

## Road Accident Proneness among Motorcyclist in Malaysia: A Structural Equation Modeling Approach

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### ABSTRACT

*Road accidents have alarmed Malaysian citizens all over the country. This study proves that a combination of human characteristics may contribute to the increase in the accident rate of motorcyclists on the road. Human characteristics such as riding anger, riding attitude, and lack of mindfulness may be the leading causes of motorcycle accidents. Malaysian road accident proneness research is still in its early phase. This study intends to investigate the relationship between riding anger, riding attitude, mindfulness, and road accident proneness. This study adopts a quantitative methodology employing a questionnaire distributed to visitors of authorised Yamaha dealers in Kuala Lumpur and Selangor. The results of structural equation modelling reveal that riding anger, riding attitude, and mindfulness substantially impact road accident proneness. The explanation of the current research contains significant theoretical and practical significance, as well as suggestions for minimising the accident rate of road users.*

**Keywords:** Mindfulness, Riding Anger, Riding Attitude, Road Accident Proneness, Road Safety

### 1. INTRODUCTION

Most road vehicles, particularly in urban areas, are motorcycles (Road Safety Department of Malaysia, 2020). Motorcycle riders are among Malaysia's most vulnerable road users, as evidenced by the frequency with which they sustain traffic-related injuries, most of which involve young drivers (Road Safety Department of Malaysia, 2020). Moreover, 16 to 20-year-olds had the highest injury rate compared to other generations during the past five years (Road Safety Department of Malaysia, 2020). The average injury rate for riders and passengers is around 65% and 52%, respectively. As a result of their injuries and deaths, victims or their families will pay several costs, including treatment expenses, vehicle repair costs, and hospital expenses (if death). As a result, if the number of road accidents grows yearly, the total number of fatalities and injuries will increase, influencing the expenditures associated with road accidents. In Malaysia, there are three primary causes of road accidents: human, vehicle, and environmental factors (Road Safety Department of Malaysia, 2020). This study focuses on classifying human variables as the causes of road accidents since human error causes 80.6% of road accidents, more than any other component (Road Safety Department of Malaysia, 2020).

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Most road accident studies in Malaysia focused more on the technical aspects than on motorcyclists' behaviour (Darma et al., 2017; Kassim et al., 2019). Malaysia requires further empirical study due to the shortage of studies on motorcyclist characteristics and the existing literature on road accident proneness. This study addressed the relationship between riding anger, riding attitude, and mindfulness on road accident proneness among Malaysian motorcyclists to bridge the gap between motorcyclist characteristics and accident proneness.

## **2. LITERATURE REVIEW**

### **2.1 Road Accident Proneness**

Road accident proneness refers to a person's tendency to be engaged in road accidents when exposed to several factors, such as human emotions (Tang et al., 2021). Road users will have a greater predisposition to be engaged in road accidents while being subjected to the same level of riding rage when operating a motor vehicle on the road (Tang et al., 2021).

Farmer and Chambers (1940) conducted the first road accident proneness study based on investigations into the number of accidents sustained by omnibus drivers, supplemented by insurance records of accident claims by owner-drivers of private cars and records of drivers of heavy lorries. Besides, Kenntner-Mabiala et al. (2016) conducted a study to analyse the pattern of road accident proneness in elderly car drivers compared to middle-aged adult drivers during a standardised driving test in real traffic.

A similar study was conducted by Moghaddam et al. (2017) to screen accident-prone car drivers in Iran. Moreover, Hu et al. (2020) studied the correlation between traffic accident tendency and driver's character using in-depth traffic accident data on car drivers. Most of these studies focus on road accident proneness among car drivers instead of motorcyclists. Motorcyclists are road users at high risk of road accidents (Abdullah et al. 2018). Therefore, the present study examined motorcyclists' accident proneness, assuming they may have high road accident proneness levels.

Farooq and Juhasz (2019) studied road accident proneness on the car – motorcycles, indicating that one of the most vulnerable road users is motorcycle riders. The researcher stated that the number of motorcycles on the road increases, so motorcycle fatality can be expected to remain a big concern for road safety. In other words, since the motorcyclist is more likely to get into a road accident, riders should take less risk when riding their motorcycles. Therefore, not only can they avoid getting hurt and losing their property, but they can also protect people around them, like their passengers or other road users.

