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Determinants of Aggression in Non-Urban Sumatra: Age, Handedness, and Regional Context

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Abstract

This study aims to analyze regional variation in aggressiveness in non-urban areas of Sumatra and to examine the simultaneous influence of demographic, biological, and regional factors on individual aggression levels. This study is important because comparative quantitative research across regions in Indonesia, particularly outside urban contexts, remains limited, even though aggression directly relates to social dynamics and regional violence risks. The study employs a quantitative approach with a cross-sectional design. The researchers collected data from 610 respondents aged 14–87 years in Simalungun Regency (North Sumatra), as well as South Lampung, Way Kanan, and Central Lampung, using convenience sampling. The researchers measured aggressiveness using the Buss–Perry Aggression Questionnaire (BPAQ) and analyzed the data through Kendall's correlation and multiple linear regression. The findings show a mean aggressiveness score of 2.815 (on a 1–5 scale), with the verbal subscale recording the highest score. The regression model explains 7.6 % of the variance in aggression and identifies four significant predictors: Simalungun region, age (negatively correlated), left-handedness, and Lampung ethnicity. Sex, income, and birth order do not demonstrate significant effects. These findings indicate that aggression is shaped more strongly by developmental factors, biological proxies, and sociocultural and regional dynamics than by economic factors alone. This study implies the importance of regionally and culturally based interventions to strengthen emotional regulation, particularly among young populations in areas with higher aggression scores. In terms of originality, this study represents the first comparative quantitative research that integrates regional, ethnic, and handedness variables within a single regression model in a non-urban Sumatran context, thereby providing empirical and methodological contributions to locally grounded social policy development.

Keywords: Buss–Perry Aggression Questionnaire; Multiple Linear Regression; Regional Aggressiveness; Sumatran Sociocultural Factors.

Abstrak

Penelitian ini bertujuan untuk menganalisis variasi regional agresivitas di wilayah non-perkotaan Sumatra serta menguji pengaruh simultan faktor demografis, biologis, dan regional terhadap tingkat agresi individu. Penelitian ini penting dilakukan karena studi kuantitatif komparatif lintas wilayah di Indonesia, khususnya di luar konteks perkotaan, masih terbatas, padahal agresi berkaitan langsung dengan dinamika sosial dan risiko kekerasan regional. Penelitian ini menggunakan pendekatan kuantitatif dengan desain potong lintang. Peneliti mengumpulkan data dari 610 responden berusia 14–87 tahun di Kabupaten Simalungun (Sumatera Utara) serta Lampung Selatan, Way Kanan, dan Lampung Tengah melalui convenience sampling. Peneliti mengukur agresivitas menggunakan Buss–Perry Aggression Questionnaire (BPAQ) dan menganalisis data dengan korelasi Kendall serta regresi linear berganda. Hasil penelitian menunjukkan skor rata-rata agresivitas sebesar 2,815 (skala 1–5), dengan subskala verbal sebagai skor tertinggi. Model regresi menjelaskan 7% variasi agresi dan mengidentifikasi empat prediktor signifikan, yaitu wilayah Simalungun, usia (berkorelasi negatif), dominansi tangan kiri, dan etnis Lampung. Variabel jenis kelamin, pendapatan, dan urutan kelahiran tidak menunjukkan pengaruh signifikan. Temuan ini menunjukkan bahwa agresi lebih dipengaruhi oleh faktor perkembangan, proksi biologis, serta dinamika sosiokultural dan regional dibandingkan faktor ekonomi semata. Penelitian ini

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berimplikasi pada pentingnya intervensi berbasis wilayah dan budaya untuk memperkuat regulasi emosi, khususnya pada kelompok usia muda di wilayah dengan skor agresi tinggi. Secara orisinal, penelitian ini merupakan studi kuantitatif komparatif pertama yang mengintegrasikan variabel regional, etnis, dan handedness dalam satu model regresi pada konteks non-urban Sumatra, sehingga memberikan kontribusi empiris dan metodologis bagi pengembangan kebijakan sosial berbasis lokal.

Kata Kunci: Kuesioner Agresi Buss–Perry; Regresi Linier Berganda; Agresivitas Regional; Faktor-Faktor Sosiobudaya Sumatra.

INTRODUCTION

Scholars generally define aggression as behavior intended to harm others, whether physically or verbally, and they recognize that it may include indirect forms such as hostility and irritability (Buss & Perry, 1992). From a public health and social cohesion perspective, understanding the factors that drive aggression becomes critically important because this behavior often deviates from prevailing social norms (Syarif, 2017). The urgency of studying aggression appears particularly salient in Indonesia, where aggressive behavior frequently escalates into significant social conflict, violence, and criminal acts. This phenomenon remains highly contextual; data from Statistics Indonesia in 2022 reported high and concerning crime rates in the Sumatra region (Badan Pusat Statistik, 2022).

Specifically, North Sumatra and Lampung Provinces recorded substantial numbers of crimes against property involving violence and crimes against property without violence. These troubling trends underscore the urgent need for quantitative behavioral assessments grounded in local realities rather than relying solely on general national statistics. Statistics Indonesia (BPS) data from 2023 show that in 2022 the North Sumatra Regional Police recorded 43,555 criminal cases, placing the province among those with the highest number of cases in Indonesia. In the category of physical crimes or crimes against persons, North Sumatra ranked first with 5,934 incidents. The province also led in crimes against morality (453 cases), crimes against property involving violence (636 cases), and crimes against property without violence, which reached 16,347 cases. These data indicate that patterns of aggression in North Sumatra remain not only quantitatively high but also diverse in their manifestations (Ayuningtyas, 2024).

