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REVIEW ARTICLE

Professional driving as an occupational disease in Saudi Arabia: a neglected epidemic: a narrative review

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ABSTRACT

Driving is a job that requires proper interaction with the vehicle and environmental conditions at the same time. Professional drivers, including taxi, bus, and long-haul truck drivers, experience greater rates of health issues compared to other occupations due to the nature of their work. Here, we highlighted and discussed professional driving as an occupational disease. The literature related to the current subject, especially that from Saudi Arabia, was obtained through an online search process. The eligible articles were reviewed and discussed under specific titles to cover our current subject. Due to the sedentary nature of driving occupation and other job characteristics, professional drivers are most exposed to several health-related risks and diseases. Actually, professional driving was found to be associated with physical diseases and psychological conditions, including musculoskeletal diseases, sleep disorders, and depression. Such conditions can put the drivers under increased risk of road traffic accidents (RTAs). Therefore, the management of RTA requires not only good road construction, but also management of such conditions and diseases related to RTA and caused by driving.

Keywords: Professional driving, occupational disease, Saudi Arabia, musculoskeletal disorders.

Introduction

Driving is a sedentary job [1]; however, it is a complex job that requires proper interaction with the vehicle and environmental conditions at the same time [2]. Driving involves the interaction of several factors that can affect the performance of the drivers, such as driving abilities, skills, experience, and physical, emotional, and psychological health, as well as the use of medication to manage different types of diseases [2]. Therefore, the level of stress in terms of job strain and effort-reward imbalance in this occupation is generally high, leading to exhaustion [1]. The complexity of job-related exposures among drivers led to a high incidence of musculoskeletal disease (MSDs), sleep disorders, stress and depression, gastritis, cardiovascular diseases, and reproductive effects [1].

Professional driving is a stressful job that is made more unpleasant by things such as the speed, bad weather, traffic jams, unclear holidays, intensity and density of the traffic flows, and unreliable transportation schedules [3]. The growing dependence on transportation has led to an increase in professional drivers who are exposed to health hazards due to that occupation [4]. Professional drivers are workers who must operate a vehicle as part of their line of work, such as a taxi, bus, or truck [3]. They have a considerable role in the transportation system, and their productivity and dependability are key elements in the effectiveness of the system [3].

Professional drivers are exposed to several occupational injuries due to the adverse conditions of their work, such as long driving hours, traffic congestion, excessive physical demands, and continuous time exposure [5]. Additionally, they are among the trade unions that are most exposed to several health-related risks and diseases owing to the nature of their sedentary job and unhealthy diet [6]. There is a lack of literature from Saudi Arabia studying professional driving as an occupational disease. Therefore, here, we present a narrative review to overview the complications and diseases related to driving and the management of road traffic.

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Method

Articles involved in this review were recruited from online research through the scientific websites "PubMed, Science Direct, and Google Scholar," using various terms as keywords for the search procedure, including "Professional driving, road traffic accidents (RTAs), Correlation, Linkage, Association, Diseases, and Management." The searching procedure was not limited to a time frame of publication date due to the lack of available studies conducted on that subject. Almost 800 articles were obtained from the research; however, there were 350 duplicate articles, and they were excluded. The remaining articles were then screened in the second step to exclude articles with irrelevant titles or those not focusing on our objective. The third step was checking the objectives and outcomes of the studies to identify relevant articles from Saudi Arabia and outside Saudi Arabia that reported diseases related to driving, as they were eligible and enrolled. All types of articles were eligible and included, except for letters to the editor and case reports. Other inclusion criteria that were considered in the fourth step were articles written in the English language and available for full-text, whereas articles written in other languages and available only for abstracts were excluded. The included articles were published between 1987 and 2025. The review was written under specific titles to cover the current subject; each author in this work discussed one or more titles. After finishing the article, each author reviewed the whole article.

