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Adolescents, Obesity, and Road Traffic Accident: Based on Indonesia National Survey

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Abstract

Background: The percentage of adolescents in Indonesia was 8.8%. Adolescents aged 15 – 20 years were the second highest (79.2%) injured due to road traffic accidents (RTA) with riding motorcycle. This study aimed to analyze the relationship between several variables that were predicted to be the cause of RTA of adolescents aged 15 – 20 years in Indonesia.
Methods: This study used a cross-sectional design using data obtained from the 2018 Basic Health Research (Riskesdas). The research sample was individuals aged 15-20 years who had experienced an injury. A total of 2,042 people were selected based on injuries due to traffic accidents and not from traffic accidents itself. Variables of sex, rural or urban areas, helmet use habits, suitability of using helmets, smoking status, history of consuming alcohol, emotional mental disorder issues and obesity issues. Bivariate analysis used the chi-square test with a significance level of P-value <0.05 and 95% confidence interval (CI), and multivariate analysis used the Binary Regression Logistic test.
Results: The variables of sex, helmet use habit, smoking habit, and obesity issues had a significant relationship with P-value < 0.005 with the incidence of traffic accidents in adolescents in Indonesia. After controlling of other variables, the direction of the positive relationship was shown in the variables of sex and obesity status with PR (95%CI) is 1.394 (1.139-1.706) and 1.551 (1.232-1.952).
Conclusion: Road Safety Education for adolescents aged 15-20 years, especially adolescents with obesity needs to be structured and implemented according to the needs of adolescents.

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INTRODUCTION

One of the global challenges, especially in a country with a large population, was Road Traffic Accidents (RTA) (Chang et al., 2020). According to the Global Road Safety Report, RTA cause more than 1.3 million deaths every year and around 20-50 million people were injured (Officer, 2019; World Health Organization, 2018b). This figure was predicted to increase by around 1.9 million in 2030 if the prevention efforts are not implemented optimally (Razzaghi et al., 2020; World Health Organization, 2020). Most of the deaths due to traffic accidents occur in low- and middle-income countries, especially in Africa and Southeast Asia (Officer, 2019; World Health Organization, 2018a).

Indonesia is a country in Southeast Asia with the fourth largest population in the world and has a fairly large risk of death due to traffic accidents (Soehodho, 2017). Traffic accidents accounted for 2.46% of deaths from the total population death and ranked eighth in terms of risk factors for death. in Indonesia. During the period 2015-2019, the number of traffic accidents in Indonesia increased by an average of 4.87% per year. The increasing in the incidence of traffic accidents in Indonesia was followed by an increase in the number of deaths and minor injuries, there are 1.41% and 6.26%, respectively (Badan Pusat Statistik Indonesia, 2020). These incidents occurred in both urban and rural areas (Rahmawati & Widyanti, 2017). Perpetrators and victims dominated by motorcycle riders who are adolescents, most of whom do not have a driver's license (Badan Pusat Statistik Indonesia, 2020; Rahmawati & Widyanti, 2017)

Adolescents have the highest vulnerability to be involved in traffic accidents compared to other age groups of drivers, especially in motorcycle accidents (Umniyatun et al., 2021a). Adolescent involvement in accidents is related to various factors, such as lack of driving experience, driving at high speed, violation of traffic rules and markings. road, fatigue, and distracted driving (using cell phones while driving) (Rolison & Moutari, 2020; Umniyatun et al., 2021a; Zhang et al., 2021). Sex is a strong predictor of risky driving behavior (Hidalgo-Fuentes & Sospedra-Baeza, 2019). Although men are more prone to risky behavior while driving, women are more likely to have mental emotional disorders, such as anxiety and fear, while driving. In women, both are prone due to panic while driving, lowering concentration, and taking irrational actions, such as maneuvers while driving that lead to traffic accidents (Hidalgo-Fuentes & Sospedra-Baeza, 2019; Rahman et al., 2021).

Another risk factor related to the risk of death due to traffic accidents is weight mass index (BMI). people with normal weight (BMI <25 kg/m2) and people who are obese (BMI ≥ 30 kg/m2) have an increased risk of death compared with people who are overweight (BMI=25 –29.9 kg/m2 persons (Arbabi et al., 2003). Apart from that, the behavior of not wearing a helmet while driving increases the risk of being involved in an accident, both in urban and rural areas. Without a helmet, accident victims are more likely to die from severe head injuries (Rahman et al., 2021). The phenomenon of ignoring the rules for wearing helmets while driving is increasing in drivers carrying passengers (OR=6.772) (Rusli et al., 2020), where most drivers do not force passengers to wear helmets. while traveling (Olanrewaju et al., n.d.). In contrast to Piatkowski's research which explains that helmet use rules are rarely ignored by drivers or passengers with higher BMI status (Piatkowski & Marshall, 2020).