Since motorcyclists are responsible for being aware of the tendency to be involved in road accidents, previous researchers have unanimously stated that motorcyclists' characteristics appeared to have an independent effect on the accidents and present a greater probability for an accident to happen (Manan et al. 2018). Furthermore, Cubranić-Dobrodolac et al. (2017) pointed out that road accident proneness consists of a unique assortment of motorcyclists' characteristics that is personally meaningful and even more important than organisational factors.

Since motorcyclists' characteristics are the strongest predictor of road accident proneness, Manan et al. (2018) and Ghaffari-Fam et al. (2016) recommended that further studies should be done on integrating several motorcyclists' characteristics to provide a deeper understanding of the riding behaviour that influences road accident proneness. Therefore, this present study integrates and examines several motorcyclists' characteristics of road accident proneness among Malaysian motorcyclists.

## **2.2 Motorcyclists Characteristics**

Previous studies have mentioned motorcyclists' characteristics as one of the primary reasons for road accident proneness (Abdullah et al. 2018). Motorcyclists' characteristics are riders' actions to ensure people's safety and compliance with riding regulations (Nadimi et al., 2021). The conditions of motorcyclists' characteristics are subjected to the riders' effective demands and cognitive and emotional state while operating their vehicle in traffic. Motorcyclists' characteristics have preceded other factors that cause road accidents and have proven the vital relationship between motorcyclists' characteristics and road accident proneness, as exemplified in previous studies (Abdullah et al., 2018; Nadimi et al., 2021).

Studies on motorcyclists' characteristics and road accident proneness are still lacking in Malaysia; therefore, extensive research is needed. This study was conducted to close the existing gaps by providing a comprehensive discussion on the types of motorcyclists' characteristics and road accident proneness.

### **2.2.1 Riding Anger**

Riding anger refers to the mental and physiological problems that lead a person to get angered in response to provocation and annoyance on the road, as well as emotional reactions like disapproval or outrage (Cludius et al., 2021; Gunson et al., 2019). In other words, anger is the capacity to feel emotions such as irritation and resentment. On the road, anger while riding a motorcycle is becoming increasingly prevalent and can be generated by various circumstances (Liew et al., 2021).

In addition, motorcyclists and other road users are subject to anger during riding because of some variables. Previous research has associated anger with unsafe driving or riding behaviours, such as speeding, reckless riding or driving, and traffic law violations (Cludius et al., 2021; Rowden et al., 2016). Anger produces biological effects, such as increased heart rate, blood pressure, and levels of adrenaline and noradrenaline that raise the risk of road accidents (Liew et al., 2021).

Several previous studies have examined the characteristics of riders on the road, but very few studies have examined the aspects of riding anger that lead to a road accident (Manan et al., 2017; Liew et al., 2021; Gunson et al., 2019). For example, a study conducted by Manan et al. (2017) concluded that riders tend to ride more quickly than other vehicles on highways.

Liew et al. (2021) conducted a study to determine the factors contributing to riding anger among motorcyclists in Malaysia. In addition, Gunson et al. (2019) also surveyed to examine riding anger among motorcyclists. Interestingly, these studies found that road conditions, design, and reckless riding are the main contributing factors to riding anger. However, the main gap in these studies is that no assessment was conducted concerning road accident proneness since the motorcycle is the high-risk vehicle category involved in road accidents. Therefore, examining the rider's expression of riding anger and road accident proneness is essential. This research would lead to a greater scientific and empirical knowledge of riders' anger and associated phenomena, as well as psychological assessment, rehabilitation improvement strategies, and evaluation of angry riders. Therefore, based on the above discussion, it can be hypothesised that:

H<sub>1</sub>: Riding anger has a significant relationship with road accident proneness.

## **2.3 Riding Attitude**

Attitude is a mental state of readiness formed by experience that has a directive or dynamic influence on an individual's response to all objects or circumstances to which it is connected (Arsyistawa, 2019). Attitudes are an adaptation of a person's ideas about an issue and are vital to

comprehending their actions (Rahardjo & Kusumawardhani, 2022). Hence, this study will focus on riding attitude, which will be more related to road accident studies. Therefore, the definition of riding attitude consists of the motorcyclists' feelings, unfavourable or favourable judgments, and behaviours toward a particular property, person, item, or experience while riding (Zuraida & Russell, 2020). According to Cubranic et al. (2017), one of the causes of traffic challenges is riders' attitudes. Several motorcyclists are aware that their riding attitude violates the law. However, instead of expressing remorse, they feel that their terrible riding attitude will have no impact on themselves or others on the road.

