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RESEARCH ARTICLE **OPEN ACCESS**

Assessment of Risky Riding Behaviors Using the Motorcycle Rider Behavior Questionnaire (MRBQ) among University Students

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Abstract:

Background: Riding behavior is a significant factor in 90% of traffic accidents, with 43% of these accidents involving motorcyclists aged between 5 and 29 years. These accidents often result in severe injuries and fatalities; therefore, a study on risky riding behavior is necessary.

Objective: This research aimed to identify risky riding behavior among university students using the motorcycle rider behavior questionnaire (MRBQ).

Methods: A cross-sectional quantitative survey was conducted on students from 12 faculties at the State University in Semarang City, Central Java, Indonesia, in June, 2023. Data were collected *via* an online questionnaire, with a final analysis conducted on 37 participants. The chi-square test with a 95% confidence interval was used for data analysis.

Results: The results showed that traffic violation in the last 12 months was related to risky riding behavior (p = 0.057, RP = 0.671; 95% CI = 0.389-1.159), while gender, driver's license ownership, history of accidents reported to the police, and driving frequency were unrelated to risky riding behavior.

Conclusion: The research provides valuable insights into the factors that influence driving behavior. It underscores the importance of safety records and the potential impact of recent traffic violations on driving behavior. Public education, risk communication, and promoting safe behavior through positive modeling can help reduce accidents and foster a safer road culture.

Keywords: Motorcycle rider behavior questionnaire (MRBQ), On-road crash risk, Riding behavior, Traffic accident, University students, Accidents.

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1. INTRODUCTION

The World Health Organization (WHO) reports that 1.35 million people died from road accidents in 2016, an average of 18.2 per 100,000 people. The highest mortality rate was found in people between the ages of 5 and 29. Of these accidents, 43% involved two-wheelers [1]. Young motorcyclists are a particular concern in Southeast Asia. Motorcyclists account for three-quarters of road deaths in Thailand [2, 3], Vietnam [4] and Indonesia [5]. Therefore, it is crucial to focus on the safety of young motorcyclists in developing countries, as this has the potential to reduce global road traffic deaths significantly.

Studies on traffic accidents consistently indicate that the causative factors behind such incidents are multifaceted, involving elements related to humans, vehicles, and the environment. The human factor emerges as the primary contributor to accidents [6, 7]. Deviant driving behavior, in particular, stands out as a significant precursor to traffic accidents [8-10]. In a relevant study by De Roma *et al*. [11], exploring motorcycle accident risk factors revealed diverse variables. These factors included age, gender, type of driver's license, occupation, education level, travelling behavior, number of driving hours per week, riding experience, violations of traffic laws in the past three years, near misses in the past three years, and the use of additional safety equipment. This comprehensive investigation underscores the complexity of influences that can contribute to motorcycle accidents, emphasizing the need to examine various factors beyond just one-dimensional considerations thoroughly.

The trend of several studies on traffic accidents shows that many studies pay attention to the risk behavior factors of motorists causing traffic accidents. One of the leading causes of motorcycle accidents is a common traffic violation that occurs mainly among young riders [12, 13]. From the trend of existing studies, a factor of driver behavior dominates the incidence of traffic accidents among young drivers.

Various methods for determining driving behavior and the relationship between driving behavior and accident involvement have been put forward in previous studies [10]. The Motorcycle Rider Behaviour Questionnaire (MRBQ), which is one of the most widely used tools to measure the riding behavior of motorcycle riders, consists of five factors, namely: traffic errors (unintentional mistakes made by the rider), control errors (motorcycle handling lapses), speed violations, the performance of stunts (intended excitement seeking actions) and use of safety equipment [14, 15].

One of the essential functions of MRBQ is to identify behaviors that increase the likelihood of a motorcycle accident. For example, traffic/control errors and speed violations are the most significant behavioral factors affecting a motorcyclist's accident risk [10, 15, 16]. Meanwhile, stunt performance is a unique MRBQ factor that correlates with accident involvement among Australian riders [17]. Similarly, this factor is the primary determinant of active accidents (*i.e*., hitting other road users or obstructions) and traffic violations (related to parking, overtaking, speeding, or other traffic violations) for Turkish motorists [18]. The factor of safety equipment use arises from all the studies mentioned above but is unlikely to be a determinant of accident or near-accident incidents.