Traffic accidents of adolescents can reduce the quality of life. Research in Mexico states that injuries from traffic accidents, especially for motorcyclists, cause the highest rates of lifetime disability (DALY's) (Chen et al., 2019; Dávila-Cervantes, 2021). Injuries from traffic accidents is 46.4% of productivity losses globally as 89% of victims experience lifelong disability (Chen et al., 2019). If the risk factors for traffic accidents in adolescents are not minimized, this will encourage an increase in the state's economic burden.

This study attempts to analyze the risk factors for traffic accidents in adolescents aged 15-20 years in Indonesia by utilizing the Riskesdas data of 2018. The several studies have found risk factors for traffic accidents of adolescents in Indonesia (Rahmawati & Widyanti, 2017; Soehodho, 2017; Umniyatun et

al., 2021b). However, there has been no similar study that uses Riskesdas data of 2018 data with the focus of adolescents. This research was important to provide the latest data and complement of previous findings by describing trends based on national demographics in Indonesia. One of the benefits is to proactively inform the adolescents about traffic accident prevention campaigns and initiate the enforcement of driving safety rules by relevant stakeholders.

METHODS

This study uses secondary data obtained from the results of the 2018 Ministry of Health Basic Health Research (Riskesdas) survey. This is a national-scale survey with a cross-sectional and non-interventional design conducted every 5 years. The population includes households in all provinces and regencies/cities (34 provinces, 416 regencies and 98 cities) in Indonesia. The data was collected by means of interviews, measurements, and examinations. Interviews used 2 instruments, there are: Household Instruments and Individual Instruments. Details on sampling techniques, survey design, survey instruments, measurement systems, and quality control have been described in several publications (Nurwanti et al., 2019; Rachmi et al., 2017; Thamrin et al., 2021). In this analysis, we used information collected from 59.423 respondents over the 15 age who had experienced in injury. Furthermore, 3.737 respondents were taken with ages between 15 – 20 years, and there are 2.042 respondents who were still high school students at the time of the interview and had filled out a complete questionnaire which was included in the final analysis.

Variables

The dependent variable of this study is traffic accident data taken from individual questionnaires with code E.06 "Is the injury caused by a traffic accident?". While, the independent variables in this study were selected based on previous research, there were 7 independent variables that we analyzed; such as: sex, rural or urban areas, habit of using helmets, suitability for using helmets, smoking issues, history of consuming alcohol, status of mental emotional disorders. and obesity issues.

Code of Ethics

The Research Ethics Committee of the Health Research and Development Agency (Balitbangkes), Ministry of Health of Republic Indonesia, reviewed and approved the survey protocol, design, data, and questionnaire (Number: LB.02.01/2/KE.024/2018). No further ethical clearance was required for the analysis of the secondary data. All participants were asked for consent and signed a consent form in the survey.

Data analysis

The data is presented in frequency and percentage based on a history of having a traffic accident. Chi-square analysis was performed to determine the relationship between the independent variable and the dependent variable. P-value <0.05 was considered statistically significant. The independent variable which has a p-value lower than 0.25 is included in the multivariable analysis. We analyze the final model using Binary Regression Logistics. All analyzes used SPSS 22.0 (IBM Corporation, NY, USA).

RESULTS AND DISCUSSION

The results of this study are presented briefly starting from the characteristics, cross tabulation results, and Binary Regression Logistics.

Table 1 shows that the characteristics of respondents who have experienced injuries due to traffic accidents in the past year were 59.1% men, 28.2% aged 15 years, 73.3% had experienced injuries to the lower limbs, 43.9% had abrasions/ bruises 95.9% had an accident with a motorcycle, and 78.7% as a rider.

The results of the cross tabulation in table 2 show the independent variables that are significantly related to the incidence of traffic accidents in adolescents with p-value < 0.005, namely sex (0.816; 0.680-0.980), the habit of using a helmet with intensity seldom (1.310; 1.052- 1.632), never used a helmet (1.654; 1.303-2.100), wore a standard unplugged helmet (1.049; 0.660-1.665), wore a non-standard helmet (1.398; 1.149-1.702), smoked with occasional intensity (1.745; 1.179-2.584), do not smoke or have quit smoking (1.529; 1.157-2.023) and obesity issues (0.653; 0.520-0.820).

