

RESEARCH ARTICLE

The influence of personality type on the risk of driving

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ABSTRACT

Accidents are often caused by the driver himself, other people, or even the circumstances while driving. Even emotions influence behavior while driving. Individual factors relate to personality type. This research aims to determine the influence of agreeableness and neuroticism personality types on driving risks mediated by driving safety attitudes. The methods used in this research are experiments and surveys. The experimental tool used in this research is a driving simulator with the help of Urban Driving software. The experimental group was treated with a traffic volume and pedestrian density of 75%, and the control group was treated with a traffic volume of 50%. The measurement instruments used in this study consisted of a measure of risky driving behavior, a measure of aggressive driving behavior, a measure of agreeableness and neuroticism from the Big Five Scale, and attitudes towards safe driving. Thirty participants in this study were divided into two groups, namely the experimental and the control groups, with 15 participants. Based on the regression results of each group. The regression results show an influence of agreeableness and neuroticism mediated by driving safety attitudes on driving risks in the experimental and control groups; however, both groups have indirect impacts. These results prove that personality type greatly influences driving risk, mediated by driving safety attitudes.

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INTRODUCTION

Personality type is still an interesting discussion related to the risk of driving. Risk of driving is an individual's driving behavior, related to how the individual detects the movement of other vehicles when the individual responds to traffic hazards and controls attention when driving (Deery & Fildes, 1999). Drivers often ignore risks when driving, one of which is stated by Ulleberg & Rundmo (2003), that drivers who drive unsafely take another driver's path, ignore existing signs, and drive at high speeds, which is also related to a person's personality.

Accidents occurred in one of the big cities in Indonesia, namely in Yogyakarta, which was released by Bappeda (2021) in 2020; there were 4,559 cases. These accidents decreased compared to the previous year, reaching the number of 5000 accident cases. The causes of accidents that often occur

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are tire bursts, difficulty holding emotions when driving, difficulty complying with applicable signs, and driving carelessly (Aszhari, 2020). Risk of driving is an individual's behavior when driving unsafely, such as cutting other people's roads, driving at above-average speeds, and violating applicable signs so that it affects the emotional state of drivers (Deffenbacher, Lynch, Oetting & Yingling, 2001). Risk of driving is risk-taking behavior when driving, engaging in above-average driving behavior, driving while calling, eating, or doing other activities outside of driving (Carey, 2013).

Previous research conducted by Chrisnatalia, Ancok, Putri, and Karmilasari (2021) stated that there was an influence between aggressive driving and risky driving behavior, which was mediated by attitudes towards driving safety, which had an influence value of 78.5%. These results were obtained by combining the two groups' studies. Some countries have rules regarding speed limits. Germany has no maximum limit that causes many drivers to drive above 120 km/hour (Anonym, 2018). The United States has a minimum limit of 40 km/hour up to 137 km/hour, and some states have specific regulations. It is different in Australia. They have a speed limit of 130 km/hour.

The same thing happens in Indonesia, which has regulations for traffic speed limits with a speed limit on urban roads of 50 km/hour. This is set in the Regulation of the Minister of Transportation of the Republic of Indonesia No. 111 of 2015. With the binding regulations, the driver intends to comply with the speed limit and avoid the risk of driving or accidents caused by the driver himself, other people, or even the situation while driving. Therefore, several factors influence individuals, both internally and externally, related to risky driving behavior.

External factors relate to individuals who annoy the driver are like a cyclist who suddenly appears while the driver is driving (Lafont, Roge, Ndiaye & Boucheix, 2018), drivers who accidentally bump into other vehicles and can provoke other drivers' emotions (Sullman, 2015; Deffenbacher, White, & Lynch, 2004; Deffenbacher, Deffenbacher, Lynch, & Richards, 2003; Deffenbacher, Lynch, Oetting, & Yingling, 2001), and the driver accidentally hits a pedestrian (Krahe in Popușoi & Holman, 2016; Dula & Geller, 2003; Derry, 1999; Matthews, Dorn, Hoyes, Glendon & Taylor, 1998).

