

Trailer-Attached Two-Wheel Tractor (Patpat) Accidents on Roads in Turkey

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Abstract

Trailer attached two-wheel tractor (Patpat) accidents on roads are in increasing trend in Turkey. This work examined these incidents to help find precautions to reduce the accidents, casualties and monetary losses. Accidents occurred on roads in Turkey from 2006 to 2016 were studied. The data were analyzed based on the number of fatal and injury accidents, number of killed and wounded, distribution to regions and provinces, accident types, accident timings, features of the drivers, accessibility to first aid, etc. In the 11 year period, 326 accidents (6 fatal, 320 injury) in Police Responsibility Areas (PRA) and 318 accidents (25 fatal, 293 injury) in Gendarmerie Responsibility Areas (GRA) with the total 644 accidents were studied. A total of 1458 people (34 dead and 1424 injured) were affected. The accidents occurred mostly as crash / collision (PRA: 69.6%, GRA: 65.7%) and were most frequent during the summer (PRA: 40.5%, GRA: 43.1%). The incidents in PRA were mostly in urban areas (82.5%) as the ones in GRA were mostly in the rural areas (53.8%). Most of the operators had primary school education (PRA: 68.1%, GRA: 47.5%), were male (PRA: 97.5%, GRA: 97.2%) and had no driver's license (PRA: 63.8%; GRA: 74.2%). These vehicles with no standard structure are not suitable for road traffic as they are slow, with low braking and steering ability and low visibility at night. As the majority of the incidents are of human origin, training and traffic surveillance should be increased. Also, low-cost and safer alternative vehicles are needed.

Key words: Two-wheel tractor, Trailer, Patpat, Agriculture, Safety, Accident

Türkiye'de Yollarda Meydana Gelen Römork Eklenmiş İki-Tekerlekli Traktör (Patpat) Kazaları Özeti

Türkiye'de yollarda meydana gelen römork eklenmiş iki tekerlekli traktör (Patpat) kazaları artış eğilimindedir. Bu çalışma; kazaları ve kayıpları azaltmak amacıyla alınabilecek önlemleri belirlemek amacıyla yapılmıştır. Çalışmada 2006-2016 yıllarında Türkiye'de yollarda meydana gelen kazalar incelenmiştir. Veriler, ölümlü ve yaralanmalı kaza sayısı, ölü ve yaralı sayısı, kazaların bölge ve illere göre dağılımı, kaza tipi, kaza zamanı, sürücü özellikleri, ilk yardım durumu gibi kriterler açısından değerlendirilmiştir. 11 yıllık dönem içerisinde Polis Sorumluluk Alanı (PSA)'nda 326 kaza (6 ölümlü, 320 yaralanmalı), Jandarma Sorumluluk Alanı (JSA)'nda ise 318 kaza (25 ölümlü, 293 yaralanmalı) olmak üzere toplam 644 kaza olmuştur. Kazalardan toplam 1458 kişi (34 ölü ve 1424 yaralı) etkilenmiştir. Kazalar çoğunlukla çarpma / çarpışma (PSA: %69.6, JSA: %65.7) şeklinde ve yaz aylarında (PSA: % 40.5, JSA: % 43.1) meydana gelmiştir. PSA'ndaki kazalar daha çok yerleşim yerlerinde (%82.5), JSA'ndaki kazalar ise kırsal alanlarda (% 53.8) meydana gelmiştir. Kazaya karışan sürücülerin çoğu ilköğretim mezunu (PSA: %68.1, JSA: %47.5), erkek (PSA: %97.5, JSA: %97.2) ve sürücü belgesine sahip değildir (PSA: %63.8, JSA: %74.2). Standart yapıya sahip olmayan bu araçlar, yavaş hareket etme, düşük frenleme ve direksiyon kabiliyeti ve geceleri görünürlüğünün düşük olması sebebiyle karayolu trafiğine uygun değildir. Kazaların çoğunun insan kaynaklı olması nedeniyle, eğitim ve trafik denetimine önem verilmelidir. Ayrıca ucuz ve güvenli alternatif araçlara ihtiyaç vardır.

Anahtar kelimeler: İki-tekerlekli traktör, Römork, Patpat, Tarım, Güvenlik, Kaza

Introduction

Agriculture is considered among the most three hazardous sectors together with construction and transportation (Lundqvist 1996). In some countries, the fatal accident rate in agriculture is double the average for all other industries (ILO 2000). Farm machinery such as tractors and harvesters has the highest frequency and fatality rates of injury in agriculture (ILO 2000). Wilkins et al. (2003) reported that about half of the fatal agricultural injuries were related to tractors and at least half of those were due to tractor overturns. Rollover Protective Structures (ROPS) are used to create safe space for tractor operators in case of tractor rollover and have a substantial effect in decreasing the fatality. Seatbelt use on tractors has also been studied. If the seatbelt was fastened on ROPS-equipped tractors, only minor injuries were observed on the operator in an overturn (Myers et al. 2006).

Most developing countries do not have ample statistical database for farm-related injuries including Turkey. Limited statistical data on farm tractor incidents are collected by government agencies mainly by Turkish Statistical Institute (TurkStat) in Turkey. These data include the number of traffic accidents causing material loss, injury, and death according to vehicle type including farm tractors on roads. Though, very limited official statistical data are available on incidents in the work environment on farms. Golbasi (2004) studied 880 tractor injuries occurred in 1990-2001 and reported that the most common accident type was rollovers (60%). Oz (2005) conducted a survey study with 250 farmers in the Aegean region and reported that the most common incident types were rollovers (27%), crash (26%), and collision (22%). Gorucu Keskin et al. (2012) conducted a survey study with 107 operators in Hatay province and most of them were tractor rollovers (65.4%). Dogan et al. (2010) reported that tractor overturn was the cause of 37.2% of the 86 deaths in tractor accidents in Konya province. Keskin and Sekerli (2018a) found that the fatality rate was very high at

about 39.6% in thresher accidents in Turkey. Keskin and Sekerli (2018b) reported that the most two common incident types were fires (41.4%) and entanglement of body parts to machinery (25.9%) in combine harvester field incidents in Turkey.