Table 1. Characteristics of Respondents with Injuries due to Road Traffic Accidents

Characteristics	Injuries due to RTA	
	N = 799	%
Sex		
Male	472	59.1
Female	327	40.9
Age (year old)		
15	225	28.2
16	211	26.4
17	176	22.0
18	99	12.4
19	50	6.3
20	38	4.8
Nature of Injury		
Head injury	43	5.4
Back injury	2	0.3
Chest injury	6	0.8
Abdominal injury	8	1.0
Upper limb injuries	154	19.3
Lower limb injuries	586	73.3
Type of Injuries		
Bruising	351	43.9
Superficial injuries	130	16.3
Sprains	236	29.5
Fractures and broken bones	51	6.4
Limb loss	7	0.9
Eye injuries	7	0.9
Brain injuries	6	0.8
Burns	11	1.4
Type of Vehicle		
Motorcycle	766	95.9
Car	33	4.1
Subject		
Passengers	170	21.3
Driver	629	78.7

Table 3 shows the results of binary logistic regression which was the final model concludes sex, helmet use, smoking status, and obesity issues have a significant relationship with p-value < 0.005 with the incidence of traffic accidents in adolescents in Indonesia. After controlling for other variables, where the direction of the positive relationship was shown in the variables of sex and obesity status with PR (95%CI) respectively 1.394 (1.139-1.706), and 1.551 (1.232-1.952).

The various factors related to traffic accidents have been found in many studies. Both vehicle factors, environmental factors, road factors and human factors; they contribute to the influence of traffic accidents. A study reported that 93% of traffic accidents occur due to human factors, 34% due to operational deficiencies, and 12% due to vehicle breakdown (Alavi et al., 2017). In this study, we try to describe the causes of accidents in terms of human factors, especially in adolescents, based on the results of the Riskesdas 2018 survey in Indonesia. The data that we get is a combination of accidents for all vehicles. Although, it does not focus on motorcycles only, but the largest percentage of vehicles used are motorcycles (95.9%). Therefore, we will discuss the factors that influence traffic accidents for all types of vehicles, especially motorcycles.

Table 2 Cross tabulation of independent variable and road traffic injuries

Variables	Injuries due to RTA				*P-Value*	PR (CI 95)
	Yes N = 799		No N = 1243			
	n	%	n	%		
Sex						
Male	472	59.1	794	63.9		
Female	327	40.9	449	36.1	0.033	0.816 (0.680-0.980)
Region						
Urban	332	41.6	558	44.9		
Rural	467	58.4	685	55.1	0.137	0.873 (0.729-1.045)
Helmet use						
Always use	236	29.5	280	22.5		1
Sometimes	348	43.6	541	43.5		1.310 (1.052-1.632)
Never	215	26.9	422	34.0	0.000	1.654 (1.303-2.100)
Suitability of helmet use						
Wearing a standard buttoned helmet	549	68.7	769	61.9		1
Wearing a standard unbuttoned helmet	32	4.0	47	3.8	0.004	1.049 (0.660-1.665)
Wearing non-standard helmets	218	27.3	427	34.4		1.398 (1.149-1.702)
Smoking status						
Everyday smokers	110	13.8	116	9.3		1
Someday smokers	69	8.6	127	10.2		1.745 (1.179-2.584)
Former smokers	620	77.6	1000	80.5	0.005	1.529 (1.157-2.023)
Alcohol consumption						
Yes	26	3.3	36	2.9		
No	773	96.7	1207	97.1	0.646	1.128 (0.676-1.883)
Mental disorders						
Yes	401	50.2	613	49.3		
No	398	49.8	630	50.7	0.701	1.035 (0.867-1.237)
Nutritional status (BMI)						
Obesity	133	16.6	291	23.4		
Normal	666	83.4	952	76.6	0.000	0.653 (0.520-0.820)

Table 3. The logistics binary result analysis

Variables	B	Sig.	PR	95 % CI	
				Lower	Upper
Sex	0.332	0.001	1.394	1.139	1.706
Helmet use		0.000			
Sometimes	-0.547	0.000	0.579	0.455	0.737
Never	-0.253	0.021	0.777	0.626	0.963
Smoking status		0.001			
Someday smokers	-0.580	0.000	0.560	0.415	0.755
Former smokers	-0.024	0.887	0.976	0.704	1.354
Obesity	0.439	0.000	1.551	1.232	1.952
Constant	0.472	0.000	1.603		

a. Variables entered on step 1: region, sex, helmet use, Suitability of helmet use, smoking status, Alcohol consumption, Nutritional status, mental disorder