Another factor that affects individuals related to risky driving behavior is the internal factors, both emotions and personality. There are several studies related to personality traits. It influences driving behavior that has an accident involvement in individuals while driving (Ulleberg dan Rundmo, 2003; Chen, 2009; Yang, Du, Qu, Gong & Sun, 2013; Monteiro, de Holanda Coelho, Hanel, Pimentel, dan Gouveia, 2018; Al-Tit, 2020). The normlessness personality type has the same effect as the neuroticism personality type on the risk of driving (Yang, Du, Qu, Gong & Sun, 2013), Neuroticism and agreeableness that affect risky driver behavior are like losing concentration while driving, losing control of the vehicle (Dahlen & White, 2006), neuroticism (Wang, Zhang, Wang, Li dan Hou, 2020), and seeking of sensation that has a direct influence on dangerous driving behavior (Hermita, 2016).

In addition, there are also several studies related to personality types that affect the risk of driving, namely the agreeableness personality type, which has a sufficient influence on the risk of driving (Al-Tit, 2020), agreeableness which tends to be more aggressive when driving (Zhang, Qu, Ge, Sun and Zhang, 2017; Yang, Du, Qu, Gong, and Sun, 2013).

However, agreeableness personality types also tend to have a safe attitude when driving and are not easily offended by other drivers' acts (Shen, Ge, Qu, Sun, & Zhang, 2018; Ulleberg & Rundmo, 2003). Agreeableness and conscientiousness are negatively related to all forms of driving aggression (Burtäverde, 2003; Chraif, Aniței, & Dumitru, 2017). Agreeableness, normlessness, and seeking sensation are related to positive evaluations when driving and tend to obey traffic rules, namely attitudes toward safety (Mallia, Lazuras, Violani & Lucidi, 2015).

In several studies, there are safety driving attitudes that become a mediating variable in research related to personality types and risks of driving. Driving safety attitudes are an individual way to evaluate themselves when driving, whether the behavior is good or not, and this is often found as one of the predictors of driving behavior, and it allows this variable to be a mediating variable between personality and driving risk (Yang, Du, Qu, Gong & Sun, 2013; Chen, 2009; Ulleberg & Rundmo, 2003). Many of the related studies employ the questionnaire method, but this researcher utilizes the simulator as an additional tool to get more comprehensive results, and it combines with filling out the questionnaire.

This study aimed to determine the effect of agreeableness and neuroticism personality types, which is the main focus of driving risk. It is also mediated by driving safety attitudes. Researchers also conducted different tests in each research group. The conceptual framework of the research is presented in Figure 1.

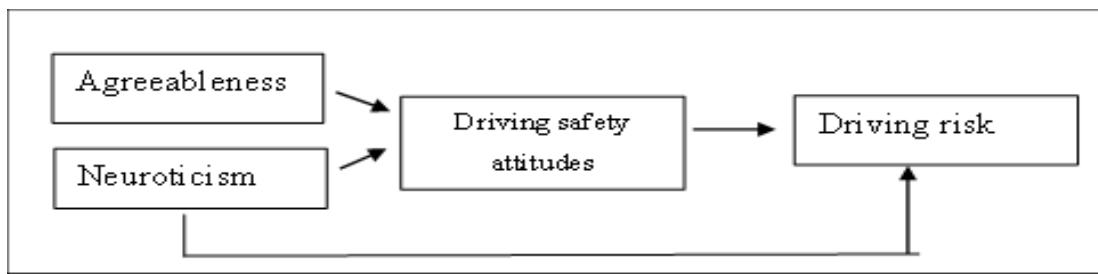


Figure 1 The conceptual framework

METHOD

This study applies an experimental and survey design, where participants try to use a driving simulator before doing the test. Experimental studies are research investigations in which the researchers manipulate independent variables to determine whether differences exist in the dependent variable among equal groups of participants (Schweigert, 2021). The most significant advantage of experimental studies is that they provide causal information about the influence of the independent variable on the dependent variable if conducted correctly.

Participants were asked to fill out an approval sheet for this experiment. After that, participants used a driving simulator. After using the driving simulator, participants completed a questionnaire regarding the personality types of aggressiveness, neuroticism, and driving safety attitudes. Participants were divided into two groups, namely the experimental group and the control group, with a morning session for the experimental group and the control group carrying out research during the day. The experimental group encountered driving obstacles at a relatively high-density level, interference from other drivers such as cutting lanes, and pedestrians crossing carelessly. In the control group, participants get certain road conditions, and the level of road density is not too high or normal.