Even if farm tractor is designed for farm works, it is common to see its uses on roads for transport particularly in developing countries including Turkey. This practice cause many accidents on roads resulting in injuries and deaths. Keskin et al. (2016) reported that from 2004 to 2013, on average, 1903 on-road farm tractor accidents occurred every year in Turkey. 79 of them were fatal (4.2%) as 1201 of them resulted in injuries. On average, annually, 40 drivers were killed and 504 drivers injured. These accidents included only the ones occurred on roads and not the ones in field conditions on farms. Darcin et al. (2016) studied 8486 tractor traffic accidents on roads in rural areas in Turkey in 2011-2015 and stated that the rate of fatality was 12.1% on average as compared to 3.9% in all vehicles.

Single-axle two-wheeled tractors are widely used in soil tillage mainly in developing countries including Turkey. On small farms, the main role of this machine is soil tillage with tools such as plow, cultivator, rotovator, roller, etc. (Golbasi 2015). It is also used to power some small farm machines like sprayers and water pumps. Terms used for two-wheel tractors include one-axle tractor, hand tractor, walking tractor, power tiller, power hoe, rotary hoe, rotary tiller, rotary plough, iron-ox, mechanical ox, oxmachine and tok-tok (Ericson 2010). In Turkey, farmers name it as "Patpat" or "Tirtir" due to its engine noise.

In recent years, there has been a great increase in the use of two-wheel tractors in Turkey. The total number increased from about 14 800 in 2006 to about 72 900 in 2016 (Figure 1) (TurkStat 2016). The total number of tractors including the two wheel tractors in Turkey was about 1.27 million as of 2016 (TurkStat 2016). The ratio of the two wheel tractors to the total number of tractors has

also increased about 3.8 times from 1.4% in 2006 to 5.7% in 2016. (Figure 1).

The trailer-attached two wheel tractors (Figure 2) are also used for transportation in

the rural and urban areas for mainly replacing animal-drawn carts even if they have been developed for use on the farms and this often results in accidents.

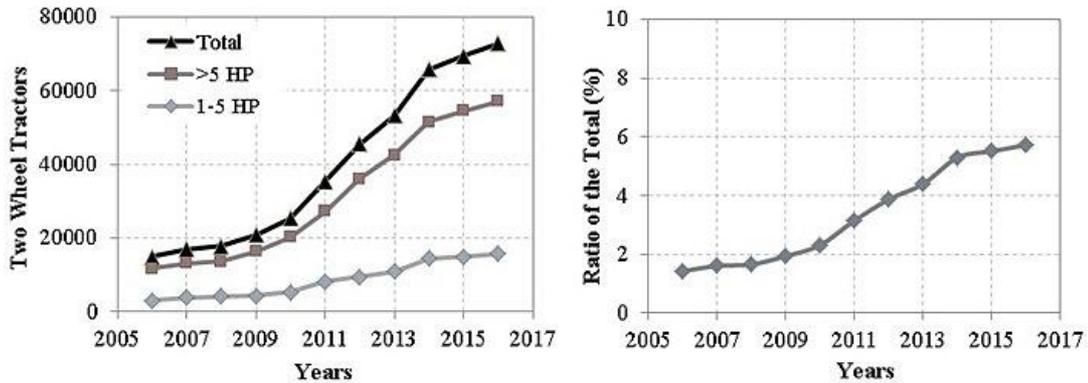


Figure 1. Total number (left) and ratio (right) of two wheel tractors in Turkey (TurkStat 2016)

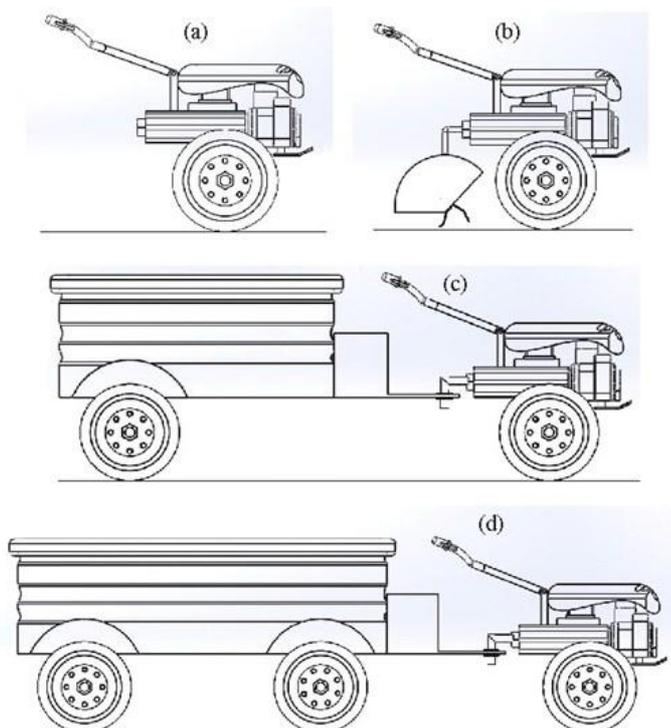


Figure 2. Two wheel tractor (a), with attached tillage equipment (b), and attached trailers (c, d)

Since these vehicles are not standard road vehicles, they are not suitable for road traffic and they are usually not registered and not given vehicle plates and also traffic tickets are issued to the driver for its use on roads (Golbasi 2015). Many accidents occur and many people are killed or injured. Even if

the use of trailer-attached two wheel tractors (Patpat) has become more widespread and the accidents have increased in recent years, there are not enough studies abroad and in Turkey regarding these accidents.