b. *Nagelkerke R Square* = 0.034

The main finding is that obesity issues and sex have a significant relationship with the incidence of traffic accidents in adolescents in Indonesia. The prevalence of overweight and obesity in adolescents aged 13-15 years based on Riskesdas 2013 is 10.8%. While in adolescents aged 16-18 years, the prevalence is 7.3% (Indonesia Ministry of Health, 2013). This figure continues to increase over a period of 5 years, with the each-respectively percentage is 16% in adolescents aged 13-15 years and 13.5% in adolescents aged 16-18 years (Indonesia Ministry of Health, 2019). It is predicted that 30% of them will experience nutritional and metabolic disorders in 2030. This prediction is in line with the phenomenon of the lack of physical activity of adolescents, which is supported by an increasing in the number of motorized vehicle production (Nurwanti et al., 2019; Umniyatun et al., 2021b).

As far as we are concerned, there are not many studies that explain why adolescent drivers with obesity are more at risk for traffic accidents. However, research in Vietnam has found evidence that motorcycle drivers who have an excessive BMI have a 12.2 times higher risk than normal BMI drivers (Truong et al., 2020). In line with this, various previous studies have also found factors associated with obesity and RTA (Bhatti et al., 2016b; Enayatollah et al., 2020; Liu et al., 2016).

Obesity is one of the main risk factors for motor vehicle collisions (Lavallière et al., 2020). Obese people tend to have low agility, balance, and activity speed (Mendoza-Muñoz et al., 2020; Thakur, 2016), and they are at high risk for Obstructive Sleep Apnea (OSA) (Bonsignore, 2017; Demirdöğen Çetinoğlu et al., 2015). In addition, people with obesity are reported to rarely use seat belts because the adipose in the abdomen of obese people shifts the seat belt from its normal position, resulting in seat belt imbalance. This results in more severe injuries in traffic accidents, especially injuries to the lower extremities and chest (Bhatti et al., 2016a; Homaie Rad et al., 2020; Schlundt et al., 2007).

On the other hand, the opportunity to ignore the rules of wearing helmets also increases by following the increasing of BMI. It is associated with physical discomfort, particularly in the neck and head (Arslan et al., 2020). Head-neck posture is the most significant determinant of neck strength and resistance to weight bearing (Chowdhury et al., 2021). However, the other studies do not confirm the anti-helmet community on motorcycle drivers is right because their statements that helmets can cause neck injuries due to the mass of the helmet (Rice et al., 2016). This is supported by Evans' research which describes the use of helmets as neuroprotective to minimize head and neck injuries for drivers (OR= 0.60 [95% CI] = 0.56-0.69]; $P < .001$) and passengers (OR= 0.35 [95% CI= 0.31-0.39]; $P = .002$) (Evans et al., 2018). The other evidence shows that drivers who do not wear helmets have a risk of 1.17 times were more likely to suffer head injuries than drivers who wore helmets (Tana et al., 2021).

As the prevalence gradually increases, obesity in adolescents can make a person experiencing significant economic and health burdens. When compared to non-obese people, obese people will increase the risk of injury severity, risk of complications, and even death (Homaie Rad et al., 2020; Theofilatos et al., 2021). In addition, obese people usually get a longer hospital stay if they have an accident. Previous research has revealed that obese people are 58% more likely to suffer an injury, particularly a neck injury, after an accident compared to normal weight people (Bittar et al., 2020; Hoebee et al., 2021).

We found that sex was also associated with RTA. In this study, sex was positively related 1.39 times with the incidence of traffic accidents. Female drivers have a higher chance of being involved in a non-fatal accident, while male drivers have a higher chance of being involved in a traffic accident that can be death. In line with this, a study reported that men had a significant relationship with the incidence of traffic accidents (Lowe et al., 2020). Where male drivers are shown to tend to engage in aggressive driving and other risky behaviors that increase the possibility of male drivers being involved in fatal accidents (Hailemariam et al., 2020). Meanwhile, female drivers have been shown to be less skilled in driving can result of failing to give the others' rights in way; it can increase the possibility of being involved in non-fatal injuries during accidents (Hailemariam et al., 2020).

CONCLUSION

From this study, it can be concluded that obese adolescents are more likely to be involved in an accident. In addition, adolescents, both male and female, have the potential to be involved in accidents due to lack of driving skills and risky behavior while driving. This study adds to the evidence that the human factor is one of the causes of traffic accidents. The human factor in this case is the condition of the driver with obesity and risky behavior while driving. So, road safety education needs to be done often for adolescents so that in their skills, knowledge, attitudes, and behavior while driving, can be safer. The limitation in this study is the injury data obtained, came from the respondents' answers but those have been completed with medical reports, so the severity of the accident could not be assessed in more detail.

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