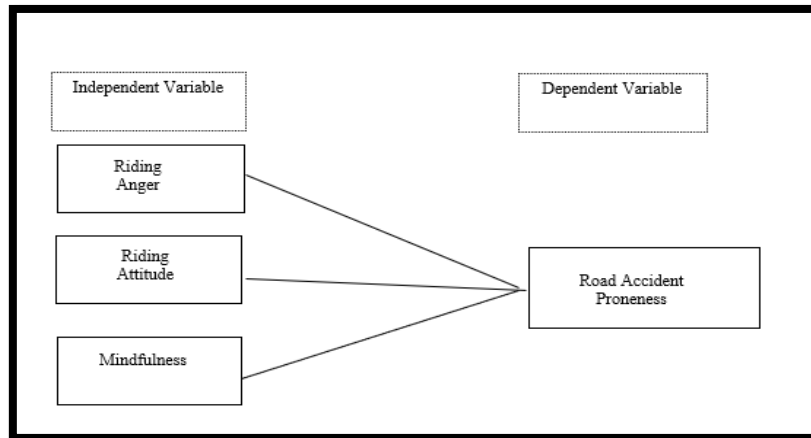
According to Hamid et al. (2019), more than 80% of accidents are caused by poor behaviour, dangerous surroundings, or both. Attitudes are sometimes compared to personality characteristics since their nature tends to be constant. However, attitudes toward anything may alter based on acquired knowledge, in contrast to characteristics that seem permanent and difficult to shift (Rahardjo & Kusumawardhani, 2022). The riders' attitudes about the breach of rules, their perception of injuries, their need for road safety knowledge, and their perspectives on the negative impacts of increasing smartphone use are utilised to evaluate their attitudes toward road safety.

There are insufficient explanations for the adverse effects of riding attitude on road accident proneness, despite statistical evidence supporting the influence of riding attitude on accident proneness. For example, Romero et al. (2019) conducted an exploratory study to determine the risky riding attitudes of motorcyclists. The results indicated that motorcyclists are more likely to ride a motorcycle at risk due to a lack of experience and knowledge. Besides, Borhan et al. (2018) conducted a study to assess the risk-taking behaviour of Malaysian motorcyclists at signalised intersections. The findings revealed that most motorcyclists with bad riding attitudes at signalised intersections are youth motorcyclists. These studies proved that riding attitudes associated with a lack of riding experience and knowledge are common among youth motorcyclists yet lacking to determine the effects of riding attitude on road accident proneness. Thus, this study tends to close the existing gap by assessing the impact of riding attitude on road accident proneness. Based on the above discussion, it can be hypothesised that:

H<sub>2</sub>: Riding attitude has a significant relationship with road accident proneness.

## **2.4 Mindfulness**

Mindfulness may be defined as a state of awareness and acceptance of what is occurring in the present moment without judgement (Kashiwazaki et al., 2020; Murphy & Sikar, 2019). In other words, mindfulness is an act of consciousness that arises from attending attentively to the present moment and without judgement towards the emergence of reality moment by minute. Additionally, mindfulness has emerged as a technique for enhancing the mental and physical of one individual and has been speculated to be advantageous for riding performance in the context of road safety research (Valero et al., 2021). Since the more attentive somebody is, the less likely they are to be involved in a traffic accident, and vice versa.



**Figure 1.** Research Framework

Figure 1 shows that riding anger, riding attitude, and mindfulness are independent variables, whereas road accident proneness is the dependent variable. Therefore, this study will determine the relationship between the independent and dependent variables.

### **3. METHODS**

This part provides the practical application of variables derived from this research and the measuring instruments for each construct derived from previous literature in the same field. Importantly, this study evaluated the dependent and independent variables considering the techniques of prior research. Quantitative approaches were used over qualitative methods since the approach is more applicable to the broader populations involved in the study. In contrast, qualitative approaches need restricted surveys and time-consuming interviews. The study's population consists of motorcycle riders from the Central Region of Peninsular Malaysia, such as Wilayah Persekutuan Kuala Lumpur and Selangor. Motorcycle riders will be selected as the population for this research considering they make up the most significant percentage of road users and are the vehicles most engaged in road accidents compared to other vehicles. In this study, 386 motorcyclists selected from various motor service companies took part. The study's survey was conducted using the Likert-scale questionnaire. In addition, the Likert scale provides a measure of agreement based on the respondents' opinions. Statistical Package for the Social Sciences (SPSS) Version 26 and Smart PLS version 3 were utilised to analyse this study's data.