Diseases linked with driving

Professional drivers can manage quite severe fatigue and adapt to long night shifts, and may be able to drive without reduced performance under greater levels of sleepiness; however, they are still prone to experience other complications and diseases related to driving [7]. It was reported that drivers who work in precarious conditions are exposed to several issues, including long driving hours, irregular shift work, and a lack of or insufficient breaks during work hours. Such issues and conditions may expose the drivers to mental health issues, cardiovascular diseases, chronic fatigue, stroke, kidney and bladder issues, and musculoskeletal pains [8]. The types of diseases are displayed based on global studies:

1.-Musculoskeletal diseases

Based on a systematic review, it was found that the prevalence of MSDs was 43.1%-93% among professional drivers, with the most common occurrence of lower back pain (LBP) among 17%-82.9% [9]. One meta-analysis focused on MSD among taxi drivers revealed that the greatest prevalence of MSDs among taxi drivers was linked with the lower back region (53.87%). Additionally, the prevalence of MSDs in various body regions, such as the neck (38.15%), shoulder (34.97%), upper back (18.30%), and knee (14.10%), was revealed [5]. Nonetheless, the previous meta-analysis had a limitation in the inclusion of heterogeneous studies.

A previous meta-analysis included 53 studies, which revealed that the prevalence of LBP among professional drivers was 35.0% for 1 week, 33.80% for 1 month, and 55.30% for 1 year. In the global population of professional drivers, the prevalence of LBP was 56.0% and 54.5% without and with a history and high risk of LBP [4]. There is a considerable correlation between daily driving time and LBP, which is a frequent work-related MSD. LBP develops due to occupational risk factors, including physical effort, manual handling of heavy loads, repetitive movement, hand-arm vibration, and whole body vibration [4]. Additionally, stress and mental psychological tension in the work environment, including time pressure, anger, and anxiety, can elevate the risk of related work-MSD [5].

2.-Metabolic diseases

The drivers are most exposed to several health-related diseases, especially metabolic diseases, owing to the nature of their sedentary jobs and unhealthy diet [6]. Inactivity, work shifts, job stress, and changing eating habits are among the major health risks for drivers, which can expose them to a higher risk for obesity and high blood pressure, which are known to be risks for metabolic syndrome [10,11]. The occupational conditions of the drivers contribute to the susceptibility of drivers to such conditions and diseases [6]. Shift work that is rotating among professional drivers can affect the metabolic system and cardiovascular system and cause high blood pressure and an elevated incidence of metabolic syndrome [12,13].

A previous analysis included 12 articles to identify the prevalence of metabolic syndrome among drivers, which revealed that among 19,350 professional male drivers, the prevalence of metabolic syndrome was 32.8%. The major causes of this syndrome among the drivers included years of driving experience, low regular exercising and shift work patterns, which are all related to driving occupation [6]. However, the included studies in this analysis did not use the same definition for metabolic syndrome, which can affect the findings of such analysis.

One cross-sectional study conducted on bus drivers in India revealed that 37.1% of the participants had hypertension, making it the most prevalent comorbidity [14].

3.-Sleep complications

Another complication of professional driving is drowsiness while driving and sleep complications [15]. Most professional drivers are involved in rotating shift work owing to their requirements. The mismatch between the internal rhythm of the body and the circadian rhythm leads to manifestations such as fatigue and sleep disorders [6]. Sleep disturbances considerably impair focus and driving attention, leading to a reduction in driving performance [16]. Additionally, sleep quality

is an element that affects driving performance [17]. In one descriptive cross-sectional study, it was found that sleep disturbances and insomnia were prevalent among 52.2% and 33.6%, respectively [15]. However, such findings may be biased due to the self-reported nature of the questionnaire. Additionally, the psychological status is known to affect the functional abilities of humans, with depression associated with cognitive impairments, especially in executive function, which adversely affects driving performance [16].

Driving diseases based on Saudi studies

Regarding studies from Saudi Arabia, one study aimed to assess the rates of occupational MSDs; the study included 173 participants, 70.5% of whom were taxi drivers and 29.5% were office workers. It was found that the self-reported MSDs prevalence among the drivers 85.3%, which was higher compared to the prevalence of MSDs reported by office workers (51.6%). The most reported MSD among the drivers was lower back (60.7%) [18]. Additionally, the study revealed that LBP, knee pain, and neck pain were the dominant pains reported by heavy vehicle drivers and transportation office workers. However, the prevalence rates of such types of pain were higher among drivers compared to office workers, but with no significant difference [18]. The prevalence rates were dependent on the subjective reporting, which can possibly be biased in some cases.

