



# Efficiency of Helmet and Protective Clothing Use on Outcomes of Patients with Motorcycle Accidents

## Motosiklet Kazalarında Başlık ve Koruyucu Kıyafet Kullanımının Hasta Sonuçlarına Etkisi

Helmet And Protective Clothing Use in Motorcycle Accidents

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### Özet

**Amaç:** Motorlu araç kazaları, özellikle gelişmekte olan ülkelerde, büyümekte olan bir halk sağlığı sorunudur. Bu çalışmada, motosiklet kazalarında başlık ve koruyucu kıyafet kullanımının kafaya, gövdeye ve ekstremitelere yönelik yaralanmalardan koruyucu rolünü aydınlatmayı amaçladık. **Gereç ve Yöntem:** Hitit Üniversitesi Çorum Eğitim ve Araştırma Hastanesi Acil Servisine 01 Ocak 2010 ile 01 Temmuz 2015 tarihleri arasında Motosiklet kazası nedeniyle başvuran 18 yaş üstü her iki cinsiyetten hastalar retrospektif olarak bu çalışmaya dahil edildi. Tıbbi kayıtlarından hastaların yaralanma bölgeleri, radyografik bulguları, başlık ve koruyucu kıyafet kullanım durumları ve konsültasyon, hastaneye yatırılma veya cerrahiye alınma durumları araştırıldı. Sonra hastalar iki alt gruba ayrıldı. Grup I: Başlık ve koruyucu kıyafet kullanmayanlar, Grup II: Başlık ve koruyucu kıyafet kullananlar. Gruplar istatistiksel olarak karşılaştırıldı. **Bulgular:** Çalışmaya motosiklet kazasıyla gelen 120 hasta dahil edildi. Hastaların 73'ünün (%60.8) başlık veya koruyucu kıyafet kullanmadıkları tespit edildi. Kullananların sayısı 47 idi (%38.2). En sık konsültasyon istenen bölüm Beyin Cerrahisi idi. Gruplar karşılaştırıldığında, travmatik beyin hasarlı 8 hastanın 7'sinin Grup I'de yer aldığı bulundu. Bu bulgu istatistiksel olarak anlamlıydı. Kaza öncesi alkol kullanım oranı grup 1'de (%15.1), grup 2'ye (%6.4) göre istatistiksel olarak anlamlı derecede daha fazlaydı. Ne var ki, gruplar yaş, cinsiyet, spinal yaralanma, uzun kemik kırıkları ve intraabdominal yaralanmalar açısından karşılaştırıldığında istatistiksel anlamlılık tespit edilemedi. **Tartışma:** Başlık kullanımı motosiklet kazalarında kafa yaralanmasını önlemektedir. Ne var ki, koruyucu kıyafet kullanımı gövde ve ekstremitelere yaralanmalarından korunmaya katkı sağlamamaktadır. Başlık kullanımı ve alkollü motosiklet kullanımı için etkili yasalar ve motosikletçilerin eğitimi, motosiklet kazalarında mortalite ve morbiditeyi azaltmaya yardımcı olabilir.