#### **3.1 Measures**

##### **3.1.1 Riding anger**

The measurement for riding anger was adapted from the Driving Anger Scale (DAS) developed by Deffenbacher et al. (1994). The DAS was used to measure the motorcyclists' riding anger in this study. The adapted version of DAS is composed of 11 items with statements representing different aspects of riding anger. The participants were asked to specify their level of agreement about their riding anger with each item, which was evaluated on a 5-point Likert-type scale (Very low = 1 to Very high = 5).

##### **3.1.2 Riding Attitude**

The measuring items for riding attitude in this study are adapted from the instrument produced by Stanojevic et al. (2020), which consists of 10 riding attitudes questions. The questionnaire is about risk-taking behaviour and riding attitude while on the road. The questions were created

and scored on a 5-point Likert scale (Very low = 1 to Very high = 5) to assess their level of agreement on riding attitude.

### 3.1.3 Mindfulness

The revised version of the mindfulness measurement by Abdul Hanan and King (2010), which consists of 8 items measuring different aspects of mindfulness, was used in this study. Besides that, the questions were designed and measured using a 5-point Likert scale (Very low = 1 to Very high = 5) to assess their level of agreement on mindfulness while riding a motorcycle.

### 3.1.4 Road Accident Proneness

The measurement items for road accident proneness were adapted from Iversen and Rundmo (2002) and Bener et al. (2008) to rate the motorcyclists' level of agreement on involvement in road accidents during their riding activities, particularly occurrences resulting in injuries and vehicle damage. The questions were created and scored on a 5-point Likert scale (Very low = 1 to Very high = 5).

## 4. RESULTS AND DISCUSSIONS

### 4.1. Demographic of Respondents

The respondents' demographic information includes their gender, age, race, marital status, level of education, licence type, riding experience, location of residence, and speed limit. The findings indicate that 67.6% of respondents are male, and 32.4% are female. Regarding age, 69.2% were between 18 and 35 years old, while 18.9% and 11.9% were between the ages of 36 and 55 and older than 55, respectively. Regarding race, 73.1% of respondents are Bumiputera, and 26.9% are non-Bumiputera. Regarding marital status, 58.3% of respondents are married, while 41.7% are single. The remaining respondents hold a diploma (11.1%), STPM/Matric (8%), or SPM (5.4%). 75% of the respondents held a bachelor's degree or above. Moreover, 80.3% of respondents hold a full licence and 19.7% a P licence. 76% of responders have between 5 and 10 years of riding experience, while 23% have more than 11 years of riding experience. In addition, 66.1% of respondents live in urban regions, while the remaining live in rural areas. 58.5% ride between 51 and 100 km/h, 28.5% ride between 10 and 50 km/h, and 13.3% ride over 101 km/h.