In Lampung Province, crime dynamics also show a fluctuating yet generally increasing trend. Based on releases from BPS Lampung Province, which drew on administrative reports from the Lampung Regional Police for the 2019–2022 period, authorities recorded 7,321 criminal cases in 2019, and that number increased by 39.20% to 10,191 cases in 2020. Although the number declined slightly to 9,764 cases in 2021, it rose again in 2022 to 11,194 cases. Along with the increase in total cases, the crime rate in Lampung also showed an upward trend, indicating growing social vulnerability in the region (Jaya, 2023). This pattern strengthens the urgency of studying aggression in the contexts of North Sumatra and Lampung, as both provinces demonstrate significant intensity and variation in crime that directly relate to the focus of this study.

Researchers generally classify determinants of aggression into internal and external factors. Internally, studies have examined psychological traits such as low self-control (Husna et al., 2025) as well as physiological proxies such as age and handedness. Scholars often interpret aggression as an adaptive strategy shaped by evolutionary pressures that emerges in response to ecological and developmental conditions (Bjorklund & Hawley, 2014). Previous literature indicates that these internal predispositions relate to neuroendocrine mechanisms and maturational processes across the lifespan (Geniole et al., 2020; Vallacher & Brooks, 2014). Externally, environmental and social influences—including family

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background, parenting styles, and peer relationships—serve as important factors that may either mitigate or reinforce aggressive tendencies (Malonda et al., 2019; Umaroh, 2017).

Although global research on aggression has expanded substantially, most evidence remains concentrated in Western, urban, or university-based populations, which limits its broader applicability (Holekamp & Strauss, 2016; Navas-Casado et al., 2023). In Indonesia, existing research typically focuses on specific demographic groups such as children, adolescents, or university students in metropolitan areas (Hapsari et al., 2024; Hutomo & Ariati, 2017; Mayangsari & Yuliandari, 2019). More importantly, local literature often relies on descriptive or qualitative approaches and lacks large-scale quantitative modeling necessary to isolate complex interactions among multiple predictors across diverse communities. Current conditions reveal a significant weakness: researchers frequently fail to consider the unique sociocultural and ecological pressures that shape aggressive behavior in rural or non-urban communities in Sumatra. In this study, 'non-urban' is operationally defined as administrative regions classified as Regencies rather than Municipalities or Cities. Based on the Indonesian Central Bureau of Statistics (BPS, 2010) classification, these regencies are characterized by lower population density, a higher percentage of agricultural households, and limited access to metropolitan infrastructure compared to provincial capitals like Medan or Bandar Lampung. While regencies may encompass small urbanized centers, they primarily consist of villages that maintain traditional social structures and agricultural landscapes.

A synthesis of existing research reveals a critical and specific knowledge gap. Scholars have conducted very few comparative quantitative studies that simultaneously assess and model the combined predictive influence of demographic factors, potential biological proxies such as handedness, and regional variation within a single integrated statistical framework. To address this gap, our study focuses on a large sample spanning a wide age range (14–87 years) across four different regencies—Simalungun, South Lampung, Way Kanan, and Central Lampung—to generate empirically robust and contextually relevant data. Addressing this gap holds not only academic significance but also practical importance for developing culturally tailored interventions grounded in local realities.

This study aims to: first, quantitatively assess overall aggression levels using the Buss–Perry Aggression Questionnaire (BPAQ) in four selected regencies; second, identify and model the combined predictive strength of demographic and biological factors on aggression; and third, analyze specific regional variation between North Sumatra and Lampung.

Based on these objectives and the existing literature, we propose the following hypotheses for testing: (H1) Significant differences in aggression levels will emerge across regencies, reflecting the influence of distinct local sociocultural and environmental factors. (H2) Age will correlate significantly and negatively with aggression levels, consistent with research on maturational processes. (H3) Handedness will serve as a significant predictor of aggression scores, reflecting the established relationship between biological proxies and aggressive behavior.

RESEARCH METHODS

This study employed a quantitative design using a cross-sectional, correlational, and multiple linear regression approach (Creswell, 2018). The researchers selected this approach to efficiently model the simultaneous predictive influence of multiple demographic variables, biological proxies, and regional factors on aggression scores at a single point in time. The unit of analysis consisted of 610 individual participants (male and female) with a broad age range (14–87 years) who resided in four target regions. The researchers conducted the study from July to August 2022 in Simalungun Regency, Central Lampung,

Way Kanan, and South Lampung. The Ethics Committee of the Faculty of Medicine, University of Lampung, granted ethical approval (Reference No.: 1909/UN26.18/PP.05.02.00/2022).

The study relied on primary data obtained directly from respondents through a structured survey. Because no comprehensive sampling frame existed for the general population across all target regencies, the researchers used a non-probability convenience sampling technique. They selected this method to ensure efficient data collection across four geographically diverse and separated locations. The inclusion criteria required participants to be at least 14 years old and native residents of the target regions. The researchers collected 610 valid responses, exceeding the minimum sample size required for robust multiple linear regression analysis.

The researchers collected data using a structured survey instrument administered through a combination of face-to-face structured interviews and self-administered questionnaires. Trained enumerators conducted field data collection to ensure procedural standardization and adherence to ethical protocols. The study measured aggression using the Buss–Perry Aggression Questionnaire (BPAQ), which consists of 29 items rated on a 5-point Likert scale (1 = extremely uncharacteristic of me to 5 = extremely characteristic of me). The instrument measures four subscales: Physical Aggression (9 items), Verbal Aggression (5 items), Anger (7 items), and Hostility (8 items). The researchers collected independent variables including age, sex, birth order, handedness (dichotomous), occupation, monthly income, and ethnicity.

The Indonesian-language version of the BPAQ used in this study underwent cultural adaptation and translation for the local context and was pilot-tested prior to the main data collection. Hamzy, Chen, and Hsieh (2023) previously validated and confirmed the reliability of the adapted instrument among Indonesian participants, and this study adopted that validated version. Prior validation demonstrated strong internal consistency (Cronbach's alpha = 0.914) and adequate validity indices (0.351–0.702) for the four-factor structure within the Indonesian context. For the current sample (N = 610), the total scale demonstrated high reliability ($\alpha = 0.83$). This indicates that the instrument is a dependable measure of aggression within the specific sociocultural context of North Sumatra and Lampung

To ensure scoring accuracy, the researchers reverse-scored two unfavorable items (items 12 and 21 in the original version). The study reported scores as mean item scores (ranging from 1 to 5). The researchers calculated the composite aggression score by averaging the scores of the four subscales.