Participants in this study were 30 people divided into two groups, namely the experimental group and the control group, with 15 participants for each. All participants are based on chance, have a driving license for at least one year, and are between 18 and 45 years old. The reason for using this age range is a study conducted by McCaulay and Sharkey (1992), which stated that drivers who use driving simulators show that older drivers are more prone to cybersickness, nausea, dizziness, and migraines that are very real. Therefore, the researchers limited the participants to that age.

The experimental group was asked to be present in the morning to use the simulator, while the control group had their data collected during the day to join the laboratory. In this study, researchers

found difficulties in getting participants due to the COVID-19 pandemic, which caused participants to be afraid of being in a closed room for a long time.

The researchers utilized City Car Driving Five software and applied driving simulator tools such as three screens for vehicle windshields. The researchers also use Logitech steering wheels and the G29 pedals equipment. In addition, the Logitech steering wheels and the G29 pedals consist of steering gear, gas pedal, brake and clutch, gears, a seat like a seat in an actual vehicle, and a Logitec C920 series webcam on the front and in the back to see the behavior of the participants while using a driving simulator. The participants use this headset to help them focus and feel like they are in a vehicle. It contains the engine sound, the brake sound, and the sound of other vehicles. City Car Driving is a tool designed to help users experience driving in a big city with various road situations, traffic density levels, and various types of cars that make the driver feel like driving an authentic or realistic vehicle. (<https://citycardriving.com/products /city card driving>).

From the simulator tool used in this study, the researchers see that violations in driving a vehicle caused the accidents. The driving simulator is in one room at Gunadarma University, Depok, West Java, Indonesia. The form of the simulator and how a participant uses a driving simulator are shown in Figure 2



Figure 2. Driving simulator and use of stimulators by participants

The scales in the research used three instruments, including the driving risk scale created by Ulleberg and Rundmo (2003). There are three components in measuring risky driving behavior: speed, rule violation, and self-assertiveness. The personality type scale uses a linguistic and cultural adaptation of the Big Five inventory developed by Ramdhani (2012). As an attitude instrument toward driving safety using a scale created by Ulleberg and Rundmo (2003), Iversen and Rundmo (2004) consist of three dimensions: traffic flow vs. compliance with rules, speeding, and fun riding.

This study uses the reliability test obtained from analyzing variations in Alpha Cronbach. The reliability value of agreeableness is 0.883, neuroticism is 0.874, and driving safety attitudes received a value of 0.949. At the same time, the results of driving risk are obtained from the simulator in the form of events, accidents, and violations.

Events are generalized data by the simulator to see the driver's response to various types of pedestrian behavior, such as crossing carelessly. Other accidents do not involve the driver or vehicles that overtake or cut off the respondent's path. Accidents occur when a driver is driving, such as hitting another driver or a pedestrian. The output results from the driving simulator can be seen in Figure 3

Violations are various types of mistakes made by drivers in the simulator, such as driving more than the average speed limit (80km/hour), violating regulations, cutting other drivers' lanes, turning without using a turn signal, and having other drivers in the simulator stop suddenly in front of them.

EVENT	DURATION	PENALTY	TIME FROM SESSION START
Motor vehicle behaviour dynamic.			
Weather conditions: Morning, Spring/Clear.			
Right-of-way at the intersection violated.			
You've had an accident.			
Right turn signal was not used when changing the lanes.		\$311	0:00:19
You are driving on a red light.		\$155	0:00:35
Right turn signal was not used when changing the lanes.		\$389	0:01:02
Dangerous entrance of the vehicle to the oncoming lane.		\$155	0:01:43
You are driving more than 10 kph over the speed limit.		\$194	0:01:46
You are driving more than 10 kph over the speed limit.		\$194	0:01:49
You are driving more than 10 kph over the speed limit.		\$194	0:02:09
You are driving more than 15 kph over the speed limit.		\$194	0:02:21
Emergency braking of the car ahead.		\$311	0:02:25
You've had an accident.		\$311	0:03:03
Right turn signal was not used when changing the lanes.		\$155	0:03:04
			0:03:24

Figure 3. Result from driving simulator

In the data collection procedure, participants are asked to fill out a consent form to participate in this activity. Participants also fill in personal data related to the Use of vehicles in daily life, such as whether they have a driving license, are used to driving at what speed km/hour, and the type of vehicle they use and usually go to. This is used to find out the results of using the simulator and what the driving attitude is when using the simulator; apart from that, from the simulator results, how many violations the driver committed can be obtained. After that, use the simulator for 10 minutes, divided into a trial and an experimental session. After the research subjects used the simulator, the drivers were asked to complete a personality questionnaire about agreeableness, neuroticism, and driving safety attitudes. The results in the driving simulator become part of the follow-up analysis.