Only several studies on two wheel tractor accidents were reported in the world

mainly in eastern Asian countries. Shridar et al. (2006) conducted a survey on two wheel tractors in Tamil Nadu province of India and reported that these machines were used mostly for weed control (78.5%) and transportation (55.5%) and most of the accidents occurred when crossing bunds (91%) and road transportation (84%). Ericson (2010) reported that 130 out of 2147 (6%) traffic accidents were related to two wheel tractors and 5% of these were fatal in Laos while 18 out of 307 (6%) accidents involved two wheel tractors and 5% of them resulted in death in Cambodia. It was also reported that 98% in Cambodia and 94% in Laos did not have rear lights. Kim et al. (2016) reported that 453 accidents involved two wheel tractors in South Korea and 178 of them were on farms as 275 of them were in the form of traffic accidents. The most common causes of the accidents were personal mistakes (carelessness, negligence of front watching and unskilled operation).

There have been a few studies on two wheel tractor accidents in Turkey which covered only one province or one region and focused only on the hospitalized victims. Karapolat et al. (2011) reported that 105 out of 549 (19.1%) accident victims brought to hospital had an accident while using a two wheel tractor. 51.4% of the incidents occurred on roads as 48.6% occurred on farm areas. 82.9% of the accidents were overturn while 14.3% are collision and 2.8% are falls from the vehicles. Kucuker (2012) analyzed 28 death cases caused by Pat-pat accidents in Afyon province. He reported that 60.7% of the accidents were rollover while 60.7% of the victims were drivers and 39.3% were passengers. Kahveci et al. (2015) studied 53 victims accepted to hospital. 39 (73.6%) of them were male and 14 (26.4%) were women with an age from 5 to 76 years while the injury zones were upper and lower extremities (52.8%) and head and neck area (17.0%). Say et al. (2016) reviewed 46 orthopedic injury patients brought to two hospitals in Samsun province. 74% of the accidents were farm work accidents as 26% were traffic accidents. 91% of the victims had

open fractures. They reported that these vehicles should have a protective structure against such injuries and they should not be used in traffic.

All previous studies carried out on two wheel tractors in Turkey focused on the accident casualties brought to hospitals in one or several provinces or regions. As a result of extensive literature search, no studies have been found to evaluate trailer-attached two wheel tractor (Patpat) accidents in whole country. Thus, the aim of this study was to analyze two wheel tractor accidents on roads in Turkey. It is aimed to share the results of the study with the stakeholders to help reduce the number of injuries, deaths and related costs.

Material and Method

This study covered whole country Turkey which has seven geographic regions and 81 provinces. Agriculture is a crucial sector in Turkey producing a wide range of products and providing jobs to nearly 23% of the total residents in 2012 (Berk 2013). The cultivated area is large (24.5 million ha); yet, the average farm size is only 5.9 ha which is much smaller than EU and US averages (Berk 2013).

In general, there are two government authorities in Turkey responsible for recording fatal and/or injury traffic accidents on roads. Police is responsible for the accidents within the city limits while Gendarmerie is responsible for the ones in rural areas. Turkish Statistical Institute (TurkStat) obtains the on-road fatal and / or injury traffic accidents data from both bodies then combines the data and publishes every year. The data is published as classified into vehicle types including farm tractors.

The data of this study covered the fatal and / or injury trailer-attached two wheel tractor (Patpat) accidents, which occurred only on roads and recorded by the General Directorate of Security (Police) (Emniyet Genel Mudurlugu, EGM) and the General Command of the Gendarmerie (Jandarma Genel Komutanligi, JGK) between 2006 and 2016. The data did not include the incidents occurred during the field work on farms. Data

were analyzed based on the following criteria: number of fatal and injury accidents, number of dead and wounded, geographic regions and provinces, accident types, accident time (season, month, day, hour), road and weather conditions, features of the drivers (age, education, driver's license, etc.), and availability of professional first aid.

Results and Discussion

Number of Incidents

In the 11 year period, in the Police Responsibility Areas (PRA), 688 people were affected (7 dead, 681 injured) in 326 accidents (6 fatal and 320 injury). On the other hand, in the Gendarmerie

Responsibility Areas (GRA), 770 people (27 dead, 743 injured) were affected in 318 accidents (25 fatal, 293 injury) (Table 1).

In both data sets, a total of 1458 people (34 dead, 1424 injured) were affected in 644 accidents (31 fatal, 613 injury). It was found that the average number of victims per accident was 2.11 in PRA and 2.42 in GRA (Table 1). This means that every year, on average, about three people (34/11) died and 129 people (1424/11) wounded in these accidents.

In both PRA and GRA, there was no increase in the number of fatal accidents over the years, but there was a substantial rise in the injury accidents (Figure 3). In 2016 alone, there were 56 accidents in PRA and 25 in GRA. Similarly, the number of injured victims increased significantly as the number of killed victims did not increase over the years.