The researchers conducted statistical analyses using R software (version 4.2.0). They performed the analysis in three main stages. First, they conducted descriptive statistics and data preprocessing. They calculated descriptive statistics, including means and standard deviations, for all aggression subscales. To ensure statistical robustness, they reclassified several categorical predictors: they grouped birth order into five categories (1, 2, 3, 4, and 5+), and they categorized ethnicity into six major groups (Javanese, Toba, Lampung, Simalungun, Sundanese, and others). They initially measured monthly income in seven categories and then dichotomized it based on the 2022 Regional Minimum Wage threshold of IDR 2,500,000, which represented the average minimum wage across Simalungun, South Lampung, Central Lampung, and Way Kanan during the data collection period. They subsequently grouped participants into "Below Minimum Wage" (< IDR 2,500,000) and "Above Minimum Wage" (≥ IDR 2,500,000) categories. The researchers dummy-coded these variables, along with sex, handedness, and region, for the multiple linear regression model to provide stronger and more sociologically meaningful interpretation.

Second, the researchers tested statistical assumptions. Before conducting the main analysis, they rigorously evaluated the requirements of the general linear model. They assessed residual normality using Q–Q plots, homoscedasticity using the Breusch–Pagan test, and multicollinearity using the Variance

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Inflation Factor (VIF) to ensure that no predictors were redundant and that the model demonstrated adequate fit.

Third, the researchers conducted inferential testing and modeling. They assessed initial relationships among variables using Kendall's tau correlation. They selected this nonparametric approach because of its robustness to non-normal distributions and its effectiveness in handling tied ranks in Likert-scale data. To test mean differences in aggression across demographic groups, they conducted independent-samples t-tests (for sex) and one-way ANOVA (for ethnicity, birth order, and region). They then applied multiple linear regression to examine the simultaneous influence of all predictors on aggression scores. They evaluated model performance using R^2 and adjusted R^2 values, and they interpreted the unique contribution of each predictor through standardized beta coefficients and exact p-values.

RESULTS AND DISCUSSION

Based on data from 610 respondents—262 females and 348 males—from the provinces of North Sumatra and Lampung, participant ages ranged from 14 to 87 years, with a mean age of 38 years. In North Sumatra, participants were recruited from Simalungun Regency, while in Lampung Province, participants were drawn from South Lampung, Way Kanan, and Central Lampung Regencies. The respondents represented diverse ethnic backgrounds, including Javanese, Batak, Lampung, Malay, Sundanese, and Balinese groups. Most participants were employed as farmers, traders, housewives, or entrepreneurs.

The highest mean score across aggression types was observed in verbal, with an average of 3.110 on a maximum scale of 5.000. The scores for physical, verbal, and hostility-related aggression were higher in males compared to females. In contrast, scores for anger-related aggression were higher in females (mean = 2.762) than in males (mean = 2.664) (see Table 1).

Table 1. Mean Scores of the Four Aggressiveness Categories According to Buss and Perry

Scale	Mean (SD)		
	Total	Males	Females
Verbal	3.110 (0.541)	3.190 (0.538)	3.005 (0.528)
Physical	2.402 (0.415)	2.465 (0.406)	2.320 (0.414)
Anger	2.706 (0.571)	2.664 (0.569)	2.762 (0.571)
Hostility	3.035 (0.544)	3.045 (0.509)	3.022 (0.588)
Total score	2.815 (0.387)	2.843 (0.371)	2.778 (0.405)

The research findings indicated that sex does not significantly influence aggression. Both males and females in the current study demonstrated a similar likelihood of engaging in aggressive behavior, even though the forms and contexts of expression may differ. While males tended to show higher levels of physical, verbal, and hostile aggression, the differences were not statistically significant. This may be explained by the nature of the aggression measured—psychological and behavioral rather than high-risk physical forms—where sex differences tend to be less pronounced (Archer, 2019). Evolutionarily, males and females have developed different aggression strategies, with females more likely to express relational or indirect aggression, which may be underrepresented in traditional metrics. Biologically, testosterone is associated with aggressive behavior (Carré et al., 2017), and males typically have higher testosterone levels than females (Pradita, 2019), which may contribute to the trend of higher males aggression in some

domains. However, the lack of significant differences in this study reflects the complex interplay of biological, social, and measurement factors that shape aggression across sexes.

Anger-type aggression was found to be more prevalent among females in this study. This phenomenon may be partially explained by biological factors, specifically hormonal fluctuations across the menstrual cycle. Peters et al. (2020) observed that while proactive aggression tends to peak around ovulation, reactive aggression, irritability, and anger significantly increase during the mid-luteal phase. Socially, however, the expression of these emotions is filtered through gender-specific norms. In many contexts, males' aggression is shaped by norms that discourage the outward expression of vulnerable emotions, whereas females are often permitted or expected to express emotions more openly, including anger.

Interestingly, while females reported slightly higher scores in anger-type aggression, the manifestation of this emotion into overt physical acts remains lower than in males. This pattern suggests a 'bottleneck' effect, where cultural expectations in patriarchal societies, such as those found in North Sumatra and Lampung, may permit females to feel or verbally express emotional distress but strictly discourage them from physical escalation. Consequently, while the internal experience of anger is higher among females, the externalization into violent behavior is more characteristic of males, who are often socialized under patriarchal values to assert dominance through physical means (Naseem & Munaf, 2020).

The four categories of aggressiveness exhibited positive correlations with one another. An increase in one form of aggression was associated with increases in the others. For example, higher levels of verbal aggression were correlated with higher levels of physical aggression (see Table 2).