The data analysis technique used is regression for each group that examines the personality types of agreeableness, neuroticism, driving safety attitudes, and risks. These four things are obtained based on the results of errors made by participants when using a driving simulator. All these analyses were aided by the Use of the Statistical Package for Social Sciences (SPSS) version 25.0

RESULT

Based on the experiment and filling out the survey, the results were obtained for the correlation test and the effect test. The purpose of this study was to determine the effect of agreeableness and neuroticism personality types mediated by driving safety attitudes toward driving risks. Based on the correlation test, the results show that the Agreeableness personality type has a relationship with driving risk ($Pearson = .163$, $p\text{-value} = .039$). *In contrast*, the Agreeableness value with driving safety attitude is obtained by a $p\text{-value} = .001$ value and a person correlation = $-.902$. This means a negative relationship exists between agreeableness and driving safety attitudes. When the agreeableness is high, the driving safety attitude is low.

Meanwhile, the test of the relationship between neuroticism and the risk of driving showed no association. However, the test of the relationship between neuroticism and driving safety attitudes showed a sig value of $.001$ and a correlation value of $.888$. This means a relationship exists between the Neuroticism personality type and the driving safety attitude. The explanation is in Table 1.

In the experimental group, there is a direct influence between the agreeableness personality type and driving safety attitudes with a regression weight value of (-0.101) . There is a direct influence between the neuroticism personality type and driving safety attitudes with a regression weight value of 0.220 . There is an influence of driving safety attitudes on driving risks. With a regression weight value of (-0.220) . As for the direct effect, it is presented in Table 2.

Table 1. Correlation of driving simulator with variables

Variable	Pearson correlation	Significance	Result
Agreeableness to the risk of driving	.16	.03	Supported
Neuroticism of the risk of driving	-.04	.07	Rejected
Attitude of driving safety to the risk of driving	-.09	.06	Rejected
Agreeableness to driving safety attitude	-.90	.01	Supported
Neuroticism to driving safety attitude	.88	.01	Supported

Table 2. Direct Effects experimental group (Group number 1 - Default model)

	X1 agreeableness	X2 neuroticism	M Driving safety attitudes
M Driving safety attitudes	-.101	.220	<.001
Y driving risk	<.001	<.001	-.220

Indirect effects between independent variables through mediating variables on the dependent variable. The influence of the agreeableness personality type, which is mediated by driving safety attitudes on risky driving behavior has an influence weight of 0.302; this means that there is an influence between the agreeableness personality type, which is mediated by driving safety attitudes on driving risks. Another result was that the neuroticism personality type mediated by driving safety attitudes towards risky driving behavior had a regression weight of (-0.420), so the results obtained were that there was an influence between the neuroticism personality type and driving safety attitudes towards driving risks. As for the direct effect, it is presented in Table 3.

Table 3. Indirect effects experimental group (Group number 1 - Default model)

	X1 agreeableness	X2 neuroticism	M Driving safety attitudes
M Driving safety attitudes	<.001	<.001	<.001
Y driving risk	.302	-.420	<.001

In the control group, there is a direct influence between the agreeableness personality type and driving safety attitudes with a regression weight value of (-.330). There is a direct influence between the neuroticism personality type and driving safety attitudes with a regression weight value of .101, and driving safety attitudes influence driving risks. With a regression weight value of (-.240). The direct effects it is presented in Table 4

Table 4. Direct effects control groups (Group number 1 – Default model)

	X1 agreeableness	X2 neuroticism	M Driving safety attitudes
M Driving safety attitudes	-.330	.101	<.001
Y driving risk	<.001	<.001	-.240

In Table 5, it is known that there is an indirect influence between independent variables through the mediating variable on the dependent variable. The agreeableness personality type mediated by driving safety attitudes towards risky driving behavior was found to have an influence weight of 0.101. This means that there is an influence between the agreeableness personality type, which is mediated by driving safety attitudes towards driving risks. Another result is that the neuroticism personality type, which is mediated by driving safety attitudes towards risky driving behavior, has a regression weight of (-0.112), so the results obtained are that there is an influence between the neuroticism personality type and driving safety attitudes towards driving risks.

