deviations are not shown in the main table because the focus is on the mean profile and previous sources have not reported summaries of variability consistently. The absolute difference between configurations is calculated as

$$\Delta_{AB} = \bar{x}_A - \bar{x}_B \quad (3),$$

while the relative change to the reference configuration can be calculated as

$$RAB = [(\bar{x}A - \bar{x}B)/\bar{x}B] \times 100\% \quad (4).$$

Means, differences, and percentages are descriptive measures; none alone demonstrates statistical significance.

3. Power formula and unit interpretation

$$P = \tau \omega, \quad \tau = \frac{P}{\omega}, \quad \omega(N) = \frac{P}{\tau} \quad (2-1)$$

Figure 2. Relationship between power, torque, and angular velocity

Mechanically, shaft power is related to torque and angular velocity through

$$P = \tau \omega \quad (5)$$

with P in watts, τ as torque in N·m, and ω as angular velocity in rad/s. If rotation is expressed as N in rpm, then

$$\omega = 2\pi N/60 \quad (6)$$

so that

$$P(W) = 2\pi \tau N/60 \quad (7)$$

This formula explains the theoretical relationship between power and torque, but this study did not recalculate power from torque because raw torque data was not provided. The HP values in the table are treated as dynamometer readings as reported by the source. No additional unit conversions were performed other than rounding to the mean.

4. Inferential Analysis and Replication Limits

$$F = \frac{MS_{\text{antara}}}{MS_{\text{dalam}}}, \quad \alpha = 0.05 \quad (8)$$

$$\alpha^* = \frac{\alpha}{m} \quad (9)$$

Figure 3. Summary Equation for ANOVA and Bonferroni Correction

The source reports one-way ANOVA for power ($p = 0.956$) and noise ($p < 0.001$), as well as a Bonferroni follow-up test for noise. In general, the ANOVA statistic is written as $F = MS_{\text{between}}/MS_{\text{in}}$ (8), where MS is the mean square. If H_0 states that all means are equal and $p < \alpha$ ($\alpha = 0.05$), H_0 is rejected; if $p \geq \alpha$, there is insufficient evidence to reject H_0 . The Bonferroni follow-up test adjusts the significance level for m comparisons, $\alpha^* = \alpha/m$ (9), or adjusts the p-value according to the software procedure. However, the ANOVA output, F-value, degrees of freedom, sample size analyzed, and the table of pairwise comparisons are not fully available. Therefore, the p reported by the source is listed as the reported result, not the result recalculated by the author of this article.

5. Sound Pressure Level Formula and Unit Precautions

$$L_p = 20 \log_{10} \left(\frac{p}{p_0} \right) \text{ dB}, \quad p_0 = 20 \mu\text{Pa} \quad (10)$$

Figure 4. Definition of Sound Pressure Level (SPL)

The sound pressure level is physically defined as $L_p = 20 \log_{10}(p/p_0)$ dB (10), where p is the effective sound pressure and $p_0 = 20 \mu\text{Pa}$ is the reference pressure in air. This formula was not used to recalculate the data because the effective sound pressure value was not available. The source cites the unit “dBm,” but dBm refers to a power level relative to 1 mW and is not a common unit for sound pressure level. Since there is no definitive information on whether the device uses A-weighting, the article refers to the number as the “reported noise value (dB)” and notes the unit and protocol as limitations. This value is not used to express.

D. RESULT AND DISCUSSION

1. Power Measurement Results

Table 1 presents the average power at each engine speed, calculated from the three iterations listed in the source table. At 5,000 rpm, the averages for the three configurations are relatively close, namely 2.70 HP with the standard exhaust, 2.77 HP with the silent mode, and 2.70 HP with the racing mode. At 5,500–6,000 rpm, the racing mode shows a higher average than the standard exhaust, while the silent mode is only slightly different. At 6,500 rpm, the silent mode has the highest average (6.70 HP), while the racing mode has 6.38 HP. At 7,000 rpm, the racing mode has the highest average of 11.50 HP, followed by the silent mode at 10.78 HP and the standard exhaust at 10.56 HP. At 7,500–8,500 rpm, the racing mode again shows a higher average value.