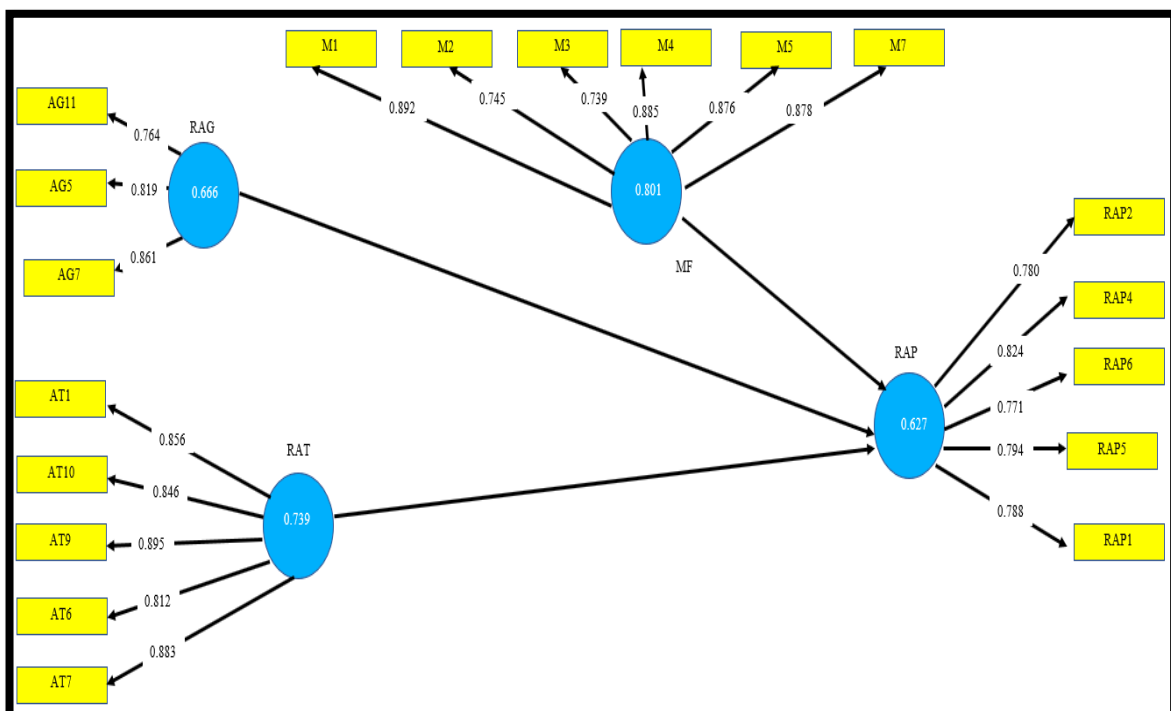
**Table 1.** Respondent's Demographic

Profile	Description	Frequency	Percentage (%)
<b>Gender</b>	Males	261	67.6
	Females	125	32.4
<b>Age</b>	18 – 35	267	69.2
	36 – 55	73	18.9
	Above 56 Years Old	46	11.9
<b>Race</b>	Bumiputera	282	73.1
	Non - Bumiputera	104	26.9
<b>Marital Status</b>	Married	225	58.3
	Single	161	41.7
<b>Academic Qualification</b>	SPM	21	5.4
	STPM/Matric	31	8.0

Profile	Description	Frequency	Percentage (%)
	Diploma	43	11.1
	Degree And above	291	75.4
Type Of License	P License	76	19.7
	Full License	310	80.3
Riding Experience	5 - 10 Years	297	76.9
	More Than 11 Years	89	23.1
Place Of Residence	Urban Area	255	66.1
	Rural Area	131	33.9
Speed Limit	10 - 50 km/h	110	28.5
	51 - 100 km/h	226	58.5
	More Than 101 km/h	50	13

#### 4.2 Assessment Measurement Model

This section presents the PLS-SEM results for the two-assessment outlined by Hair et al. (2019): the assessment of the measurement model and the structural model. The first phase is the measurement model assessment, which includes the assessment of the reliability and validity of each construct in this study.



**Figure 2.** PLS Measurement Model

Note: RAG = Riding Anger, RAT = Riding Attitude, MF = Mindfulness, RAP = Road Accident Proneness

**Table 2.** Summary of Construct Validity, Composite Validity, and AVE

Constructs	Items	Loadings	Composite Reliability	AVE
<b>RAG</b>	AG5	0.819	0.825	0.666
	AG7	0.861		
	AG11	0.764		
<b>RAT</b>	AT1	0.856	0.875	0.739
	AT6	0.812		
	AT7	0.883		
	AT9	0.895		
	AT10	0.846		
<b>MF</b>	M1	0.892	0.891	0.801
	M2	0.745		
	M3	0.739		
	M4	0.885		
	M5	0.876		
	M7	0.878		
<b>RAP</b>	RAP1	0.788	0.852	0.627
	RAP2	0.780		
	RAP4	0.824		
	RAP5	0.794		
	RAP6	0.771		

Note: RAG = Riding Anger, RAT = Riding Attitude, MF = Mindfulness, RAP = Road Accident Proneness

In addition, Hair et al. (2019) highlighted that higher reliability values often indicate decent reliability levels. According to Table 2, composite reliability coefficients for all components in this study are above 0.80 and less than 0.95, meaning that all constructs have adequate reliability. Furthermore, computing a measurement model's discriminant validity is the final stage in the assessment measurement model. Fornell and Larcker (1981) defined the approach for evaluating discriminant validity as comparing the square root of each construct's AVE and its correlations. As shown in Table 3, the computed square root of AVE for each construct was more significant than the individual construct's intercorrelations, demonstrating discriminant validity. Therefore, the measurements are regarded as reliable.