Table 6 shows the results of the driving simulator, which finally revealed that participants experienced accidents and violations in the experimental group and control group; the forms of violations were such as exceeding the driving speed limit, deliberately cutting into another driver's path, deliberately blocking other drivers from walking, subjects trying to avoid other drivers who were driving and cutting off lanes, breaking through traffic lights, and not using turn signals when turning.

Table 5. Indirect Effects (Group number 1 - Default model)

	X1 agreeableness	X2 neuroticism	M Driving safety attitudes
M Driving safety attitudes	.000	.000	.000
Y driving risk	.101	-.112	.000

Table 6. Table of the number of participants who experienced accidents and violations in the driving simulator

Behavior in a Driving Simulator	Experiment groups	Control groups
Participants deliberately cut into another driver's lane (entering the opposite lane, crossing the broken line, and going the wrong way).	Ten participants	Eight participants
Participants deliberately block other drivers from moving (do not want to yield when turning or cornering)	Twelve participants	Ten participants
Participants follow other drivers who cut into their lane (blocking other vehicles, too close to other cars)	Twelve participants	Seven participants
Participants avoid other drivers who cut into their lane (respond quickly and make sudden braking)	Five participants	Nine participants
Pass the traffic light	Thirteen participants	Eight participants
Do not use sign lights	Nine participants	Nine participants
Exceeding the speed limit	Twelve participants	Six participants

DISCUSSION

The regression results show an influence of agreeableness and neuroticism, mediated by driving safety attitudes on driving risks in the experimental and control groups; however, both groups have an indirect role. This means that each individual in the experimental and control groups has a different risk of driving; this is also influenced by certain personality types, namely agreeableness and neuroticism. These results indicate that individuals with these two personality types still have a high enough risk of neglecting driving safety. This can be seen from the experimental results that some people drive at speeds above the average number, go through red lights, and enter the lane in the opposite direction to overtake other drivers.

This is in line with research conducted by Chraif et al. (2016), which states that individuals who drive with agreeableness and conscientiousness personality types and have good emotional stability tend to have a positive relationship with risky driving behavior. Meanwhile, the neuroticism personality type has a negative association with dangerous driving behavior. However, if it exists simultaneously, a reasonably high influence on driving risk is mediated by driving safety attitudes.

The calculation results show that the agreeableness personality type is related to the risk of driving. This means that participants in this study have a safe attitude when driving. This statement also aligns with the opinion of Roccas et al. (2002), which states that individuals with agreeableness personality types tend to be kind, obedient, modest, and more cooperative.

In addition, individuals who have this personality type tend to feel a little indifferent to driving safety. It is found that there is a negative relationship between agreeableness personality type and safety-driving attitudes. This means the safety driving attitude is lower when the agreeableness is higher. Participants in this study felt that it was necessary to have a safe attitude when driving, and they admitted that sometimes they tended to disobey the applicable rules. Another study conducted by Jiang and Rau (2018) states that drivers believe there is no problem whatsoever when they violate the rules, and they do not care whether they violate the law or not as long as the desired goal can be achieved and does not harm others. In contrast, the opinion of Chen (2009) states that individuals with a high tendency to the agreeableness trait will show a cooperative and trusting attitude. So, these individuals are less likely to engage in risky driving behavior.

The results showed that individuals with a neuroticism personality type did not have a relationship with driving risk. This is because the participants in this study did not have the pressure that caused anxiety when using this simulator. This aligns with research conducted by Yang et al. (2013), which states that neurotic individuals do not have an excessive risk when driving. Miles and Johnson (2013) said there was no significant difference between conscientiousness and neuroticism in driving violations.

The results showed that the neuroticism personality type has a safe driving attitude. This is also evident in a study conducted by Lajunent (2001), which states that extraversion has a positive relationship with the number of deaths due to traffic accidents. Meanwhile, neuroticism is negatively correlated with fatalities due to road accidents. Individuals with neuroticism tend to be safe when driving to avoid accidents.