Table 1. Average Power According to Engine RPM and Exhaust Configuration

Rotation (RPM)	K59 Standard (HP)	Silent Mode (Cellphone)	Racing Mode (HP)
5000	2.70	2.77	2.70
5500	3.82	3.83	4.05
6000	5.15	5.26	5.64
6500	6.63	6.70	6.38
7000	10.56	10.78	11.50
7500	8.24	8.59	9.45
8000	7.88	8.01	9.18
8500	7.23	6.96	8.96

Figure 5 shows that power increases toward around 7,000 rpm, then decreases at higher revs for all three configurations. This pattern aligns with the source narrative, which reports peak power from the dynotest graph at 7,000–7,250 rpm. There is a discrepancy between the table averages recorded at discrete revs and the dynotest graph peaks: the source reports 10.81 HP for the standard exhaust and silent mode and 11.66 HP for the racing mode at 7,250 rpm. Since the 7,250 rpm figure is not included in the repeatability table, the graph peak is reported as a separate result from the source narrative and is not combined with the table averages.

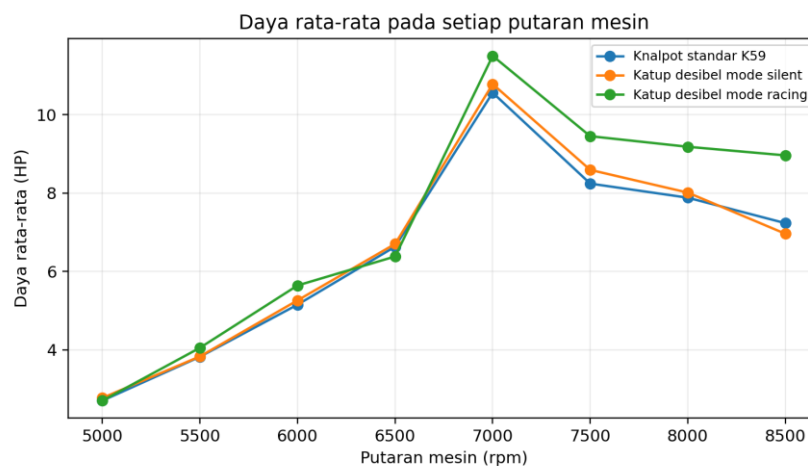


Figure 5. Average power profile at various engine speeds

Descriptively, racing mode delivers the highest power at the upper rev range in the table and the peak reported in the graph. However, the one-way ANOVA results in the source state $p=0.956$, indicating no significant difference. This value should be treated with caution: combining measurements from multiple revs into a single exhaust factor can mask rev-dependent patterns, and data from a single vehicle measured repeatedly are not completely independent. Without the full ANOVA table, group definitions for the analysis, and raw data,

this article does not speculate on these p-values. The safest inferential conclusion is that the source reports a non-significant power ANOVA result, while the descriptive statistics show a difference across a number of revs, particularly in racing mode at the upper rev range.

2. Noise Level Measurement Results

Table 2. Noise levels according to engine speed and exhaust configuration

Rotation (RPM)	K59 Standard (dB)	Silent Mode (dB)	Racing Mode (dB)
1700	72.1	73.4	82.1
2000	74.3	74.8	84.8
3000	75.6	75.2	86.4
4000	77.1	76.9	89.2
5000	77.8	78.1	91.4
6000	78.2	79.3	94.3
7000	80.2	81.5	97.9
8500	81.8	83.1	102.2

Table 2 shows that racing mode consistently produced the highest noise levels across all tested rpms. The figures increased from 82.1 dB at 1,700 rpm to 102.2 dB at 8,500 rpm. The standard exhaust has a range of 72.1–81.8 dB, while the silent mode is 73.4–83.1 dB. The difference between silent and standard modes is relatively small compared to the differences between them compared to racing mode. At 8,500 rpm, racing mode is 20.4 dB above the standard exhaust and 19.1 dB above the silent mode, based on recorded figures.