Table 2. Correlations Among the Four Types of Aggressiveness (Correlation Coefficients in the Lower Triangle; Significance Levels [p < 0.01] in the Upper Triangle)

	Verbal	Physical	Anger	Hostility
Verbal	-	<0.01	<0.01	<0.01
Physical	0.279	-	<0.01	<0.01
Anger	0.345	0.356	-	<0.01
Hostility	0.286	0.249	0.354	-

Furthermore, the correlation analysis showed a strong positive association among physical, verbal, hostile, and anger-driven aggression. This indicates that individuals who experience high levels of anger are also more likely to display other aggressive tendencies. Anger, often characterized by intense emotional arousal and reduced self-control, can escalate into aggressive acts such as shouting or physical violence. Research by Lochman et al. (2024) highlights that while anger frequently leads to outwardly aggressive behaviors, it may also be linked to internal distress. Although both males and females may experience similar levels of anger, societal norms often influence how this emotion is expressed. Males are typically permitted or even encouraged to show anger, whereas females may be socialized to suppress it. In addition, reactive aggression, which stems from emotional reactivity to threats or provocations, is more impulsive and emotionally charged. In contrast, proactive aggression tends to be more deliberate and goal-oriented, involving little emotional intensity. These two forms of aggression also relate differently to an individual's social behavior and interpersonal relationships (Lochman et al., 2024). This pattern supports earlier findings by Buss and Perry (1992), who observed that individuals are more prone to aggressive actions when experiencing heightened anger. Similarly, Allen et al. (2018) emphasized that aggression

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often arises when individuals interpret certain actions as unfair or threatening, prompting retaliatory responses.

Aggression scores were analyzed across four districts, with the highest average score observed in Simalungun Regency at 2.872 out of a maximum of 5.000. The lowest average score was found in Way Kanan Regency, at 2.751 (see Table 3).

Table 3. Mean Aggressiveness Scores by Research Area

Scale	Mean (SD)			
	South Lampung	**Way Kanan**	**Central Lampung**	**Simalungun**
Verbal	2.953 (0.450)	2.996 (0.632)	3.036 (0.519)	3.231 (0.519)
Physical	2.416 (0.381)	2.394 (0.482)	2.224 (0.306)	2.461 (0.420)
Anger	2.446 (0.532)	2.713 (0.634)	2.847 (0.558)	2.749 (0.540)
Hostility	3.215 (0.551)	2.905 (0.610)	2.946 (0.520)	3.046 (0.508)
Total score	2.761 (0.390)	2.751 (0.454)	2.769 (0.363)	2.872 (0.363)

Regional variations in aggression levels were identified, with respondents residing in Simalungun Regency showing significantly higher aggression scores compared to those in the three regencies in Lampung Province, as confirmed by the general linear model analysis. This distribution is visually represented in Figure 1, which illustrates that while median scores across the regions are relatively comparable, Simalungun exhibits a higher concentration of elevated aggression scores and a higher mean value compared to South Lampung, Central Lampung, and Way Kanan.

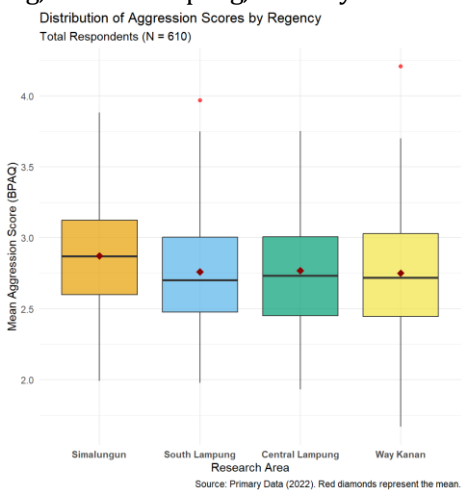

Figure 1. Boxplot of Aggression Scores across Research Regencies

As shown in Figure 1, the distribution of aggression scores across the four research regencies appears relatively comparable in terms of their central tendency, yet several differences remain visible. Simalungun shows the highest median and mean aggression score among the four areas, while South Lampung, Central Lampung, and Way Kanan display slightly lower and fairly similar central values. The boxes illustrate the interquartile range (IQR), indicating the spread of the middle 50% of responses, whereas the horizontal lines inside each box mark the median score. The red diamonds indicate the mean

scores for each regency and further confirm that Simalungun has the highest average aggression level. In addition, the presence of several upper-end points suggests that a small number of respondents in certain regencies reported notably higher aggression scores than the majority of participants.

Consistent with the objective to analyze regional variations, the significantly higher aggression scores in Simalungun suggest that localized sociocultural frameworks play a critical role. In Simalungun, the emphasis on cultural values such as assertiveness and a strong sense of honor may influence how individuals perceive and respond to social stressors (Nisbet, 2018). These regional disparities are further supported by macro-level data; for instance, North Sumatra reported a high frequency of physical abuse and homicides in 2021 (Badan Pusat Statistik, 2022). These findings indicate that aggression levels are heightened by specific regional stressors, such as urban pressures in Medan (capital city of North Sumatra), which create a distinct environmental context for aggressive expression.

The preliminary independent samples t-test (Table 4) indicated a significant difference in aggression between males and females ($t = 2.010$, $p = 0.045$). However, when these variables were entered into the multiple linear regression model (Table 6), the significance of sex vanished, suggesting that its initial effect was likely confounded by other demographic factors. Conversely, handedness, which was non-significant in the bivariate t-test ($t = 1.881$, $p = 0.084$), emerged as a statistically significant predictor in the multivariate model ($p = 0.021$). This shift indicates that controlling for covariates like age and regional identity unmasked the unique predictive power of handedness on aggression levels.