This study complements the shortcomings of existing studies by examining how traffic accidents occur among these young drivers. As the problem of risky motorist behavior is directly related to traffic accidents, it is crucial to know how motorist behavior contributes significantly to traffic accidents. In particular, this study answers how students' risky driving behavior can increase the risk of traffic accidents. A deep understanding of risky driving behavior provides information for problem-solving or lessons learned to prepare action plans for handling traffic accidents in young drivers.

This research is based on an argument that traffic accidents are not only caused by driver behavior factors but also have alarming implications for solving problems caused by traffic accidents. Traffic accidents experienced by students have become the basis for problem-solving difficulties. As part of public health problems, traffic accidents can occur due to poor driving behavior of drivers. At the same time, various misconducts occur as a result of limited knowledge about driving safety. Thus, risky driving behavior is based on various factors of society/students. This research aims to identify the risk of traffic accidents among university students using the Motorcycle Rider Behavior Questionnaire (MRBQ).

2. METHODS

2.1. Study Design and Setting

Students who experienced traffic accidents were used as the analysis unit of this study. Practicing safe riding behavior by students can prevent traffic accidents. A problem-solving model can be built to overcome traffic accidents by examining safe riding behavior in students. The targeted subjects of this cross-sectional quantitative survey were students (37 participants) of the State University in Semarang City, Central Java, Indonesia, in June, 2023. Inclusion criteria for the study include students having an active status, who have never received training on riding safely, and who are willing to be respondents by filling out the informed consent sheet. Informs consent was shared with participants to ensure no individual names would be reported or mentioned during data analysis and reporting.

2.2. Data Collection

Consequently, the questionnaire was distributed among participants *via* a hyperlink, and they responded electronically *via* WhatsApp. At the onset of the survey, comprehensive clarifications were provided regarding the objectives and criteria for inclusion. Participants were duly informed that their involvement in the study would be entirely voluntary, granting them the freedom to withdraw at any point and that their personal information would be treated with utmost confidentiality.

The data collection instrument comprised a researcher-developed questionnaire divided into two distinct components. The initial segment of the study encompassed the collection of demographic data, specifically about age, student gender, driver's license, traffic violations, a police-reported accident, driving frequency, and the primary purpose of driving. The second section had 27 questions on driving behavior based on the Indonesian version of MRBQ, which had been tested for validity and reliability with Cronbach's Alpha Reliability: 0.742. The respondents were asked to rate the frequency of their driving behavior for a year, choosing one option from the 6-point scale: 1 = never, 2 = hardly ever, 3 =

occasionally, 4 = quite often, 5 = frequently, and 6 = nearly all the time [14, 15]. Riding behavior is categorized into three categories, namely less (scoring range of 27-72), enough (scoring range of 73-117), and good (scoring range of 118-162) (Supplementary material).

2.3. Data Analysis

This preliminary research involved a modest sample size, as 60 questionnaires were distributed, but only 40 college students (66.6%) actively participated. However, after meticulous reviewing of the data, three participants were excluded due to incomplete responses, leaving us with a final sample size of 37 participants for the conclusive analysis. This final count not only met but surpassed our initial sample size requirements. The gathered information and responses underwent a systematic coding process, followed by statistical analysis through dedicated software for Windows. Before the analysis, we performed a Shapiro-Wilk test to determine whether the data was normally distributed. This step is crucial as it allows us to perform more accurate statistical analysis if our data adheres to a normal distribution. Second, following the Shapiro-Wilk test, we performed a descriptive statistical analysis to describe the data concisely and readably. This analysis allowed us to succinctly summarize our data, providing essential information, such as the amount of data, mean value, standard deviation, median, *etc*. This form of analysis served as our first step in understanding our data.

Third, we also performed a chi-square test, setting a significance level at $P < 0.05$ or a 95% Confidence Interval (CI). This limit is crucial in determining the significance of our results. If our results fall within this confidence interval, we can confidently assert that they are statistically significant. Lastly, we employed Principal Component Analysis (PCA) to analyze our data further. PCA is a technique used to reduce the dimensionality of data by focusing on the main variations in the data. This analysis helped us identify the relationships between variables and reduced the number of variables in our analysis. In the context of our study, we examined the prevalence ratio (RP) through PCA.