The driving simulator shows the lack of a relationship between driving safety attitudes and driving risks in the simulator. This is because attitude measurement is carried out simultaneously with operating risk-taking. As stated by Ulleberg and Rundmo (2003), it can be problematic to admit that attitude predicts behavior because risk-taking behavior is measured simultaneously as attitude measurement, so it is common for attitudes to predict risk-taking behavior when driving. Other results showed an influence of agreeableness and neuroticism on the risk of driving, 63%. The results of this study are similar to the research conducted by Dahlen and White (2006). According to them, the openness personality type predicts risky driving behavior, and aggressiveness can indicate drivers who lose control of their vehicle. In addition, emotional stability can predict unsafe driving behavior and extraversion personality. Conscientiousness cannot demonstrate risky driving behavior.

Thus, the subjects in the study had a relatively high level of driving risk, which was influenced by agreeableness and neuroticism personalities. Research conducted in Jakarta, Indonesia, shows that conscientiousness, extraversion, agreeableness, and neuroticism have a significant relationship with driving risk, and other results show that male drivers tend to be more at stake when driving than female drivers (Triman & Bagaskara, 2016). This is in line with the results of this study, which showed no significant difference between male and female drivers. Research conducted by Idris and Napitupulu (2015) states that there is a relationship between the Big Five Personality Types and the risk of traffic accidents that occur among bus drivers in Riau.

Other studies explain agreeableness and neuroticism personality types on the risk of driving and conscientiousness, openness to experience, and extraversion have no relationship with the risk of driving (Chrisnatalia, M., Jie, L., Jixiong, C., & Wei, Z, 2023). The agreeableness personality type is related to the driver's violation behavior. Drivers with low agreeableness scores tend to have a higher risk of driving than those with high agreeableness (Arthur & Graziano, 1996). In addition, at the same time, changes in neuroticism also precede the onset of driving disorders in older drivers (Kuzma in Lucidi et al., 2014).

These results align with the research conducted by Yang, Du, Qu, Gong, & Sun (2013). The driver's personality traits were found to be significant. It also correlates with anger, sensation seeking, normlessness, and altruism. It is an effective predictor of ordinary offenses; altruism and normlessness were significant predictors for the total number of accidents experienced by drivers, and risky driving behavior and accident involvement, specifically anger and normlessness traits, were effective predictors of aggressive offenses.

Therefore, the driver needs to suppress aggressiveness while driving. Otherwise, there will be an accident that causes a risk while driving. This is similar to the research conducted by Chrisnatalia,

Ancok, Putri, and Karmilasari (2021), which said that aggressive driving had a 78.5% effect on risky driving behavior mediated by safe driving attitudes. Driving safety attitude can be an excellent mediating variable for driving risk.

Based on the results of the driving simulator, there are differences between the experimental and control groups based on the results of total violations in the simulator. This is by the conditions the researchers set to see the risks in the driving simulator. Among participants in the experimental group, there were differences between participants who braked suddenly and did not use signal lights when they wanted to turn or overtake other drivers. Drivers who often violate traffic signs tend to have accidents on the highway; drivers often ignore their surroundings or do not even focus when driving. This aligns with research that shows that drivers of a certain age tend to drive their vehicles relatively high, which can cause driving risks, especially for young drivers (Bingham & Shope, 2003; Tronsmoen, 2010).

CONCLUSION

This study concludes that driving risk influences agreeableness and neuroticism personality types, mediated by driving safety attitudes towards risky driving behavior. The acceptance of this research hypothesis evidences this. Researchers suggest multiplying participants and taking participants more diverse in age and occupation. With various participants, more prosperous and in-depth results will be obtained regarding the risks of driving on the highway. The Use of other modes of transportation, such as motorbikes or trucks, can also be investigated.

DECLARATION

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Author contribution statement

Maria Chrisnatalia led the overall research design, wrote up the results, and discussed and interpreted the results. Dian Kemala Putri and Karmilasari contributed to the research design, data collection, and analysis process. Stephanus Benedictus Bera Liwun contributed to preparing experimental tools and analysis processes.

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Data access statement

The data described in this article can be accessed by contacting the first author.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper

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