Table 4. Independent Samples t-test Results for Aggression Scores by Sex and Handedness

Variable	Group (n)	Mean	t-value	df	p-value
Sex	Male (347) / Female (263)	2.84 / 2.78	2.010	526.44	0.045*
Handedness	Left (16) / Right (594)	3.09 / 2.81	1.881	12.27	0.084

The one-way ANOVA (Table 5) showed that while regency had a significant overall effect on aggression ($F = 4.222$, $p = 0.006$), the effect of ethnicity was not statistically significant when analyzed in isolation ($F = 1.704$, $p = 0.132$). However, the multiple linear regression revealed a more nuanced pattern (Table 6). While the overall ethnic variation was broad, the specific identity of Lampung ethnicity emerged as a significant predictor of aggression ($p < 0.05$) when other demographic and regional factors were controlled. This suggests that the influence of certain ethnic identities on aggression is better understood when integrated with environmental and biological covariates, rather than as a standalone category.

Table 5. One-Way ANOVA Results for Aggression Scores Across Demographic and Regional Groups

Variable	df	F	p-value	Interpretation
Regency	3	4.222	0.006*	Significant
Ethnicity	5	1.704	0.132	Not Significant
Income	7	0.939	0.476	Not Significant
Birth Group	4	0.637	0.636	Not Significant

Before interpreting the regression coefficients, diagnostic tests were performed to ensure the model met the necessary assumptions. The results confirmed the absence of multicollinearity, with all VIF values below 1.4. The Shapiro-Wilk test indicated that the residuals were normally distributed ($W = 0.99$,

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p = 0.070), and the Breusch-Pagan test (BP = 32.21, p = 0.150) showed that the assumption of homoscedasticity was satisfied. These results confirm the robustness and validity of the linear model.

The multiple linear regression model was statistically significant (F = 2.845, p < 0.001), explaining 7.6% of the variance in aggression scores (see Table 6). Geographic location was a significant predictor, with participants in Simalungun Regency exhibiting higher aggression levels (estimate = 0.172, p = 0.001) compared to the reference group (South Lampung). Handedness also significantly influenced aggression scores; right-handed individuals demonstrated lower levels of aggressiveness (estimate = -0.246, p = 0.031, 95% CI [-0.483, -0.039]) than left-handed individuals. While handedness emerged as a significant predictor, it should be noted that the left-handed group represented a small portion of the total sample (n = 16). Furthermore, age showed a significant inverse relationship with the dependent variable, indicating that aggression levels decrease as individuals age (estimate = -0.004, p < 0.001). Among the ethnic groups, identifying as Lampung ethnicity was associated with significantly higher aggression (estimate = 0.156, p = 0.011) compared to Javanese respondents. Other demographic factors, including sex, income (categorized by Regional Minimum Wage), and birth order, did not significantly predict aggression in this model.

Table 6. Multiple Linear Regression Analysis of Predictors for Aggression Scores

	Estimate	**Standard Error**	**T-value**	**P-value**
Intercepts	3.119	0.131	23.747	<0.001*
Regency (Ref: South Lampung)				
Central Lampung	0.060	0.058	1.023	0.307
Simalungun	0.172	0.055	3.158	0.001*
Way Kanan	-0.070	0.067	-1.056	0.291
Sex (Ref: Male)				
Female	-0.021	0.037	-0.583	0.560
Income (Ref: Below RMW)				
Above RMW	0.022	0.042	0.520	0.603
Handedness (Ref: Left-handed)				
Right-handed	-0.246	0.114	-2.159	0.031*
Age	-0.004	0.001	-3.687	<0.001*
Birth order (Ref: 1)				
2	-0.059	0.043	-1.352	0.177
3	-0.004	0.049	-0.099	0.921
4	0.010	0.061	-0.163	0.870
>5	0.013	0.047	0.279	0.780
Ethnicity: (Ref: Javanese)				
Lampung	0.156	0.061	2.560	0.011*
Simalungun	0.102	0.075	1.368	0.172
Sunda	0.049	0.072	0.681	0.496
Toba	-0.021	0.051	-0.420	0.674
Others	0.109	0.056	1.936	0.053

Note: * = Significant at $p < 0.05$; RMW: Regional Minimum Wage; Model Fit: $R^2 = 0.0758$; Adjusted $R^2 = 0.0491$; $F(16, 555) = 2.845$, $p < 0.001$. Assumptions: Multicollinearity was checked via Variance Inflation Factor (VIF < 2.0); Residuals were normally distributed (Shapiro-Wilk $p = 0.070$); Homoscedasticity was confirmed (Breusch-Pagan $p = 0.150$).

The primary objective of this study was to identify demographic, biological, regional predictors of aggression in North Sumatra and Lampung. The multiple linear regression results demonstrate that geographic location, age, handedness, and ethnicity are pivotal factors, while other demographic variables such as income levels, birth order, and sex did not yield significant influence. As visually summarized in the conceptual model (Figure 2), the study highlights a clear distinction between significant predictors (represented by solid arrows) and non-significant predictors (represented by dashed arrows), providing a focused lens on the drivers of aggression in the sampled populations. This empirical evidence shifts the focus from purely economic explanations—given that income level was not a significant factor ($p = 0.603$), toward extrinsic factors like localized social dynamics and cultural norms (Carter & Kushnick, 2018; Labella & Masten, 2018; Lemke et al., 2013). By mapping these relationships, the study addresses the need for analytical clarity and provides a robust framework for understanding how environmental and developmental factors intersect to shape aggressive behavior.

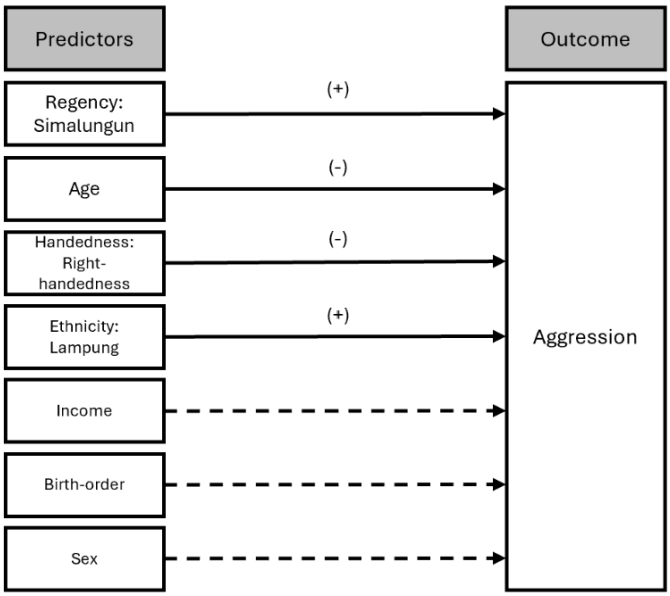

Figure 2. Conceptual framework of aggression predictors based on multiple linear regression analysis.