3. RESULTS

3.1. Respondents' Characteristics

Table **1** illustrates the demographic characteristics of the respondents. The average age of participants was approximately 19.86 years, with a small standard deviation, indicating a relatively homogeneous group of young adults. While the majority of respondents were women (70.3%), statistical analysis revealed no significant gender difference (p-value > 0.05), suggesting that gender did not play a significant role in influencing safe riding behavior. A notable 70.3% of respondents reported possessing a driver's license. However, the similarity in average scores between those with and without a driver's license yielded a non-significant p-value, implying that having a driver's license did not correlate with safe riding behavior. Regarding riding behavior, a modest proportion (21.6%) admitted to a traffic violation in the past 12 months, and 8.1% reported involvement in a traffic accident. These figures suggest a group of drivers with relatively minor incidents, and the non-significant p-value indicates no strong association.

Examining riding frequency, the majority (83.8%) drove motorcycles daily, showcasing a high dependency on this mode of transportation for daily activities. However, the lack of significant variation in average riding frequency values suggests that the riding frequency did not significantly impact respondents' safe riding behavior. Notably, the primary purpose of motorcycle riding for most respondents (70.3%) was commuting to campus, aligning with age demographics and reflecting the geographic location and community characteristics where the study was conducted. Thus, the study provides an overview of respondents' characteristics, riding habits, and involvement in traffic violations and accidents. This information can provide valuable initial insight into understanding riding behavior patterns within groups of respondents.

Table 1. Distribution of respondents' characteristics.

Variable	Frequency (n = 37)	Percentage (%)	Mean	SD	P-value
Age	19.86 ± 1.273				
Gender	-	-	-	-	-
Man	11	29.7	133.09	16.932	0.984
Woman	26	70.3	133.19	13.051	
Driver's license	-	-	-	-	-
Yes	26	70.3	133.54	13.261	0.806
No	11	29.7	132.27	16.481	
Have a traffic violation in the past 12 months.	-	-	-	-	-
Yes	8	21.6	127.13	18.295	0.174
No	29	78.4	134.83	12.550	
Accidents reported by police prior to participation in the study	-	-	-	-	-
Yes	3	8.1	131.67	16.073	0.851
No	34	91.9	133.29	14.143	

(Table 1) contd.....

Variable	Frequency (n = 37)	Percentage (%)	Mean	SD	P-value
Riding Frequency	-	-	-	-	-
Every day	31	83.8	132.13	13.694	0.398
Several times per week	4	10.8	143.25	17.289	
Once a week	1	2.7	121	-	
Less than once a week	1	2.7	137	-	
The primary purpose of riding	-	-	-	-	-
Trip	9	24.3	126.33	15.572	0.215
To the College	26	70.3	135.77	11.850	
Other	2	5.4	130	32.527	

3.2. Riding Behavior

MRBQ is used to identify the riding behavior of a rider that can increase the likelihood of a motorcycle accident. Table **2** presents the ranking of all MRBQ items from the means and standard deviation values. Based on the mean value on the MRBQ questionnaire, three actions were most often taken by students, namely "Drive Under the Influence (DUI) of alcohol," "pull the gas too fast and the front wheels lift off the road," and "try or lift the front wheels of the vehicle." This DUI indicates alcohol violations and control errors. Generally, the last two actions are carried out for fun/adventure among the students and are not under the influence of alcohol. However, these actions are predominantly associated with recreational activities or adventurous behavior among college students and are not necessarily associated with the influence of alcohol. Students doing this action are likely to seek sensation when riding a motorcycle, so it needs to be studied more deeply; hence, it will be included in the next study.

These results suggest that the most common risky behaviors among college students in the study were riding a motorcycle under the influence of alcohol, excessive speeding that causes the front wheels to lift off the road, and attempting or taking action to lift the front wheels. These three actions describe behaviors that can contribute to violations and control errors while riding. By identifying such behaviors, the study provides insight into several aspects that may be a priority for improving motorcycle safety among college students. This information may be used to design educational programs, safety campaigns, or other interventions to reduce dangerous behavior and encourage safer riding behavior.

Table 2. MRBQ items are ranked by mean of value.