**Table 3.** Result of Discriminant Validity

	MF	RAG	RAP	RAT
MF	<b>0.895</b>			
RAG	0.813	<b>0.816</b>		
RAP	0.560	0.639	<b>0.792</b>	
RAT	0.517	0.791	0.534	<b>0.860</b>

Note: RAG = Riding Anger, RAT = Riding Attitude, MF = Mindfulness, RAP = Road Accident Proneness

### 4.3 Assessment of Structural Model

Following the evaluation of the measurement model, the second part of the PLS analysis is the evaluation of the structural model, also known as the inner model. The purpose of the structural model is to construct hypothesised links between variables of the study framework (Hair et al. 2019). The structural model was assessed according to the set of components' collinearity, the variance explained ( $R^2$ ), the significance of route coefficients, the impact size ( $f^2$ ), and its predictive value ( $Q^2$ ) (Hair et al. 2019). The specific findings are shown as follows in Table 4 and Table 5.



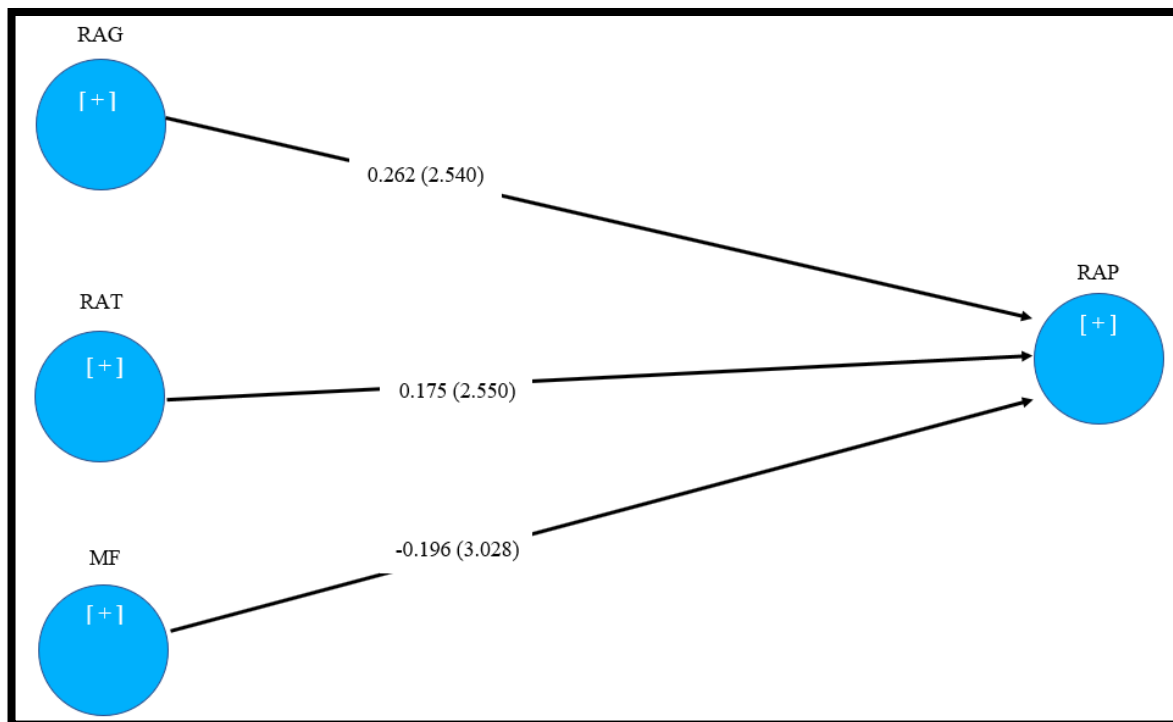
Before assessing the structural model, it is essential to determine the degree of collinearity between each set of predictor variables. According to Hair et al. (2019), a variance inflation factor (VIF) value above 5 indicates a collinearity issue; however, collinearity issues can also occur at VIF levels between 3-5. VIF values should ideally be between 3 and below. According to Table 4, the VIF values for all predictor variables were close to or less than 3, suggesting that multicollinearity did not constitute a potential threat to the parameter estimations of this study.