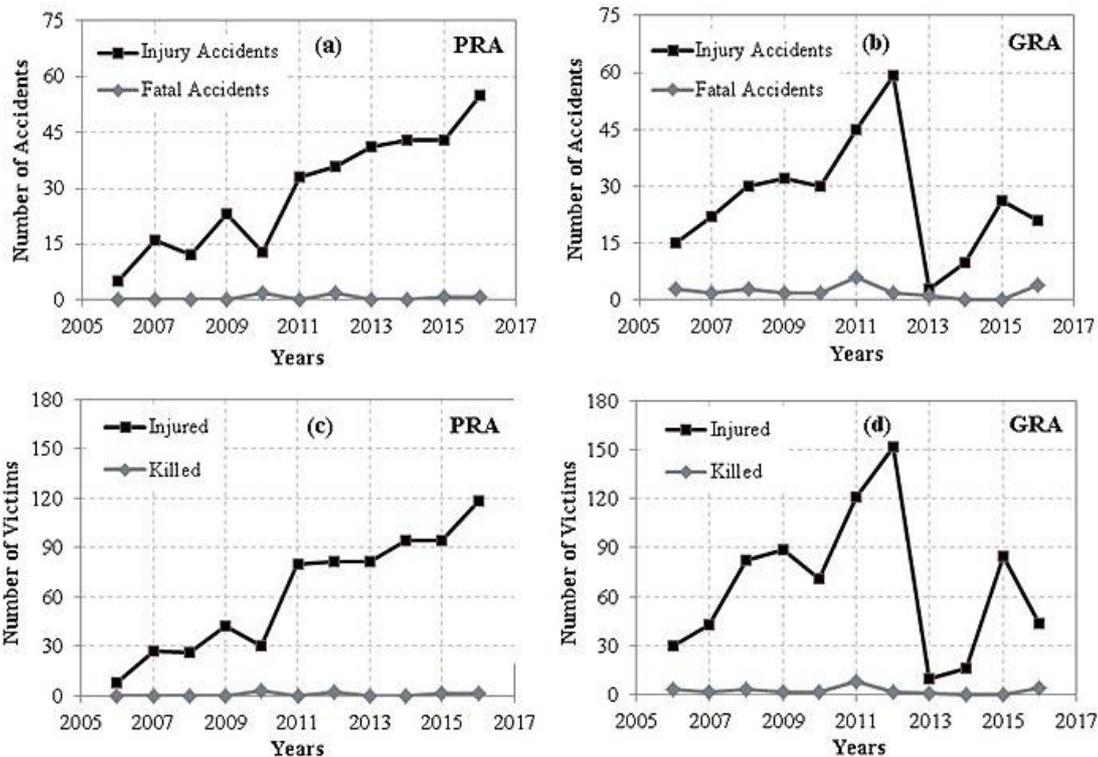


Figure 3. Trailer-attached two wheel tractor accidents in PRA (a) and GRA (b) and the victims in PRA (c) and GRA (d) (PRA: Police Responsibility Area, GRA: Gendarmerie Responsibility Area)

During the study period, a total of 34 people died and 1424 people were injured in

a total of 644 accidents (Table 1). It should be noted that some of the injured victims lose

their lives while being treated at the hospital. Karapolat et al. (2011) reported that approximately 2.9% of Patpat accident victims brought to hospital died while being treated. Erkol et al. (2013) reported that 48.8% of the deaths occurred at the incident scene or while being transported to hospital. Thus, the number of people who were killed in these accidents might be higher.

The rate of fatal accidents in the GRA (7.9%) was greater than that in the PRA (1.8%) (average 4.8%) (Table 1). The higher

rate of fatal accidents in GRA can be attributed to the fact that these areas are generally rural areas and the road characteristics (slope, curvature, road cover, etc.) are less favorable than the ones in PRA. Also, it is thought that emergency health crews need longer time to arrive at the incident site in GRA, thus transporting the victim to the hospital takes longer which causes the late intervention on the victim and thus increase the mortality rate.

Table 1. Number of accidents and people affected from the accidents

	PRA*	GRA*	Total
Fatal accidents <i>Ölümlü kazalar</i>	6	25	31
Injury accidents <i>Yaralanmalı kazalar</i>	320	293	613
Total accidents <i>Toplam kaza</i>	326	318	644
Percentage of fatal accidents (%) <i>Ölümlü kaza oranı</i>	1.8	7.9	4.8
Number of people killed <i>Ölen kişi sayısı</i>	7	27	34
Number of people injured <i>Yaralanan kişi sayısı</i>	681	743	1424
Total number of people affected <i>Toplam etkilenen kişi sayısı</i>	688	770	1458
Injury per accident <i>Kaza başına yaralanma oranı</i>	2.09	2.34	2.21
Affected people per accident <i>Kaza başına etkilenen kişi oranı</i>	2.11	2.42	2.26

*PRA: Police Responsibility Area, *GRA: Gendarmerie Responsibility Area

Ericson (2010) reported that 5% of two wheel accidents in both Laos and Cambodia resulted in death which is comparable with the average value (4.8%) found in the present study. Also, Keskin et al. (2016) reported that annually 1903 on-road farm tractor accidents were recorded in Turkey in 2004-2013 and 4.2% (79/1903) of them were fatal. Darcin et al. (2016) found that the rate of fatal tractor accidents in Turkey in 2011-2015 was 12.1%.

The number of total casualties per accident in GRA areas (mainly rural) (2.42) was higher than that of PRA areas (mainly urban) (2.11) (Table 1). This could be explained by the context that these vehicles are used in passenger transport more

intensively and in longer distances in rural areas. Even if it is not right to use tractors for transporting passengers on roads, it is very common to see this practice especially in developing countries including Turkey. Kucuker (2012) analyzed 28 death cases caused by Pat-pat accidents in Afyon province of Turkey and reported that 60.7% of the victims were drivers and 39.3% were passengers. Oz (2005) found that 90% of the farmers carried people on tractors in the Aegean Region. Dogan et al. (2010) reported that 43.0% of the people who lost their life in tractor accidents were passengers in Konya province. Görücü Keskin et al. (2012) stated that 87.9% of the drivers reported that

transporting passenger on tractors was wrong; but, 53.3% carried passengers on the tractor in Hatay province. Also, Yavuz et al. (2014) reported that 90% of tractor operators transported passengers on tractors in Sanliurfa province. In the current study, it was also found that in 6.3% of the accidents in PRA and 10.5% of the accidents in GRA had 5 or more victims (Arslan, 2017). This finding also supports that the finding that these vehicles are used to carry people.