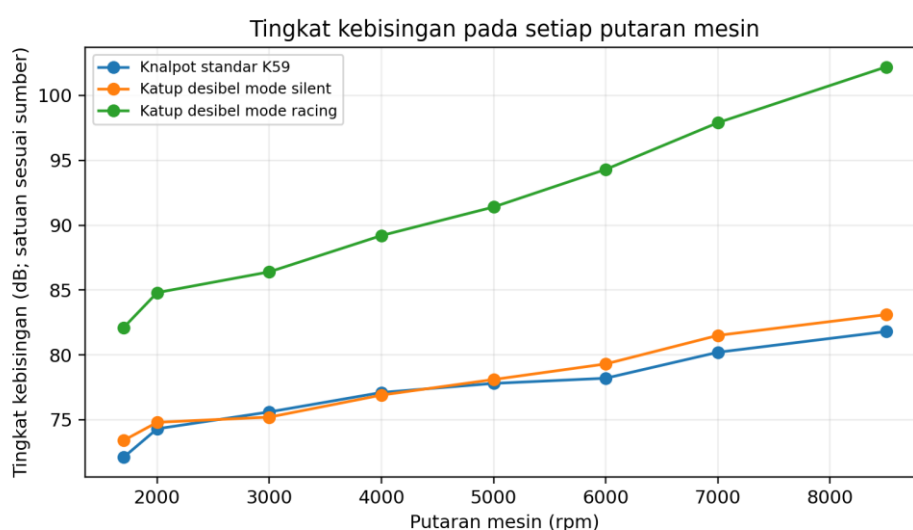


Figure 6. Noise level profile at various engine speeds

The source reports a one-way ANOVA for noise with $p < 0.001$ and mentions a Bonferroni follow-up test indicating a difference primarily related to racing mode. The descriptive pattern in Table 2 supports a clear separation between racing mode and the other two configurations. However, the complete post hoc test is not available as a numerical table in the extractable text, so paired comparisons and individual p-values are not reconstructed. For the noise test, the source provides only one value per condition; if these numbers are not derived from independent replicates, the ANOVA assumptions and estimates of within-group variation are questionable.

3. Interpretation of Performance and Noise Simultaneously

A comparison of the two parameters shows that racing mode has the highest peak power, according to the graph, and also the highest noise level across all measurement points. This suggests a practical compromise between high-revving performance and sound output.

However, this study did not measure backpressure, emissions, fuel consumption, or component durability; therefore, the mechanistic reasoning linking racing mode with lower backpressure remains an interpretation, not a direct measurement. A study by Murali et al. (2021) supports the relevance of backpressure to engine performance, but the relationship could not be proven specifically for exhausts tested without pressure measurements.

The silent mode produces noise levels relatively close to the standard exhaust at some revs, although slightly higher at most points. This is consistent with the valve's function as a sound control, but does not prove that the configuration meets all regulatory requirements. In addition to the difference between the 80 and 83 dB thresholds within the source, compliance determination also depends on the type of test, the position of the sound level meter, environmental conditions, and frequency weighting. SAE International (2020) points out the importance of consistency in motorcycle noise measurement procedures. Therefore, the claim that the silent mode “passes regulations” is not made in this article.

From a technical perspective, the data suggests that the advantage of using the switchable modes is the ability to shift the sound character. However, the silent mode is not identical to the standard exhaust: the silent mode noise range reaches 83.1 dB at 8,500 rpm, while the standard exhaust is 81.8 dB. At higher revs, this difference is noteworthy, although it should not be confused with the results of formal compliance tests. Similarly, higher power at some points does not necessarily mean that the racing mode provides a significant performance increase across the rev range according to the reported inferential tests.