**Table 4.** Collinearity Assessment

CONSTRUCT	VIF
RAG	2.534
RAT	2.303
MF	2.674
RAP	2.463

Note: RAG = Riding Anger, RAT = Riding Attitude, MF = Mindfulness, RAP = Road Accident Proneness

Hair et al. (2019) mentioned that bootstrapping procedures were employed to evaluate the relevance of hypothesised linkages in Figure 3.



**Figure 3.** PLS Structure Model

Note: RAG = Riding Anger, RAT = Riding Attitude, MF = Mindfulness, RAP = Road Accident Proneness

Table 5 displays the hypothesis test results for the direct association in this study. Specifically, riding anger ( $\beta=0.262$ ,  $t=2.540$ ) and riding attitude ( $\beta=0.175$ ,  $t=2.550$ ) are positively associated with road accident proneness, whereas mindfulness ( $\beta=-0.196$ ,  $t=3.028$ ) is negatively associated with road accident proneness. In addition, as shown in table 5, all variables accounted for 44% ( $R^2$ ) of the variance in road accident proneness and were deemed to have an appropriate degree of prediction accuracy (Hair et al. 2019). The data also demonstrated that all path coefficients have a moderate impact size, although the  $Q^2$  value ( $Q^2=0.365$ ) indicated a medium predictive relevance of the direct approach to road accident proneness.

**Table 5.** Path Coefficient

Hypotheses	Path	$\beta$ (Beta)	T - Value	R <sup>2</sup>	f <sup>2</sup>	Q <sup>2</sup>
1	RAG → RAP	0.262	2.540	0.440	0.245	0.265
2	RAT → RAP	0.175	2.550		0.347	
3	MF → RAP	- 0.196	3.028		0.026	

Note: RAG = Riding Anger, RAT = Riding Attitude, MF = Mindfulness, RAP = Road Accident Proneness

## 5. CONCLUSIONS

This study aimed to examine whether riding anger, riding attitude, and mindfulness are significantly associated with road accident proneness. Furthermore, the present study demonstrates that anger while riding correlates with road accident proneness. Before beginning a journey, self-disciplined motorcyclists can better manage their travel time by preparing a travelling schedule (Hildebrandt, 2019). In other words, motorcyclists may ride at their own pace and in their own time to keep a good mindset before embarking on any adventure. According to Mehrotra et al. (2016), it is crucial to understand riders' perceptions of the factors that influence their riding style. Therefore, planning a journey assures that riders may ride in peace. Rushing and haste can cause riders' brains to become muddled, resulting in reckless behaviour and anger emotion. Based on the above argument, it is possible to conclude that angry motorcyclists are more likely to be engaged in traffic accidents. Therefore, the first hypothesis is supported.

In addition, the present study demonstrated an association between riding attitude and road accident proneness. There are several riding attitudes, but speeding is the primary cause of poor riding attitudes in road accidents. Manan et al. (2017) report that over 50% of motorcyclists exceed the speed limit. For instance, the North-South Expressway has a speed restriction of 90 km/h to 110 km/h, although many motorcyclists violate this limit. Due to their excessive speed, most motorcyclists fail to use their turn signals, occasionally leading other vehicles to react impulsively and collide with one another. Based on the above reasoning, it is possible to conclude that negative individuals with bad attitudes are more likely to be involved in traffic accidents. In conclusion, the second hypothesis is validated.

Moreover, one of the objectives of this study was to establish whether there is a correlation between mindfulness and road accident proneness. Being mindful involves paying attention to the present moment and embracing one's emotions and thoughts without judgement (Salazar & Khandelwal, 2021). In other words, mindfulness is a process that is fundamentally opposed to situations in which individuals allow their thoughts to wander unintentionally, essentially functioning on human autopilot. Therefore, the condition may be summed up as a person's attention wandering owing to low levels of mindfulness caused by either an internal factor (such as human emotion) or an external source (e.g., a traffic jam). For example, when a motorcyclist is upset, they often lose concentration on the road. As a result, individuals are oblivious to the possibility that their actions may result in traffic accidents owing to overpowering emotions. Therefore, based on the justifications offered above, it is possible to conclude that mindfulness is a significant predictor of the likelihood of road accidents. As a result, it has been demonstrated that mindfulness has a negative and substantial effect on road accident proneness; hence, Hypothesis 3 was supported.

The relationship between riding anger, riding attitude, mindfulness, and road accident proneness has been determined to achieve the research objective. In addition, these relationships demonstrate that hypotheses 1, 2, and 3 were accepted.

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