Accident Types

In both PRA and GRA data, about two-thirds of the incidents (PRA: 69.6%, GRA: 65.7%) were of crash / collision (Table 2). Rollovers were second with 16.6% in PRA and 17.9% in GRA as Run-off-road accidents were third with 12.0% in PRA and 15.4% in GRA. When the crash / collision accidents were studied, it was found that approximately half of these (PRA: 49.3%, GRA: 43.1%) was as side crashes while the other two major accidents were mutual collision (PRA: 17.2%, GRA: 27.8%) and rear crash (PRA: 15.9%, GRA: 14.8%) (Arslan 2017).

Table 2. Number of accidents based on accident types

Data Set	Accident Type	Fatal	Injury	Total	Ratio (%)
PRA*	Crash / collision <i>Çarpma / çarpışma</i>	3	224	227	69.6
	Rollover <i>Devrilme</i>	3	51	54	16.6
	Run-off-road <i>Yoldan çıkma</i>	0	39	39	12.0
	Fall from vehicle <i>Araçtan düşme</i>	0	6	6	1.8
	Total	6	320	326	100
GRA*	Crash / collision <i>Çarpma / çarpışma</i>	11	198	209	65.7
	Rollover <i>Devrilme</i>	9	48	57	17.9
	Run-off-road <i>Yoldan çıkma</i>	5	44	49	15.4
	Fall from vehicle <i>Araçtan düşme</i>	0	2	2	0.6
	Other <i>Diğer</i>	0	1	1	0.3
Total	25	293	318	100	

*PRA: Police Responsibility Area, *GRA: Gendarmerie Responsibility Area

Similarly, some researchers reported the most common accident type as crashes in tractor accidents. Oz (2005) stated that the most common tractor accident types were crash and collision (26% + 22%) and rollover (27%) in the Aegean region. Akbolat et al. (2007) found that most of the tractor and farm machinery accidents in Isparta province were collision (57.6%) and rollover (35.8%). In contrast, some other researchers reported the most common accident type as rollover. Karapolat et al. (2011) reported that the majority of Patpat accidents (82.9%) were rollover followed by collision with other

vehicle in the western Black Sea region. Kucuker (2012) analyzed 28 death cases caused by Pat-pat accidents in Afyon province and reported that 60.7% of the accidents was rollover collision. Golbasi (2004) stated that tractor accidents occurred in Turkey were in type of rollover (60%) and crash / collision with other vehicle (25%). Dilay et al. (2011) found that both fatal (61.0%) and injury (38.5%) accidents were mostly rollover in Karaman province. Gorucu Keskin et al. (2012) reported that 65.4% of tractor accidents were rollover in Hatay province. Keskin et al. (2016) reported that 42.9% of

fatal tractor accidents were rollover as 25.0% were crash to other vehicle or object in Hatay province. Darcin et al. (2016) found that the most frequent type of tractor accidents was run-off-road (43%) and rollover (29%) for fatal accidents and rollover (29%) and side crash (18%) in injury accidents on roads in rural areas of Turkey. Yildirim and Altuntas (2015) reported that most common tractor accident type was rollover (49.1%) in Tokat province. Saglam et al. (2017) reported that most common tractor accident type was rollover and run-off road (34.9%) in Kayseri province.

Regions and Provinces

Turkey has seven geographic regions. In PRA, the first three regions where the accidents occurred the most were Black Sea (37.4%), Mediterranean (19.0%) and Aegean (14.7%) regions (Table 3) while in GRA, Aegean (28.0%), Black Sea (25.2%) and Mediterranean (16.7%) regions were the first three regions where accidents occurred mostly. In both datasets, the first three regions where the accidents occurred mostly were the same regions while the order was different.

Table 3. Number of accidents according to the geographical regions

Data Set	Region	Fatal	Injury	Total	Ratio (%)
PRA*	Black Sea <i>Karadeniz</i>	2	120	122	37.4
	Mediterranean <i>Akdeniz</i>	1	61	62	19.0
	Aegean <i>Ege</i>	2	46	48	14.7
GRA*	Aegean <i>Ege</i>	11	78	89	28.0
	Black Sea <i>Karadeniz</i>	2	78	80	25.2
	Central Anatolia <i>İç Anadolu</i>	6	29	35	11.0

*PRA: Police Responsibility Area, *GRA: Gendarmerie Responsibility Area

Table 4. Number of accidents according to the provinces

Data	Order	Province	Region	Fatal	Injury	Total	Ratio (%)
PRA*	1	Afyon	Aegean <i>Ege</i>	2	44	46	14.1
	2	Ordu	Black Sea <i>Karadeniz</i>	2	43	45	13.8
	3	Mersin	Mediterranean <i>Akdeniz</i>	1	36	37	11.3
GRA*	1	Afyon	Aegean <i>Ege</i>	10	75	85	26.7
	2	Zonguldak	Black Sea <i>Karadeniz</i>	2	31	33	10.4
	3	Isparta	Mediterranean <i>Akdeniz</i>	4	23	27	8.5

*PRA: Police Responsibility Area, *GRA: Gendarmerie Responsibility Area

There are 81 provinces in Turkey and top five provinces where these accidents occurred are given in Table 4. In the PRA, the first three provinces were Afyon (14.1%), Ordu (13.8%) and Mersin (11.3%) while Afyon (26.7%), Zonguldak (10.4%) and Isparta (8.5%) were the first three provinces in GRA. In both datasets, Afyon was the province where the accidents were most frequent. The reasons for the higher numbers of accidents in these regions and provinces could be tied to the factors such as the use of these vehicles more frequently there and the ruggedness (sloped roads) of the territory. As the data on the numbers of two wheel tractors according to the regions and provinces were not available, the relations between these two factors could not be investigated.

Timing of the Accidents

The accidents intensified mostly in the summer (PRA: 40.5%, GRA: 43.1%) and autumn (PRA: 32.8%; GRA: 35.8%) (Figure 4). This is probably due to the increased use of these vehicles on the roads as a result of the increased farm activities in these seasons. Farmers use these vehicles as a means of transport to go to the fields where farm works are performed and also to carry agricultural products. Other scientists have reported similar results. Karapolat et al. (2011) reported that 53.3% of the Patpat accidents occurred in summer in the western Black Sea region. Say et al. (2016) found that Patpat accidents in Samsun province were mostly in summer (65%). Copuroglu et al. (2012) reported that 36% of the machinery accidents in agriculture occurred in summer.