In Saudi Arabia, one comparative cross-sectional study was conducted using an online survey to assess 6 years of driving experience of women in relation to sleep, fatigue, depression, and anxiety by enrolling 1,382 women. The comparison between experienced driving women and non-driving women revealed no considerable variations across all measured items, including physical health (p = 0.6), sleep quality (p = 0.4), mental health (p = 0.7), depression (p = 0.302), anxiety (p = 717), and stress (p = 0.476). Despite the non-significant result (p = 0.07) regarding fatigue score, the mean perceived fatigue severity score was higher in women who drive compared to non-drivers [16]. Such previous findings cannot be generalized owing to the nature of the convenient sampling technique adopted in that study. Another Saudi study conducted on 338 truck drivers revealed that there was a high prevalence of sleepy driving and a high risk of obstructive sleep apnea [17]. The findings of this study are also based on self-reported data.

The correlation between diseases related to driving and RTAs

Road accidents are linked with great rates of injury and mortality, which makes it a significant global issue [19,20]. In Saudi Arabia, RTAs account for 13% of the Saudi population's disability-adjusted life years, and it has the greatest RTAs-linked mortality, where mortality related to RTAs represent 4.7% of all fatalities in Saudi Arabia [21]. Driving performance is affected by several factors, including body functions such as cognition, physical motor, and sensory perception. Therefore, the presence of some medical conditions can affect the ability to drive safely, which may result in an elevated risk of traffic accidents [20]. The linkage between traffic accidents and diseases is strong and complex. Therefore, it is important to understand the health-related causes of drivers that may impair driving to prevent motor vehicle collisions [20].

Disorders such as obesity, high blood pressure, and metabolic syndrome can affect the health status of the drivers and, in turn, increase the risk of accidents and may cause temporary or permanent disabilities in drivers [22]. Additionally, it was revealed that drowsiness, obstructive sleep apnea, sleep deprivation, sleepy driving, and sleep patterns are associated with an increase in accidents [23].

RTAs are suggested to be due not only to physical driving conditions, but also greatly affected by psychosocial work factors [8]. Depression can compromise driving skills, increasing the probability of traffic violations and accidents [16]. Physiological factors also can contribute to the progression of stress, fatigue, and risky behavior behind the wheel and increase the probability of accidents [8].

Fatigue impairs attention and often occurs with conditions such as pain and depression [16]. Fatigue is a condition that can cause crashes and result in severe injuries and fatalities. The increased risks occur during driving at night or in the early morning, where driving while being fatigued and sleepy impairs driving performance and causes deteriorated longitudinal and lateral control of the vehicle, eventually leading to lane departures and accidents [7].

In the United States, driver fatigue was found to be the major cause of 415,000 accidents involving large trucks, whereas in France, drowsiness while driving was the main cause of 20% of the total road accidents. The drowsiness while driving and factors related to falling asleep represent 5%-30% of the total road accidents based on the driver and/or the road network [15].

One study reported that fatigue, drowsiness, respiratory disease, headache, fever, and negative emotions affected the drivers. Additionally, having any physical illness was the main reason to avoid driving to avoid accidents [2].

A study from Turkey enrolled 104 individuals who had an in-vehicle traffic accident. It was found that 9.62% experienced increased daytime sleepiness, 14.42% had poor sleep quality, and 14.42% had a high risk of obstructive sleep apnea syndrome, whereas the highest proportion (29.1%) had chronic fatigue in 30 (29.1%). Therefore, it was deduced that in-vehicle traffic accidents were related to various sleep disorders and chronic fatigue [24].

One study focused on taxi drivers revealed that the drivers reported an average of 41 hours per week, and

22% of the drivers reported at least one RTA in the previous year. However, the overall fatigue levels were not linked with self-reported RTAs [25].

A systematic review included 17 studies with different designs revealed that over 50% of the participants in the studies experienced sleep deprivation ranging from 3.5% to 67.3%. It was revealed that sleepiness and sleep deprivation were related to RTAs, and sleep deprivation was the principal contributor to drowsiness while driving [26].

Regarding findings from Saudi Arabia, one study examined sleepiness as a risk factor for road accidents. The study included drivers following their involvement in RTAs. It was found that 10.3% reported sleepiness as the main cause of the accident. Additionally, 27.9% reported snoring at night, and 47% stated that they usually went to sleep after midnight. Most of the drivers (72.1%) reported sleeping 6 hours or less per night. Overall, 41.1% attributed their accidents to sleepiness based on a Stanford Sleepiness Scale [27].