Item	Statement	Mean	SD	Variance
27	Riding under the influence of alcohol	5.84	0.442	0.195
20	Pull the gas too quickly, and your front wheel lifts off the road	5.81	0.462	0.213
19	Do you try or lift the front wheel of your vehicle	5.68	0.580	0.336
21	Inadvertently doing wheel spin	5.65	0.633	0.401
17	Engage in racing with other riders	5.54	0.730	0.533
18	Turn at such high speed that you feel scared	5.27	0.769	0.592
23	Change gears/lower speed when turning around a bend or bends	5.27	1.097	1.203
9	Drive so fast around corners that you feel like you've lost control	5.19	0.739	0.547
22	Brake or *throttle back* (slowly) when circling a corner	5.16	1.014	1.029
3	Not paying attention to the "STOP" sign when going to cross the main lane and almost collided with another vehicle that had the right of way	5.14	1.084	1.176
14	The race starts when the traffic light shows green to defeat the next driver	5.11	1.220	1.488
15	On minor roads, you drive at speeds of more than 60km/h	5.00	0.972	0.944
25	Slipping on wet roads or manhole covers	4.95	0.998	0.997
1	Not seeing someone stepping out of the back of a parked vehicle until it was almost too late to stop	4.89	1.022	1.044
16	Drive in two lanes of traffic at high speed	4.81	1.101	1.213
13	Ignoring speed limits on residential roads	4.73	0.902	0.814
2	Not paying attention to someone waiting at the crosswalk whose light just turned red	4.65	1.495	2.234
4	Failing to notice or anticipate other vehicles that stop suddenly in front of you and having trouble stopping	4.62	0.861	0.742
24	You have difficulty controlling the motorcycle when riding at high speeds (*e.g., steering wobble*)	4.59	1.013	1.026
5	You try to overtake another vehicle that you are unaware of signals a left turn	4.57	1.144	1.308
6	When driving at the same speed as other traffic, you find it difficult to stop at the time of the red light	4.54	1.304	1.700
7	The driving distance is so close to the vehicle ahead that it will be difficult to stop in an emergency	4.54	0.931	0.866
8	Taking too wide a lap when turning corners	4.49	0.901	0.812
12	Ignoring speed limits on highways	4.46	0.989	0.977

(Table 2) contd.....

Item	Statement	Mean	SD	Variance
10	Exceeding the speed limit on the streets	4.41	0.896	0.803
11	Ignoring speed limits late at night or early in the morning	4.30	1.151	1.326
26	Having problems with your visor foggy glasses	3.97	1.590	2.527

Table 3. Relationship of gender, driver's license ownership, accident history, and traffic violations with driving behavior.

-	Driving Behavior				*p-value*	*RP (95% CI)*
	Enough		Good			
	n	%	n	%		
Gender						
Man	2	18.2	9	81.8	0.623	0.925 (0.678 – 1.263)
Woman	3	11.5	23	88.5		
Driver's License						
Yes	2	7.7	24	92.3	0.144	1.269 (0.869 – 1.853)
No	3	27.3	8	72.7	-	
Accident History						
Yes	0	0	3	100	1.000	1.172 (1.020 – 1.348)
No	5	14.7	29	85.3	-	
Driving Frequency						
Often	5	16.1	26	83.9	0.567	0.839 (0.719 – 0.979)
Sometimes	0	0	6	100		
Traffic violations in the last 12 months						
Yes	3	37.5	5	62.5	*0.057	0.671 (0.389 – 1.159)
No	2	6.9	27	93.1	-	

Meanwhile, the three least common actions by students were “exceeding the speed limit on the streets,” “ignoring the speed limit late at night or early in the morning,” and “having problems with foggy visors or goggles.” This indicates that traffic errors are related to safety equipment factors and speed violations. From this information, it can be concluded that students tend to pay attention to safety factors when driving, such as speed limits and the use of personal protective equipment. The fact that they rarely speed or ignore the speed limit shows that they know the risks associated with speeding. Similarly, safety equipment issues are related to efforts to keep it in good condition to provide maximum protection while riding motorcycles. This information can be used to design more specific approaches to students’ safety and driving awareness and identify areas requiring more attention in safety campaigns.

The research findings are presented in Table **3**. A correlation was found between traffic violations in the preceding 12 months and risky riding behavior, while gender, driver's license ownership, history of accidents reported to the police, and driving frequency were unrelated to risky riding behavior. The statistical analysis showed no significant association between sexes (p = 0.623, RP = 0.925; 95% CI = 0.678-1.263), indicating no significant difference in driving behavior between men and women. The statistical analysis also demonstrated that driver's license ownership (p = 0.144, RP = 1.269; 95% CI = 0.869-1.853) did not signify a statistically significant difference in driving behavior, even though individuals with a driver’s license tended to exhibit better driving behavior. This was because the confidence interval (CI) was 1.

The history of accidents reported to the police (p = 1.000, RP = 1.172; 95% CI = 1.020-1.348) indicated a strong correlation between not having a history of accidents and better driving behavior, as this difference was statistically significant because it did not have CI value of 1. This suggests a robust link between a lack of accident history and improved driving behavior.