Solid arrows indicate statistically significant relationships ($p < 0.05$), with (+) and (-) denoting the direction of the effect. Dashed arrows represent non-significant predictors included in the model.

Biological Factors and Handedness. A compelling finding in this study is the significant association between hand preference and aggression, with left-handed individuals exhibiting higher levels of aggression (Estimate = -0.246, $p = 0.031$). This aligns with Larsson et al. (2023), who suggested that left-handed individuals might possess a strategic advantage in confrontational situations. Buser et al. (2021)

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further argued that behavioral differences based on handedness can occasionally surpass typical sex-based differences.

While some literature, such as Liu et al. (2012) previously linked this to prenatal hormone exposure, our findings, which lack direct hormonal data, emphasize a neuropsychological and behavioral adaptation perspective. As noted by Larsson et al. (2023), these differences likely reflect variations in emotional processing and impulse control related to brain lateralization rather than purely hormonal drivers.

Age and Emotional Maturity. In line with the research objectives, age emerged as a significant negative predictor of aggression ($p < 0.001$). As individuals age, their aggressive tendencies significantly decrease. This pattern is consistent with Naseem and Munaf (2020) and Liu et al. (2012), who attributed this decline to improved emotional regulation, enhanced self-control, and a heightened awareness of social and legal consequences. Liu et al. (2012) highlighted that the manifestation of aggression changes across the lifespan; adolescents may be more reactive due to peer pressure, whereas adults achieve greater stability through increased social responsibilities. Chester (2024) further posits that this maturity is not merely a failure of self-control but rather the ability to deliberately exercise restraint over impulsive aggressive actions.

A crucial outcome of this study is the regional and ethnic variation in aggression, with Simalungun Regency exhibiting the highest aggression scores (Estimate = 0.172, $p = 0.001$) and the Lampung ethnicity emerging as a significant predictor (Estimate = 0.156, $p = 0.011$). Given that income level was not a significant predictor in our regression model ($p = 0.603$), the elevated aggression in Simalungun and among the Lampung ethnicity is likely not driven by economic hardship alone, but rather by complex sociocultural dynamics.

Instead, these results may be attributed to specific cultural norms and environmental stressors. Afiah (2015) notes that different ethnic groups maintain distinct traditions and norms that guide emotional expression. In regions with high ethnic diversity like Simalungun and Lampung, interaction patterns may shape more assertive interpersonal conduct. For the Lampung ethnicity, this may be linked to cultural values such as *Piil Pesenggiri*, which emphasizes dignity and social honor. While its ideal form promotes hospitality and moral integrity , it can also function as a sociocultural framework where individuals respond more expressively or assertively when they perceive a challenge to their social standing or self-esteem (Sinaga, 2014).

This finding shifts the focus from intrinsic factors toward extrinsic factors like family environment, localized life experiences, and regional social dynamics (Labella & Masten, 2018; Lemke et al., 2013). As visualized in the conceptual model (Figure 2), aggression in this context is a multifaceted behavior where regional and ethnic identities intersect with developmental factors like age, rather than being a simple byproduct of economic status.

Non-Significant Predictors: Birth Order and Income. This study found no significant relationship between birth order and aggression, supporting research by Sultana & Latif (2013) which suggests that personality development is shaped more by individual parenting styles than by ordinal position. Similarly, the non-significance of income levels indicates that aggression in this sample is more influenced by developmental maturity and regional context than by immediate economic status based on the 2022 Regional Minimum Wage (RMW) thresholds.

DISCUSSION

This study demonstrates that region of residence, age, handedness, and Lampung ethnicity significantly influence respondents' levels of aggression. In contrast, sex and income level do not show significant effects in the model. These findings indicate that, within this research context, demographic-territorial factors and specific biological characteristics shape aggression more strongly than classical socioeconomic variables such as income or sex alone.

Age shows a negative relationship with aggression. Older individuals tend to report lower levels of aggression than younger individuals. Emotional maturation and the development of self-control across the life span explain this decline. More mature individuals generally possess more stable emotional regulation capacities, greater ability to consider social consequences, and broader social experience in managing conflict. These neurological and social maturation processes strengthen impulse control mechanisms, thereby reducing aggressive responses as age increases.

Simalungun exhibits relatively higher levels of aggression compared to the reference regions in the model. Local social contexts that shape stress experiences, competition over resources, and community relational dynamics may explain this difference. Social structures experiencing economic pressure, agrarian change, or broader social transformation may increase sensitivity to interpersonal conflict. In addition, an existing honor culture within certain communities may foster firmer responses to perceived threats against self-esteem or reputation. However, scholars must interpret this finding contextually and must not generalize it as an inherent characteristic of the region.

Lampung also shows a significant effect on aggression. Scholars can interpret this significance through local cultural norms such as *Piil Pesenggiri*, which emphasizes self-respect, honor, and responsibility to uphold the dignity of family and community. These norms may function as strong mechanisms of social control; however, in certain situations, they may also frame responses to symbolic or social threats in a more defensive manner. Thus, aggression does not merely represent impulsive action but may reflect a response structured by cultural values concerning honor and social position.

Handedness also demonstrates a significant effect on aggression. Literature on lateralization and impulse control indicates that differences in hemispheric dominance relate to variations in emotional regulation and responses to provocation (Larsson et al., 2023). Individuals with specific dominance patterns may process emotional stimuli differently or make rapid decisions under pressure in distinct ways. These findings reinforce the argument that biological factors continue to play a role in shaping variations in aggressive behavior, even as they interact with broader social contexts.