Another Saudi study enrolled 1,219 drivers and found that 33.1% of the drivers reported at least one near-miss accident caused by sleepiness. Among those who had actual accidents, 11.6% were attributed to sleepiness [28].

The management of RTAs

RTAs in Saudi Arabia are the main cause of premature mortality and the second most common cause of death [29]. Saudi Arabia has the greatest mortality rate related to RTA among developed nations, as reported by the Global Status Report on Road Safety 2018 [30]. Safety is one of the crucial characteristics of transportation networks; it implies arriving at the destination with no harm or causing death [31].

The World Health Organization recommended five elements for road safety to manage RTAs, including road safety management, safer road infrastructure, safer behavior among road users, safer vehicles, and post-crash care [32]. Some causes of RTAs may return to road geometry. Additionally, crash-causing risky driving behavior and habits can cause RTAs, including ignoring red light signals, speeding, sudden lane changes, not using seat belts, blocking intersections, and vehicles turning suddenly [33].

Therefore, avoiding risky behavior can reduce the incidence of RTAs, as risky behavior was found to be responsible for 96% of accidents in Ethiopia [34]. Additionally, a study from the Eastern Mediterranean region revealed that 86% of the drivers are engaged in at least one risky behavior during driving [35]. One study from Indonesia demonstrated that there were three approaches to traffic safety management according to participants, including traffic engineering (42%), followed by education and training (30%), and law enforcement (28%) [36].

It was stated that the educational programs, online support, and telehealth assessment/monitoring would help improve the well-being, safety, and health of professional drivers, which will lead to increased safety on the road [37]. Implementing effective health management strategies and minimizing work-related stress was recommended in one study as these steps are expected to reduce work-related disorders among drivers, and in turn, they may reduce RTA incidence [14].

A previous review from Saudi Arabia reported that adhering to road rules and safety guidelines may help in reducing the number of fatalities and disabilities resulting from an otherwise preventable cause. However, the authors reported the safety measures that can protect the drivers from different types of injuries caused by RTAs, but they didn't report the management approach for RTAs [38].

One study from Saudi Arabia reported that drinking/eating, cell phone use, and violation of traffic rules were potential reasons for RTA. These findings indicate the role of risky behavior in RTA incidence; therefore, avoiding such risky behavior may reduce RTAs. However, the study didn't highlight the role of driving disease in RTAs and their management [39]. Another Saudi study suggested that decision makers in the Saudi traffic and transportation department should continue monitoring accident prevention strategies and their impacts [40]. Nonetheless, there was no information reported regarding such preventive strategies or their application.

Limitations, strengths, and recommendations

The limitations of this review include the presentation of a few Saudi studies due to the lack of Saudi studies focusing on the current subjects. Additionally, we did not report details about the management of RTAs owing to the scarcity of literature reporting this subject. However, this review has strengths, including that it is the first work reporting and discussing professional driving as an occupational disease, and we highlighted the gaps in the literature regarding the current subjects, which will help future research in research design and subjects. Therefore, further global and Saudi studies are highly recommended.

Conclusion

Professional driving can be considered an occupational disease as it is associated with several conditions and diseases, including MSDs, fatigue, sleep disorders and complications, obesity, and hypertension. Such conditions, including psychological diseases related to this occupation, such as depression, are in turn linked with RTA incidence. However, studies focus on MSDs and sleep disorders, with a scarcity of literature reporting other diseases related to professional driving and RTAs. This scarcity is highly noted in Saudi literature. This may return to the fact that professional driving may not be studied or considered as an occupational disease. Generally, there is also insufficient literature regarding the management of RTAs, especially regarding the management of RTAs related to the progression of

diseases while driving. There was no literature or study from Saudi Arabia focused on the management of RTAs. However, the management strategies will differ from one country to another based on the major causes of RTAs, the major driving diseases causing RTAs, and the construction of the roads. There are several health policies that can be adopted by healthcare settings to alleviate occupational diseases related to professional driving, such as clinical examination, routine screening for sleep apnea, and examining the dividers for their mental health. Additionally, the drivers should take rest and avoid driving while being sleepy. Additionally, the drivers should cease smoking and check their health status continuously.

List of Abbreviations

LBP	Lower back pain
MSDs	Musculoskeletal disease
RTA	Road traffic accident

Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this article.

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