### Anahtar Kelimeler

Acil; Kask; Motosiklet Kazası; Koruyucu Giysi; Travma

### Abstract

**Aim:** Motor vehicle accidents are a growing public health problem, particularly in developing countries. In this study, we aimed to clarify the role of helmet and protective clothing in prevention from injuries to the head, trunk, and extremities in motorcycle accidents. **Material and Method:** Patients over 18 years old of both genders who were admitted to the Emergency Department (ED) of Hitit University Corum Training and Research Hospital due to a motorcycle accident between January 1, 2010 and July 1, 2015 were included in this retrospective study. We used their medical records to identify the location of injury, radiographic findings, use of helmet and protective clothing, and whether the patient was consulted, hospitalized, or underwent surgery. Then, patients were divided into two subgroups. Group I: Patients without helmet and protective clothing. Group II: Patients with helmet and protective clothing. The groups were compared statistically. **Results:** One hundred and twenty patients admitted to our ED due to a motorcycle accident were included in the study. It was determined that 73 (60.8%) of the patients had not used a helmet or protective clothing, whereas 47 (38.2%) had used a helmet or protective clothing. Neurosurgery was found to be the most frequently consulted speciality. When the groups were compared, it was found that 7 of 8 patients with traumatic brain injury were in Group I. This finding was statistically significant. The rate of alcohol intake before the accident of Group I (15.1%) was statistically significantly higher than in Group II (6.4%). When the groups were compared according to age, gender, spinal injuries, long bone fractures, and intraabdominal organ injuries, there was not any statistical significance. **Discussion:** Helmet use is found to be useful to prevent head injuries in motorcycle accidents. However, protective clothing does not contribute to prevention from injuries to the trunk and extremities. Strict laws for helmet use, intake of alcohol prior to driving a motorcycle, and education of motorcyclists may help reduce morbidity and mortality in motorcycle accidents.

### Keywords

Emergency; Helmet; Motorcycle Accident; Protective Clothing; Trauma

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**Introduction**

Road traffic injuries and death are a major health problem worldwide, particularly in developing countries [1,2]. More than half of the people killed in traffic crashes are young adults aged between 15 and 44 years. According to the reports of the World Health Organization (WHO), more than one million people died from road traffic crashes in low and middle-income countries in 2000. It is estimated that this number will double by the year 2020 [3]. As a form of motorized transportation, motorcycles are one of the most dangerous types [4]. Motorcyclists were reported to be three times more likely than car occupants to be injured in a crash, and 16 times more likely to die [5].

In this study, we aimed to determine the effects of helmet and protective clothing on injuries to the head, trunk, and extremities after motorcycle crashes.

**Material and Method**

After institutional review board approval, patients over 18 years old of both genders who were admitted to the Emergency Department (ED) of Hitit University Corum Training and Research Hospital due to a motorcycle accident between January 1, 2010 and July 1, 2015 were included in this retrospective study. We used their medical records to identify the location of injury, radiographic findings, use of helmet and protective clothing, and whether the patient was consulted, hospitalized, or underwent surgery. Patients whose data was not fully accessible, who had minor injuries, those who required cardiopulmonary resuscitation (CPR), and those whose injury site could not be determined were excluded from the study.

Patients were divided into two subgroups. Group I: Patients without helmet and protective clothing. Group II: Patients with helmet and protective clothing. The groups were compared according to the findings in the ED. Protective clothing was considered to include a jacket, pants, shoes, and gloves [8].

For the statistical analysis, Statistical Package for the Social Sciences (SPSS) for Windows version 17.0 (SPSS, Inc, Chicago, IL) software program was used. Continuous data are presented as means and standard deviations, and categorical variables are presented as percentages. Groups were compared using the Chi-square test.  $P < 0.05$  was considered significant, with a 95% confidence interval.

**Results**

During the 67-month period, 2235 motor vehicle accident cases were admitted to our ED. Of these, 248 patients were admitted due to motorcycle accidents. Only 120 patients met the study inclusion criteria. Of the excluded patients, 110 patients with minor injuries were treated in the ED and discharged without follow-up, and 18 patients required CPR on admission to the ED. (12 died in the ED and 6 died in the Intensive Care Unit.)

The mean age of the 120 patients enrolled in the study was  $36 \pm 14$  years. 107 (89.1%) of the patients were male and 13 (10.8%) were female.

It was determined that 73 (60.8%) of the patients had not used a helmet or protective clothing (Group I), while 47 (38.2%) did use a helmet or protective clothing (Group II).