The distinction between descriptive and inferential results is an important limitation of research. Graphs and averages depict patterns of measured results; p-values summarize the results of a particular statistical model based on its assumptions and unit of analysis. If an ANOVA analysis combines values from different runs or treats repetitions as independent observations, the test results may not accurately address the question of configuration differences across runs. Because sources do not provide complete statistical output data and adequate repetition protocols, p-values for power and noise need to be confirmed before being used as final evidence. A better approach would be to use a repeated-measures design, report variation between repetitions, and explicitly analyze the effects of configuration and engine speed.

In practice, these results suggest that exhaust selection should not be based solely on perceived loudness or perceived higher performance. On the test units, the racing mode produced significantly higher noise levels and a descriptive power advantage at higher revs, while the quiet mode had a noise level closer to the stock exhaust. Users and workshops should consider regulatory compliance, environmental comfort, emissions, and compatibility with engine tuning. This study did not test the ECU or emissions, so any tuning recommendations should be viewed as a follow-up testing agenda, not a conclusion based on the current data.

4. The Meaning of Power Patterns According to Rotation

The power patterns should be read as a response curve to revs, not as a single value representing all vehicle conditions. At low revs, the mean differences among the three configurations are relatively small. In the mid- to high-rev range, racing mode shows a number of higher averages, but this pattern does not imply that racing mode is superior at all revs or under all driving conditions. The maximum power cited in the source narrative comes from a different graph/test result point than the table of averages at a fixed rev. Therefore, the peaks reported in the narrative should not be equated with the averages in a single row of the table. Differences in rev resolution and graph reading methods can produce non-identical values; future studies should include digital dynamometer data and an explicit peak determination procedure.

5. The Meaning of Noise Patterns and Decibel Scales

The racing mode noise value increased from 82.1 at 1,700 rpm to 102.2 at 8,500 rpm in the source table. The standard and silent mode exhausts showed significantly lower and closer values, although the silent mode was not always identical to the standard. This upward trend aligns with the findings of Subandono et al. (2017) that increasing engine speed can increase exhaust noise. Similar findings regarding the importance of muffler geometry are described in studies by Biswas and Phate (2022), Susilo et al. (2024), and a study of small engine mufflers in 2024. However, comparisons across studies require caution because engine types, measurement distances, weightings, and procedures can differ. Because the decibel scale is logarithmic, differences in values should not be translated into percentages of sound energy by simple arithmetic subtraction.

E. CONCLUSION

In testing a 2017 Honda Vario 125 K60, the power profiles of the three exhaust configurations showed a relatively close pattern at low-mid revs, while the racing mode had a higher average at some higher revs. The highest table average occurred in racing mode at 7,000 rpm at 11.50 HP; the source also reported a chart peak of 11.66 HP at 7,250 rpm. However, the power ANOVA result cited by the source was $p=0.956$ and did not show a significant difference according to the analysis. Because the unit of analysis and the structure of repeated measures have not been adequately described, the inferential power results need to be verified before being considered conclusive. Racing mode noise levels were highest across all measured revs, increasing from 82.1 dB at 1,700 rpm to 102.2 dB at 8,500 rpm. The standard and silent mode exhausts showed closer values, ranging from 72.1–81.8 dB and 73.4–83.1 dB, respectively. The source reported a noise ANOVA result of $p<0.001$; however, inferential validity remains dependent on the existence of replication and the fulfillment of test assumptions that have not been fully documented.

Overall, the racing mode exhibited a combination of higher peak power and significantly higher noise levels, while the quiet mode exhibited a noise character closer to that of a standard exhaust. The study was limited to a single vehicle, did not measure backpressure or emissions, and did not fully document the noise procedures or statistical outputs. Further research should include more vehicles, repeat noise measurements, report instrument calibration and positioning, and employ analyses that account for engine speed and repeated measurements.

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