These results align with the broader literature that distinguishes internal and external determinants of aggression. Internal factors include psychological traits such as low self-control (Husna et al., 2025) and physiological proxies such as age and handedness, which relate to neuroendocrine mechanisms and maturational processes across the life span (Geniole et al., 2020; Vallacher & Brooks, 2014). Scholars often interpret aggression as an adaptive strategy shaped by evolutionary pressures and ecological conditions (Bjorklund & Hawley, 2014). This study confirms that age correlates negatively with aggression and supports the argument that maturation strengthens emotional regulation and impulse control. At the same time, the effect of handedness in the model supports the assumption that biological factors remain relevant in explaining variation in aggressive behavior.

On the other hand, the literature emphasizes that external factors such as family background, parenting style, and peer relationships play important roles in shaping or mitigating aggressive tendencies (Malonda et al., 2019; Umaroh, 2017). Although this study does not directly measure all environmental variables, the significance of region and ethnicity indicates that social and cultural contexts remain critical

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structures that frame the expression of aggression. Therefore, these findings strengthen a multidimensional approach that conceptualizes aggression as the product of interactions between internal predispositions and socioecological pressures.

This study also offers relevant empirical novelty within both global and national literature. Most empirical evidence on aggression remains concentrated in Western, urban, or university-based populations (Holekamp & Strauss, 2016; Navas-Casado et al., 2023). In Indonesia, research on aggression typically focuses on children, adolescents, or university students in metropolitan areas (Hapsari et al., 2024; Hutomo & Ariati, 2017; Mayangsari & Yuliandari, 2019) and frequently relies on descriptive or qualitative approaches without large-scale quantitative modeling. This study moves beyond those tendencies by using a non-urban sample in Sumatra and integrating region, ethnicity, and handedness within a single comparative cross-regency model. This approach addresses the weakness of contemporary literature that has not sufficiently considered the unique sociocultural and ecological pressures in rural Sumatran communities, while also contributing methodologically through more integrative and contextualized quantitative modeling.

From a historical perspective, scholars must interpret aggression in this context within broader processes of social change through the lens of social disorganization theory, which emphasizes the weakening of social institutions as a driver of deviance and violence (Porter et al., 2015). Modernization, population mobility, and rural economic transformation in Indonesia have altered traditional family- and community-based social control patterns, thereby eroding informal control capacity (Siegmunt, 2015; Taylor, 2018). Urbanization without equitable economic development, as observed in Cirebon and Gresik, demonstrates how modern economic expansion can coexist with the growth of vulnerable urban poor populations and informal sectors, thereby increasing social instability (Tirtosudarmo, 2013). Furthermore, the post-1997 sociopolitical crisis revealed systemic social disintegration accompanied by increases in various forms of violence and crime, reflecting conditions of anomie and weakened collective control (Braithwaite, 2011). Large-scale social restriction policies during the pandemic further exacerbated the economic vulnerability of small enterprises and daily wage workers, thereby intensifying structural pressures within communities (Daga et al., 2022; Syafarina et al., 2021). In this context, the shift from kinship-based control mechanisms to more individualistic relations may reduce social cohesion and increase the likelihood of aggression as a response to social uncertainty and weakened collective supervision.

From a social perspective, community relational patterns and constructions of local masculinity may shape how individuals express emotion and respond to conflict through the framework of hegemonic masculinity, which positions dominance, bravery, and assertiveness as ideal male standards. Research shows that young Indonesian men face dual pressures to act as responsible citizens while also displaying hypermasculine toughness and heroism (Nilan, 2009). In certain cultural contexts, male power relations remain preserved even within seemingly egalitarian systems such as Minangkabau matrilineal traditions, thereby reproducing dominance norms in social practice (Bahardur et al., 2022). Studies in Aceh also demonstrate that hegemonic masculinity may manifest through militarization and violence, although in some cases it takes nonviolent forms that still maintain gender hierarchy (Kunz et al., 2018). In digital spaces such as cycling communities in Bandung, homosocial interaction within WhatsApp groups reproduces gender stereotypes and reinforces exclusive masculine boundaries (Gumilar et al., 2025). Risky practices such as cyanide diving in fishing communities show how bravery in facing danger functions as a rite of passage that reinforces machismo culture (Pauwelussen, 2022). Media and advertising representations of masculinity, including comedians from the New Order era and

contemporary "soft masculinity" symbolism, continue to operate within the boundaries of socially accepted hegemonic masculinity. In fragmented social structures, these norms may weaken deliberative informal control mechanisms and encourage aggression as a rapid means of defending honor or social position within the community.

From an ideological perspective, norms concerning honor, dignity, and social hierarchy create specific legitimacy for expressions of anger or self-defense through the framework of honor culture, which emphasizes balance between internal self-worth and public recognition (Cross et al., 2014; Dow, 2014). In Indonesia's plural context, shaped by Hindu-Buddhist heritage and local cultural dynamics (Yudhistira & Fatmawati, 2020), honor often manifests through practices that emphasize reputation, etiquette, and respect for hierarchy. The honorific system in oral traditions in Madiun illustrates how language functions as an instrument for maintaining social status and respect in daily interaction (Cahyono et al., 2024). Cultural practices such as sungkeman in Java emphasize respect for moral authority and social harmony as elements of collective ethics (Pakpahan et al., 2021), while collectivistic orientations in Javanese multilingual interaction strengthen sensitivity to social face and group reputation (Nursanti et al., 2024). In societies that place collective self-worth at the center of value systems, individuals may interpret provocation as a threat to shared identity, thereby perceiving firm responses as legitimate social responsibility. Although globalization and digital transformation increasingly influence younger generations and modify local value expression (Kamisi, 2020; Rochimah & Widigda, 2023), honor-based value systems continue to provide ideological meaning to aggression in specific cultural contexts.