Comparison of groups according to characteristics and findings are summarized in Table 1. When the two groups are compared,

Table 1. Comparison of groups according to characteristics and findings in Emergency department

Characteristics	Group I (n,%)	Group II (n,%)
Number of patients	73 (60.8)	47 (38.2)
Mean age (years)	$35 \pm 13$	$37 \pm 13$
Gender		
Male	65 (89)	42 (89.4)
Female	8 (11)	5 (10.6)
Alcohol intake*	11 (15.1)	3 (6.4)
Additional passenger presence on motorcycle	17 (23.3)	10 (21.3)
Colliding object with motorcycle		
Vehicle	26 (35.6)	16 (34)
Human	13 (17.8)	9 (19.1)
Animal	9 (12.3)	6 (12.8)
Fixed objects	21 (28.8)	13 (27.7)
Other reasons	4 (5.5)	3 (6.4)
Emergency application time (hours after accident)		
First hour	48 (65.8)	30 (63.8)
1-2 hour	13 (17.8)	9 (19.2)
>2 hours	12 (16.4)	8 (17)
Consultation		
Others	23 (54.7)	19 (45.2)
Neurosurgery	20 (62.5)	12 (37.5)
Orthopedics	15 (60)	10 (40)
General surgery	8 (61.5)	5 (38.4)
Plastic surgery	3 (60)	2 (40)
Ear-nose-throat surgery	3 (75)	1 (25)
Thorax surgery	2 (100)	0 (0)
Injuries		
Subdural hematoma*	4 (80)	1 (20)
Epidural hematoma	2 (100)	0 (0)
Spinal trauma	2 (66.6)	1 (33.3)
Long bone fracture	4 (66.6)	2 (33.3)
Intraabdominal organ injury	1 (50)	1 (50)
Maxillofacial trauma	1 (100)	0 (0)

\* Statistically significant difference,  $p < 0.05$

there is not any statistically significant difference for gender and mean age.

Of the patients in Group I, 65.8% were admitted to the ED in the first hour after the accident. Similarly, this rate was 63.8% in Group II.

The alcohol intake rate of Group I (15.1%) was statistically significantly higher than in Group II (6.4%).

For both groups, the objects most frequently colliding with their motorcycles during accidents were other vehicles and fixed objects.

The additional passenger presence rates of Groups I and II were similar (23.3%, 21.3%).

Of 120 patients, 32 patients were consulted with neurosurgeons, 25 with orthopedic surgeons, 13 with general surgeons, 5 with plastic surgeons, 4 with ear-nose-throat surgeons, 2 with thorax surgeons, and 42 with other specialities. Besides, 12 patients were hospitalized by neurosurgeons, 7 by orthopedic surgeons, 2 by general surgeons, 1 by ear-nose-throat surgeons, and 1 by plastic surgeons after surgery.

Traumatic brain injury (TBI) was determined in 7 patients who

were consulted with neurosurgeons (subdural hematoma in 5 and epidural hematoma in 2). Also, traumatic spinal bone fracture was determined in 3 patients. Long bone fracture requiring surgery was determined in 6 patients.

In 2 patients, intraabdominal organ injury was determined. One patient underwent surgery for tissue defect by plastic surgeons and 1 by ear-nose-throat surgeons for maxillofacial trauma.

When the groups were compared, it was found that 7 of 8 patients with TBI were in Group I. This finding was statistically significant. However, when the groups were compared according to spinal injuries, long bone fractures, and intraabdominal organ injuries, there were no statistically significant differences.

## Discussion

The prevalence of motorcycle injuries has been reported to vary from 12.8% to 60% [7]. The prevalence of motorcycle accidents among all motor vehicle accidents was found to be 10.6% in our study. As motorcycle use grows rapidly in Turkey, the incidence of injuries related to motorcycle accidents will increase.

Most injuries and disabilities due to motorcycles occur in the productive age group of the society, which causes enormous social and economic problems [8]. Compatible with the literature, our study revealed that young adults of productive age are more likely to be affected by motorcycle accidents. It is also known that men are more frequently affected [4]. In accordance, the majority of the patients involved in our study were men.

Alcohol intake is one of the most important factors that can lead to traffic accidents. Mascarenhas et al. reported that 13.3% of the cases with motorcycle injuries had consumed alcohol in the six hours prior to the accident [9]. Similarly in our study, the alcohol intake rate of Group I was 15.1%, statistically significantly higher than that of Group II (6.4%).