Conversely, the analysis showed no significant relationship between driving frequency and better driving behavior (p = 0.567, RP = 0.839; 95% CI = 0.719-0.979), indicating that drivers who drive frequently exhibit worse driving behavior than those driving occasionally. This difference was significant because the confidence interval was not 1, implying that driving frequency does not substantially affect driving behavior. It is plausible that more frequent may be more confident or less cautious.

The statistical analysis further revealed a relationship between traffic violations committed in the last 12 months and risky riding behavior (p = 0.057, RP = 0.671; 95% CI = 0.389-1.159). This indicates that individuals who committed traffic violations tended to display worse riding behavior, although this difference was insignificant because CI was 1. This suggests a trend where respondents who committed traffic violations tended to exhibit driving behavior that was considered not “good” and did not comply with the rules.

In the context of this study, the analysis results can provide valuable insights into the factors associated with rule-breaking driving behavior. This study revealed that accident history was the most potent predictor for "moderate" driving behavior, whereas traffic violations in the past 12 months had a great impact on altering good driving behavior, although this effect was not statistically significant.

4. DISCUSSION

The results of the demographic analysis demonstrated no statistically significant difference among variables, such as gender, driver's license ownership, having a traffic violation in the past 12 months, the occurrence of traffic accidents in the past 12 months, driving frequency, and the primary purpose of driving. The finding that gender does not significantly impact driving behavior aligns with prior research emphasizing the uncertainty of gender-related influences on driving behaviors and traffic accidents [19, 20]. Similarly, the absence of a correlation between driver's license ownership and driving behavior corroborates existing literature [21-23]. However, the identified odds ratios hint at potential associations that merit further investigation. It would be worthwhile to explore whether driver's license ownership is linked to socioeconomic status or transportation accessibility. Future studies, with larger and more robust samples, could delve into these potential effects of demographic variables on driving behavior.

The research findings suggest that accident history was the most important predictor for "sufficient" driving behavior. This is an important finding because it reminds us of the important role safety records play in assessing a person's driving ability. Furthermore, the study reveals that people who drive frequently tend to exhibit less adequate driving behavior. This may indicate that more driving experience does not necessarily translate to better driving skills. Also, the research indicates that recent traffic violations might potentially affect the quality of driving behavior, although this impact was not found to be statistically significant. This suggests that while past traffic violations might have some influence, their recent occurrence might not significantly alter a person's driving behavior.

Safe driving behavior is essential for road safety. Factors, such as alcohol, poor driving skills, use of safety equipment, and speeding, can seriously affect the safety of drivers, passengers, and other road users. This study shows that driving under the influence of alcohol, driving control errors, poor safety equipment, and speed violations are associated with risky riding behavior. All these factors can increase the risk of traffic accidents.

Driving under the influence of alcohol or being drunk is one of the main risk factors for traffic accidents. The use of alcohol is a predictor factor in traffic accidents [24]. Alcohol can interfere with a driver's coordination, reactions, and motor ability to process information correctly. As driving ability declines, the risk of serious accidents increases dramatically. The results reported that victims of traffic accidents had consumed alcohol before the accident [25].

Driving errors can include many aspects, such as failure to maintain a safe distance from the vehicle ahead, not following the lane, or failure to control the vehicle when turning. This error can result in collisions or other dangerous situations. Some studies reported that traffic errors and violations are the leading causes of traffic accidents [10, 24] and driving offenses [26, 27]. The results of this study demonstrated control errors when driving carried out by respondents, where respondents stated that they "pull the gas too fast and the front wheels lift off the road" and "try or do lift the front wheels of the vehicle". Therefore, training is needed in order to improve driving skills. Training on safe driving increases knowledge and attitudes about driving safely [28, 29] and reduces the risk of injury from traffic accidents [30].

Safety equipment, such as helmets, goggles for motorcyclists, and other safety systems, is essential to protect the riders. Drivers and passengers should always use safety gear, as this can reduce the risk of serious injury in an accident. This is consistent with the findings of a study by Kumphong *et al*., which reported that countries with higher helmet law enforcement efficiency and greater use of helmets have lower rates of motorcycle-related deaths [31]. The study reported that drivers encountered problems using glasses due to fog. This follows several research results, which found that using personal protective equipment is infrequent in countries with the highest number of motorcycle users, such as Thailand, Vietnam, Indonesia, and Malaysia [31-34].