This study plays an important role in expanding empirical understanding of aggression determinants in non-urban Sumatra. It provides a quantitative model capable of identifying the simultaneous roles of biological and sociocultural factors in explaining variation in aggression. This model assists policymakers and scholars in designing more data-driven and contextually grounded interventions.

However, this study also presents specific dysfunctions that scholars can explain through critiques of methodological reductionism, which refers to the tendency to explain complex phenomena by breaking them into simpler, isolated components (Lausen, 2014; Richardson, 2006). Although this approach increases analytical precision and facilitates hypothesis testing (Meyer-Ortmanns, 2015), it risks overlooking relational complexity and symbolic meaning embedded in everyday social practices (Gargiulo, 2021; Mazzocchi, 2012). In this context, the quantitative design limits exploration of subjective aggression dynamics shaped by interaction, local history, and collective experience. Critiques of reductionism in biology and social science emphasize that comprehensive understanding of complex phenomena often requires holistic and interdisciplinary approaches (Pogozhina & Savchenko, 2019; Rosenberg, 2007; Walker & Cloete, 2023). Therefore, researchers must interpret the use of ethnic and regional categories within broader historical and structural frameworks to avoid simplification, and future research should integrate quantitative approaches with more contextual qualitative exploration.

Another dysfunction arises from model specification limitations that exclude mediating factors such as family relationship quality, childhood exposure to violence, or exposure to violent media, thereby potentially generating omitted variable bias (OVB). OVB occurs when researchers exclude relevant variables that correlate with both predictors and outcomes, which produces biased and inconsistent estimates and obscures causal inference (Spanos, 2006; Wilms et al., 2021). Excluding important variables may significantly distort effect sizes and lead to erroneous conclusions about relationships among variables (Clarke, 2009; Walsh et al., 2021), and in mediation analysis, indirect effects may reflect bias from unmeasured variables (Coenen, 2022). In addition, the use of cross-sectional data without longitudinal

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design limits the ability to test directionality and temporal dynamics, even though panel data structures often reduce bias more effectively than cross-sectional data with extensive controls (Du et al., 2025). Methodological literature also emphasizes the importance of sensitivity analysis to assess how strongly unobserved confounders must influence results to alter conclusions (Cinelli et al., 2024; Cinelli & Hazlett, 2020). Therefore, researchers should position these findings as an initial foundation that requires further development through longitudinal design, more comprehensive variable selection, and more robust analytic strategies to minimize bias and strengthen causal validity.

To address these dysfunctions, scholars and practitioners must formulate action plans targeting two primary issues: methodological reductionism and omitted variable bias. First, at the academic level, researchers should develop follow-up studies using mixed methods designs that integrate quantitative and qualitative approaches holistically. Researchers should complement statistical surveys with in-depth interviews, participant observation, and historical-community studies to contextualize relational dynamics, symbolic meanings, and subjective experiences of aggression. Researchers should also design panel-based longitudinal studies to examine temporal directionality and incorporate mediating variables such as family relationship quality, childhood violence exposure, and media exposure to reduce model specification bias. They should accompany these strategies with sensitivity analysis and more robust causal modeling to strengthen inferential validity.

Second, at the policy and social practice level, educational institutions, local governments, and customary leaders should develop community-based interventions that address not only individuals but also relational structures and local historical contexts. Stakeholders should design emotional regulation and conflict literacy programs for younger populations through interdisciplinary collaboration that involves families, schools, customary leaders, and youth organizations as both units of analysis and intervention. Local governments should establish cross-ethnic dialogue forums and community-based mediation mechanisms grounded in longitudinal community data to ensure that violence prevention policies do not rely on simplistic categorical assumptions. Through these steps, this study moves beyond descriptive findings and serves as a foundation for integrative research development and contextually grounded, multidimensional, and methodologically stronger preventive policy.

CONCLUSION

This study demonstrates that aggression in non-urban contexts in Sumatra is significantly influenced by region, age, handedness, and specific ethnic identity, particularly Lampung ethnicity. The study finds that age correlates negatively with aggression, indicating that older individuals tend to exhibit lower levels of aggression than younger individuals. The study also shows that respondents residing in Simalungun Regency display higher levels of aggression than those in the comparison regions, and left-handed individuals demonstrate higher aggressive tendencies than right-handed individuals. In addition, the study identifies Lampung ethnicity as a significant predictor when analyzed alongside other demographic and regional variables. In contrast, sex, income, and birth order do not show significant effects in the regression model. These findings indicate that aggression is not solely driven by economic factors but is shaped by the interaction among developmental processes, biological proxies, and sociocultural as well as regional dynamics.

This study contributes to the scientific literature in three primary ways. First, the study provides comparative quantitative data across multiple regencies in non-urban Sumatra, a context that remains underrepresented in aggression research. Second, the study integrates demographic, biological, and regional variables within a single multiple linear regression model, thereby offering a more

comprehensive modeling of aggression determinants. Third, the study extends theoretical discourse by demonstrating that extrinsic factors, such as regional context and cultural identity, interact with developmental and biological factors in shaping aggressive behavior. Accordingly, this study strengthens the multidimensional approach in aggression research and provides an empirical foundation for locally grounded social policy development.

This study also acknowledges several limitations. The study employs a cross-sectional design; therefore, it cannot establish causal directionality over time. The study does not include important mediating variables such as family relationship quality, childhood exposure to violence, or exposure to violent media, which may limit model specification. In addition, the use of convenience sampling restricts the generalizability of the findings to broader populations. Other limitation of this study is the disproportionate number of right-handed versus left-handed participants. While the current results align with neurobiological theories of aggression, the small sample size of the left-handed group may limit the generalizability of this specific finding. Future research should employ panel-based longitudinal designs, incorporate more comprehensive mediating variables, and combine quantitative and qualitative approaches to achieve a deeper, more contextual, and more causally robust understanding of aggression.

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