In PRA data set, fatal accidents occurred

mostly in July (66.7%) and injury accidents in September (16.3%) (Figure 4). In the GRA data set, fatal accidents occurred mostly in August (28.0%) as injury accidents occurred mostly in August (15.7%). Similar findings were reported in previous studies.

Karapolat et al. (2011) reported that Patpat accidents occurred mostly in August (35.2%) in the western Black Sea region. Kahveci et al. (2015) stated that the victims of Patpat accidents were brought to hospital mostly in April (20.8%), June (18.9%) and November (18.9%) in the western Black Sea region. Say et al. (2016) reported that the Patpat accidents that took place in Samsun province occurred mostly in summer (65%) and August (34%). Keskin et al. (2016) reported that 177 tractor accidents were mostly in June (18.6%) in Hatay province.

Regarding the incident days, the fatal accidents occurred mostly on Saturdays (66.7%) and injury accidents on Mondays (15.6%), Sundays (15.0%) and Saturdays (14.7%) in the PRA data set (Figure 4). In the GRA dataset, fatal accidents occurred mostly on Thursdays (24.0%) and Sundays (20.0%) as injury accidents on Wednesdays (17.1%), Fridays (16.7%) and Tuesdays (16.4%). In both data sets, the accidents were more frequent at the beginning of the week and at the end of the week while the day on which the minimum accidents occurred was Thursday. Findings reported in other studies were similar. Darcin et al. (2016) reported that tractor accidents took place mostly on Saturdays and Sundays (weekends). Keskin et al. (2016) reported that tractor accidents took place in Hatay province mostly on Sundays and Wednesdays.

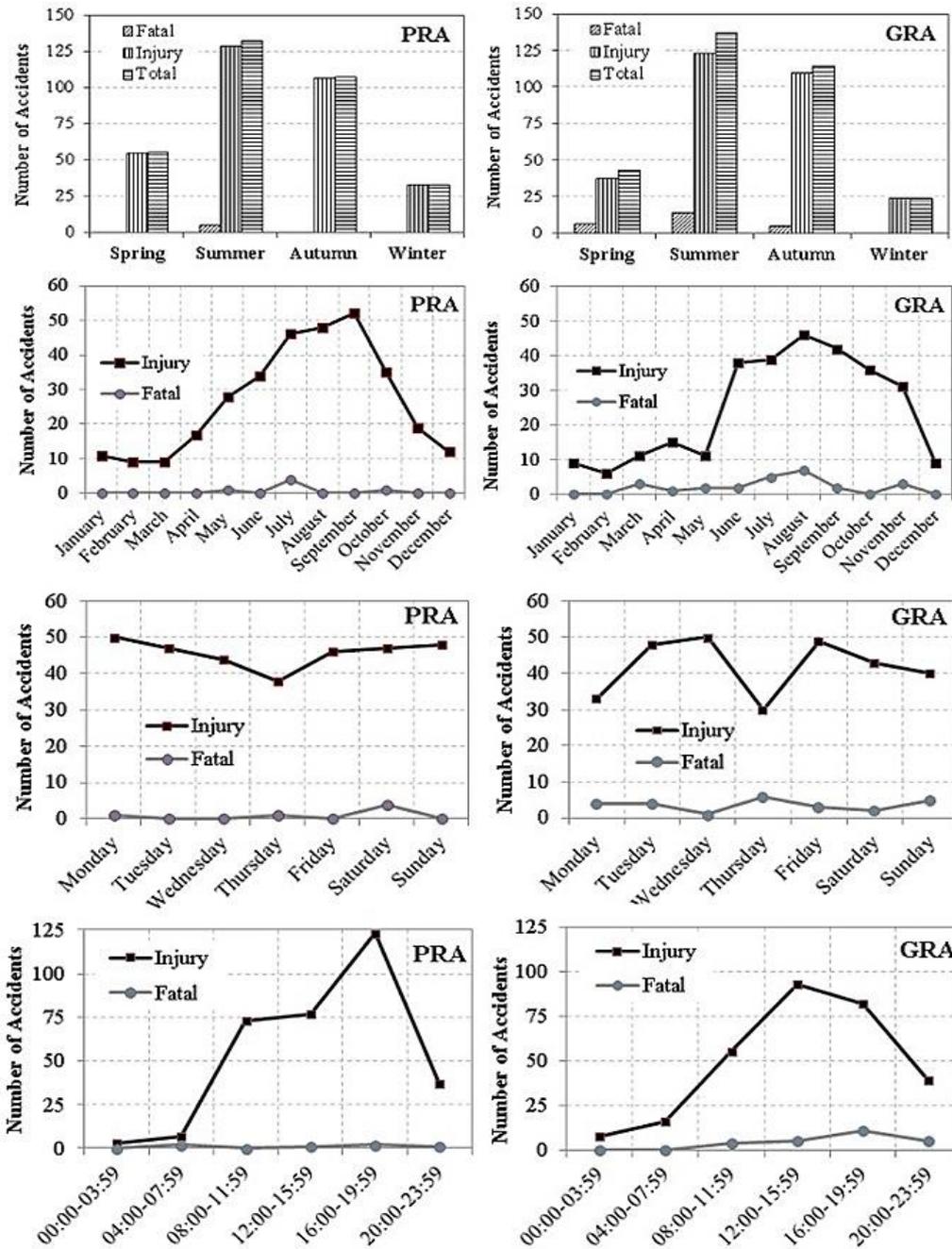


Figure 4. Trailer attached two wheel tractor accidents according to seasons, months, days and hours (PRA: Police Responsibility Area, GRA: Gendarmerie Responsibility Area)

Concerning the incident time slot, fatal accidents were in the mornings (04:00-07:59; 33.3%) and evenings (16:00-19:59; 33.3%) while injury accidents were mostly in the evenings (16:00-19:59; 38.3%) in the PRA data set while in the GRA data set, the fatal accidents were most frequent in afternoons (16:00-19:59; 44.0%) as injury accidents were

mostly in afternoons (12:00-15:59; 31.7% and 16:00-19:59; 28.0%) (Figure 4). Kahveci et al. (2015) reported that Patpat accidents mostly occurred around noon and afternoon hours (12:00-17:59). Similarly, Darcin and Darcin (2017) stated that the tractor accidents in Bilecik province were mostly around noon and afternoon hours (11:00-15:00; 46%).