In a study by Nwadiaro et al., it was reported that most motorcycle accidents caused a single injury rather than polytrauma. In their study, they found that 90.6% of the patients had a single injury. They also reported that this may result from the fact that most of the motorcycle accidents took place within the town, where traffic speeds are slower and high-velocity injuries are less likely [10]. In our study, accordingly, the majority of the patients suffered a single injury requiring a single consultation. In one study, it was reported that head injuries and fractures represent about 60% of the cases [4]. Similarly, in a study by Burns et al., the rates of the most common orthopedic injuries were found to be fractures of the tibia/fibula (19.01%), spine (16.21%), and forearm (10.14%). The most common non-orthopedic motorcycle crash injuries were concussions (21.09%), skull fractures (8.23%), face fractures (13.66%), and hemo- and pneumothorax (8.79%) [11]. In our study, compatible with these findings, the head was the most common injury site. Orthopedic problems took second place.

Traumatic brain injuries (TBIs) are a leading cause of motorcycle-related deaths and are also among the most severe and costly nonfatal motorcyclist injuries. Nonfatal TBIs consume significant medical resources in the acute phase of treatment, and patients with nonfatal TBIs may also require extensive rehabilitation. It is known that helmets that meet federal safety standards are the most effective way to reduce the risk of head trauma in a motorcycle crash [12]. Helmets are estimated to be

42% effective at preventing death and 69% effective at preventing head injury when a crash occurs [13]. Our results have also shown that riders who do not wear helmet are under significant risk of TBIs.

The results of these studies underline the importance of helmet use for motorcyclists. However, it was also reported that helmet use rates have not yet reached the desired level. The most common reason for not wearing a helmet was found to be the weight of the helmet (77%). Other reasons were the feeling of heat during helmet use (71.4%), neck pain (69.4%), feeling of suffocation (67.7%), and limitations in the movements of the head and neck (59.6%) [10].

In our study, TBI was determined in only one patient in Group II. This result indicates the importance of helmet use for motorcyclists for preventing mortality and morbidity. Helmet use must be encouraged and increased. We agree with Faryabi et al. that helmet manufacturers must, in the construction of standard helmets, consider factors that determine the ease of use and motorcyclist comfort, in order to increase usage. Also, motorcyclist training should seek to change their attitudes and behaviors to help increase the usage of helmets and decrease risky behaviors during riding [8]. In addition, as Erdogan et al. have suggested, strict license controls and adding motorcycle protective clothing to motorcycle sales may reduce the incidence of injuries from motorcycle crashes [6].

When the results of our two groups were compared, while helmet use was found to be effective, protective clothing use did not affect patient outcomes. In a study by Bjonskau et al., it was reported that motorcycle jackets had no significant effect on systemic injuries but were effective against soft-tissue injuries. Motorcycle pants, shoes, and gloves were not protective for upper and lower extremity fractures, but they were protective against soft-tissue injuries [14]. In another study, it was determined that motorcycle protective clothing reduced soft-tissue injuries. It was also determined that there was a need for protective clothing to evolve to protect against fractures and systemic injuries [6]. Similarly, our results revealed that protective clothing does not protect motorcyclists from injuries to the trunk and extremities.

The motorcyclists and their passengers were nearly equally involved in the motorcycle injuries. Thus, the passengers have an equivalent risk of injury [15]. So, strict licence laws and education of motorcyclists is essential not only for their own lives but also for their passengers' lives.

## Conclusion

Road traffic accidents are one of the leading preventable causes of illnesses and premature deaths. Policymakers must implement effective policies to reduce this menace, especially among men. It is also known that accidents have a high cost to society [4]. Motorcycling is a growing factor in transportation-related costs. In this study, we determined that helmet use decreases risk of TBI in patients with motorcycle accidents. However, protective clothing does not contribute to prevention from injuries to the trunk, spine, and extremities. Strict license laws and continuous education for motorcyclists must be implemented in order to reduce mortality and morbidity.

### Competing interests

The authors declare that they have no competing interests.

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