Speed violations, such as driving too fast for the legal limit or ignoring top speed signs, can lead to dangerous situations. WHO states that pedestrians hit by vehicles at more than 50 kph have an 80% chance of fatality. However, the probability of the fatality rate drops to below 10% if the speed is lowered to less than 30 kph [35]; this is supported by research finding that risky behaviors, such as speeding or driving at high speeds, are predictors of traffic accidents [24, 36]. Speeds that do not match road and traffic conditions can reduce the driver's reaction time to avoid accidents and lead to more severe consequences in the event of an accident. Speed violations while driving are a sign of deviant driving behavior. Thus, speed violations while driving contribute to traffic accidents.

It is important to remember that safe driving behavior includes vigilance, awareness, and responsibility toward yourself and others on the road. Avoiding the effects of alcohol before driving, obeying traffic rules, controlling vehicles, and using safety equipment are essential steps to reduce the risk of accidents and protect the health and life of oneself and others.

Recognizing potential hazards and committing to safe driving behavior are important steps to reduce the risk of accidents and promote a safer driving culture by providing education and information, true stories and experiences, family and friend involvement, and positive behavior modeling. Positive behavior modeling is when a person

presents an example of behavior others expect or desire. You can inspire others to adopt similar behaviors by demonstrating safe and rule-abiding behavior. For example, use safety equipment, obey traffic rules, avoid alcohol use, obey speed limits, and avoid using mobile phone driving data. Therefore, positive behavior modeling can stimulate a change in driving and encourage widespread adoption of safe behavior. If more people engage in safe behavior, this can positively change societal behavioral norms and expectations. Moreover, in order to improve road safety, educating and informing the public about the importance of safe driving behavior is important.

The primary limitation of this study lies in its preliminary nature and reliance, and it is important to note that these findings may be influenced by the study's design limitations and the small sample size; therefore, follow-up studies with larger samples are needed for more robust results, and multivariate analyses may be necessary to confirm these results and examine other factors related to driving behavior. Additionally, the homogeneity in age among respondents restricts the generalizability of the findings to a broader population. This limitation raises concerns about the potential need for a more accurate representation of the diversity of driving behavior in the general population. Consequently, there is a clear need for future research endeavors to employ larger and more diverse samples, allowing for a more comprehensive exploration of the potential effects of variables related to driving behavior.

Despite these limitations, the insights from this initial research serve as a foundation for understanding the variables that could influence driving behavior, providing valuable implications for policy and practice. Employing more sophisticated variable selection methods grounded in theoretical foundations is recommended to enhance the robustness and depth of future studies. This approach aims to yield more meaningful and interpretable results, contributing to a more nuanced comprehension of the factors shaping driving behavior.

The practical implications of this research underscore the complexity of driving behavior and experience. Valuable insights into road safety and safe driving behavior can be gleaned by considering factors, such as previous driving frequency and accidents. If these variables prove relevant in a more comprehensive model, they could contribute to developing effective policy initiatives and targeted interventions to enhance road safety.

CONCLUSION

This research provides valuable insights into the factors that influence driving behavior. It highlights the importance of safety records and the potential impact of recent traffic violations on driving behavior. Safe driving behavior, which includes avoiding alcohol, adhering to traffic rules, use of safety equipment, and controlling the vehicle properly, is crucial. Safety equipment, such as helmets and goggles, is essential despite challenges in optimal use. Speed violations, which reduce reaction time and contribute to accidents, are also highlighted. Research shows that driving under the influence of alcohol, making errors while driving, and using non-optimal safety equipment are associated with risky driving behavior.

Moreover, future research efforts should focus on measuring and verifying significant associations between risky riding behavior and the risk of traffic accidents associated with motorcycle use. This targeted approach ensures that recommendations for further research align with the critical goal of elucidating and addressing specific challenges related to road safety and driving practices.

LIST OF ABBREVIATIONS

MRBQ	=	Motorcycle Rider Behavior Questionnaire
WHO	=	World Health Organization
CI	=	Confidence Interval
PCA	=	Principal Component Analysis
RP	=	Prevalence Ratio

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethics approvals for this study were obtained from the Research Ethics Committee of the Faculty of Medicine Ethics Commission at Mulawarman University in Samarinda, Indonesia, and Certificate number 111/KEPK-FK-VI/2023.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were according to the ethical standards of institutional and/or research committees and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

The researchers gained permission from the University of Diponegoro, Central Java, Indonesia, to perform the study in 12 faculties, and all participants were included.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

SUPPLEMENTARY MATERIAL

Supplementary material is available on the publisher's website along with the published article.

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