Accident Place, Road, Weather Conditions

The accident data were also classified based on the place as populated areas and unpopulated areas (Table 5). When both data sets were evaluated together, it was observed that the majority of the accidents in PRA occurred in populated areas (82.5%) while the accidents in GRA mostly occurred in unpopulated areas (53.8%). Concerning the type of the roads, it was found that majority of the accidents in PRA were recorded on the streets while in GRA, accidents occurred mostly on village roads (47.8%) (Table 6).

Results show that these vehicles were widely used for transport in populated areas even if they are not suitable for road traffic mainly due to their low capability of speed, steering, and braking and low visibility at nights. Similarly, Shridar et al. (2006) reported that 55.5% of two wheel tractors were used for transport in India's Tamil Nadu province. The finding that the majority of the accidents in PRA were recorded on the streets (49.1%) supports this finding. On the other hand, in the GRA dataset (rural areas), the accidents occurred mostly on village roads (47.8%). Other researchers reported similar results. Darcin et al. (2016) reported that 70% of fatal and 61% of injury tractor accidents in rural areas occurred on the

village roads. Similarly, Keskin et al. (2016) reported that tractor accidents in Hatay province occurred mostly on village roads (fatal: 78.6%, injury: 55.7%).

Conditions of the roads on which the accidents occurred were also studied (Arslan 2017). Most of the accidents were on asphalt roads (PRA: 87.1%, GRA: 83.6%) in both data sets (PRA and GRA). In the case of road curviness, most of the accidents occurred on straight roads (PRA: 78.5%, GRA: 70.4%) and slightly curvy roads (PRA: 8.9%, GRA: 18.9%). Regarding the road slope, the accidents mostly occurred on the roads without slope (PRA: 65.3%, GRA: 54.4%) and on the slightly sloped roads (PRA: 12.3%; GRA: 29.6%). In addition, regarding the condition of the road surface, majority of the accidents occurred on the roads with dry surfaces (PRA: 90.2%, GRA: 89.0%). Finally, the accidents mostly occurred in clear sky conditions (PRA: 89.3%, GRA: 83.3%) and cloudy weather (PRA: 4.3%; GRA: 11.3%). It can be stated that the adverse road and weather characteristics did not have much impact on the accidents. These vehicles, which have slow travelling, low braking and low turning capabilities seem to have involved in a high amount of accidents even on favorable road conditions.

Table 5. Number of accidents classified based on the place where they occurred

Data Seti	Accident Place	Fatal	Injury	Total	Ratio (%)
PRA*	Populated area <i>Yerleşim yeri içi</i>	4	265	269	82.5
	Unpopulated area <i>Yerleşim yeri dışı</i>	2	55	57	17.5
	Total	6	320	326	100.0
GRA*	Populated area <i>Yerleşim yeri içi</i>	8	139	147	46.2
	Unpopulated area <i>Yerleşim yeri dışı</i>	17	154	171	53.8
	Total	25	293	318	100.0

Table 6. The type of the roads on which the accidents occurred

Data Set	Road Type	Fatal	Injury	Total	Ratio (%)
PRA*	Street <i>Cadde</i>	0	160	160	49.1
	State road <i>Devlet yolu</i>	2	71	73	22.4
	Province road <i>il yolu</i>	1	30	31	9.5
	Alley <i>Sokak</i>	0	29	29	8.9
	Village road <i>Köy yolu</i>	1	19	20	6.2
	Other <i>Diğer</i>	2	11	12	3.9
	Total		6	320	326
GRA*	Village road <i>Köy yolu</i>	15	137	152	47.8
	Province road <i>il yolu</i>	3	79	82	25.8
	State road <i>Devlet yolu</i>	1	35	36	11.3
	Street <i>Cadde</i>	3	27	30	9.4
	Alley <i>Sokak</i>	1	10	11	3.5
	Other <i>Diğer</i>	2	5	7	2.2
	Total		25	293	318

Characteristics of the Drivers

Age groups of the drivers involved in the accidents are given in Table 7. It was found that while 41-50 (20.6%), 18-30 (19.3%) and 51-60 (19.0%) age groups were prevailing in the PRA data set, the age groups of 41-50 (18.6%) and 18-30 (25.8%) and 31-40 (17.9%) were dominant in the GRA data set.

It can be stated that the drivers involved in the accidents were mostly in the middle age group in both data sets. On the other hand, generally, young people (<18) who have less experience and / or no driver's license and older people are more likely to

have an accident than middle-aged people. In the PRA data set, 6.1% of the drivers were under 18 years of age and 6.6% in the GRA data set. The ratio of drivers in the age group of 71 years and older was 6.7% in the PRA data set and 3.1% in the GRA data set.

The education level of the drivers who involved in the accidents were also examined (Table 8). It was observed that majority of the drivers had elementary school education (PRA: 68.1%; GRA: 47.5%). Almost none of the drivers had university education (PRA: 0.3%; GRA: 0.0%).

Table 7. Age group of the drivers involved in the accidents

Data Set	Age Group	Fatal	Injury	Total	Ratio (%)
PRA*	<18	0	20	20	6.1
	18-30	2	61	63	19.3
	31-40	0	47	47	14.4
	41-50	3	64	67	20.6
	51-60	0	62	62	19.0
	61-70	1	41	42	12.9
	>=71	0	22	22	6.7
	Undetermined	0	3	3	0.9
Total		6	320	326	100.0
GRA*	<18	2	19	21	6.6
	18-30	4	78	82	25.8
	31-40	2	55	57	17.9
	41-50	2	57	59	18.6
	51-60	8	44	52	16.4
	61-70	4	31	35	11.0
	>=71	3	7	10	3.1
	Undetermined	0	2	2	0.6
Total		25	293	318	100.0

Table 8. Education level of the drivers who involved in the accidents

Data Set	Education level	Fatal	Injury	Total	Ratio (%)
PRA*	Primary <i>İlkokul</i>	6	216	222	68.1
	Secondary <i>Ortaokul</i>	0	25	25	7.7
	High school and College <i>Lise ve Üniversite</i>	0	27	27	8.3
	Undetermined <i>Belirsiz</i>	0	52	52	16.0
	Total	6	320	326	100.0
GRA*	Primary <i>İlkokul</i>	13	138	151	47.5
	Secondary <i>Ortaokul</i>	0	17	17	5.3
	High school and College <i>Lise ve Üniversite</i>	2	17	19	6.0
	Undetermined <i>Belirsiz</i>	10	121	131	41.2
	Total	25	293	318	100.0

Previous studied report that vast majority of the accident causes are of human origin (Golbasi, 2004; Gorucu Keskin et al. 2012) and the drivers with low-level

education are more likely to involve in accidents. Thus, the education level has an important impact on the reduction of the accidents. In addition to general education, training in occupational safety in farm machinery has importance in decreasing accidents. Gorucu Keskin et al. (2012) reported that 95.1% of tractor operators thought that the accidents could be reduced by training in Hatay province.

Regarding the genders of the drivers, in both PRA and GRA data sets, the majority of the drivers involved in the accidents were male (PRA: 97.5%, GRA: 97.2%). It should be noted that the ratios given here covers only the drivers, not the other casualties that were injured or killed in the accident.

Similarly, Say et al. (2016) reported that the majority of the victims (drivers and others) (43/46; 93.5%) injured in Patpat accidents and brought to the hospital in Samsun province were males. Karapolat et al. (2011) stated that approximately 69.5% of the Patpat accident victims who were brought to hospital were male. Kahveci et al. (2015) reported that most of the Patpat accident victims (73.6%) injured and brought to hospital were male.

Regarding the driver’s license availability of the drivers, around two thirds (63.8%) of the drivers in the PRA and about three quarters of the drivers (74.2%) in the GRA did not have driver's license (Table 9).

Table 9. Driver’s license availability of the drivers who involved in the accidents

Data Set	Driver's Licence	Fatal	Injury	Total	Ratio (%)
PRA*	Available <i>Belgesi var</i>	1	80	81	24.8
	Not available <i>Belgesi yok</i>	4	204	208	63.8
	Undetermined <i>Belirsiz</i>	1	36	37	11.3
	Total	6	320	326	100.0
GRA*	Available <i>Belgesi var</i>	2	53	55	17.3
	Not available <i>Belgesi yok</i>	20	216	236	74.2
	Undetermined <i>Belirsiz</i>	3	24	27	8.5
	Total	25	293	318	100.0

The low ratio of driver’s license availability could be one reason why these vehicles had so many accidents. Considering that the majority of the accidents are of human origin (Golbasi 2004), it can be said that it is inevitable for the young (<18) drivers who do not have adequate driver training and driver certificate to involve in accidents.

Blood alcohol content levels of the drivers who involved in the accidents were also available in both data sets (PRA and GRA) (Arslan 2017). Only a small portion of the drivers (PRA: 4.3%; GRA: 0.3%) had more

alcohol than the legal limit in their blood (>0.5 promil; 50 mg alcohol/100 ml blood).

One of the crucial factors in saving the lives of the people having had an accident is the availability of professional emergency health crew. In the current study, in the majority of the accidents in GRA (48.1%), victims were assisted by the public / bystanders while in 42.5% of the accidents, an emergency health crew was available (Table 9). Similarly, Karapolat et al. (2011) reported that 51.4% of the Patpat accident victims were brought in private vehicles to

the hospital while 48.6% of them were brought by an ambulance. Keskin and Sekerli (2018b) reported that in combine harvester accidents, 65.5% of the field accidents and 91.4% of the road accidents, the victims were transferred to the hospitals by ambulances.

Conclusions

Accidents of farm vehicles called Patpat which were adapted from two wheel tractors by adding a trailer behind have increased in recent years. In the 11 year period (2006-2016), total of 1458 people (34 dead, 1424 injured) were affected in 644 accidents (31 fatal, 613 injury) in both Police Responsibility Areas (PRA) and Gendarmerie Responsibility Areas (PRA). The incidents occurred mostly in the form of crash / collision (PRA: 69.6%, GRA: 65.7%) in both areas.

A significant difference existed in the number of accidents in different regions and provinces. The accidents were the most frequent in summer (PRA: 40.5%, GRA: 43.1%). The majority of the operators had primary school education (PRA: 68.1%, GRA: 47.5%) and were male (PRA: 97.5%, GRA: 97.2%) and had no driver's license (PRA: 63.8%; GRA: 74.2%).

The accidents involving these vehicles (Patpat) tend to increase in Turkey. These vehicles are not suitable for driving on the roads since they are slow, with low braking and low steering ability, difficult to be noticed at night and not having standard structure. Considering that the majority of the accidents are of human origin, it is suggested that training and traffic surveillance should be given importance in this regard. Inexpensive and safer alternative vehicles are needed.

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