
THE EFFECTS OF FATIGUE ON TRUCK DRIVERS IN CARGO TRANSPORTATION: A LITERATURE REVIEW

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SUMMARY

Road accidents have been treated as a public health problem, since they overload the health system of countries, bringing a high social cost because the main victims are economically active young people. In Brazil, between 2007 and 2018, 38,040 people died in accidents in which at least one truck was involved. It is estimated that fatigue is involved between 20% and 50% of serious accidents in the world. Fatigue can increase the frequency, amplitude or variability of errors a driver can make while driving. Thus, the main objective of this study is to carry out a comprehensive literature review, seeking to synthesize the evidence related to the factors that influence the fatigue of truck drivers. The review worked with 56 selected articles and iden-

tified three main factors that can influence the manifestation of fatigue, namely sleep, work and health. Research has indicated that fatigue refers to a decrease in a driver's abilities due to factors such as lack of sleep, excessive physical exertion, extended working hours, and others. In addition to the potential impact on driver's care, insufficient sleep is a risk factor causing a wide range of health problems. Working conditions and stress related to the profession not only have the potential to negatively impact the health of truck drivers, but also put the protection of others on the roads at risk. Future research should investigate methods for aligning work conditions with technological advancements, including the use of fatigue monitoring and prevention systems.

Introduction

Supply Chain Management (SCM) involves a network of extraction, production, distribution, consumption and disposal operations, with one of its main objectives being to increase organizational efficiency with its improvement (Çankaya

and Sezen, 2019). Transportation plays a fundamental role within a logistics chain, linking its different stages. It is responsible for about a third of logistical costs and has a direct influence on the performance of operations. Transportation is mandatory in all production processes, from manufacturing to delivery to the final consumer and return (Wolff and Caldas, 2018).

In accordance with findings from the National Transport Confederation (CNT, 2019a), the transport sector experienced a noteworthy 2.2% expansion in its contribution to the Brazilian Gross Domestic Product (GDP) during the year 2018, amounting to an impressive total of R\$ 256.08 billion. The index is twice the total GDP growth of the economy. The Brazilian transportation sector as

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a whole has nearly 200,000 companies, with about 2.5 million formal jobs, and road transport is responsible for 70% of the jobs, that is, about 1,750,000 jobs (Messias *et al.*, 2019).

Road transportation is the predominant form of transportation in many countries. In Brazil, for example, the road transportation sector currently accounts for 65% of cargo transportation (Soliani, 2022). In Europe, this rate was 72.8% in 2019 (EC, 2019). The imbalance between modes of transportation is even greater in passenger travel, as road transportation represents 70% in the US (BTS, 2018), 81% of travel in the European Union (EC, 2019) and 95% in Brazil (ANTT, 2020). Currently, 2,879,080 trucks and 660,394 buses circulate in Brazil (IBGE, 2020).

Traffic occurrences have been reported as a public health problem, as they burden the health system of countries, and bring a high social cost, as the main victims are economically active young people (Ladeira *et al.*, 2017). Especially truck drivers, who often drive for long periods and irregular shifts, are at relatively high risk of being involved in accidents during their workday (Islam and Ozkul, 2019).

As reported by the National Transportation Confederation (CNT, 2019b), considering all accidents recorded on Brazilian federal highways from 2007 to 2018, 570,029 accidents involving at least one truck were recorded. Also, according to the same report, between 2007 and 2018, 38,040 people died in accidents in which at least one truck was involved. Davidović *et al.* (2018) estimate that fatigue is involved between 20% and 50% of serious accidents worldwide. However, official statistics often do not reflect its real effect, because drivers involved in accidents often do not recognize the effects of fatigue (Stern *et al.*, 2019).

Traffic accidents affect more than just the vehicles and those inside them. They are not limited to disruptions in daily and urban transportation, but also have public health implications. Traffic crashes have the power to alter the lives of many people and are a significant source of patients for a country's health-care system (Pal *et al.*, 2019). According to the National Road Safety Observatory (ONSV, 2020), in 2015, hospitalizations due to traffic accidents cost the Brazilian public health system R\$ 52 billion.

Therefore, the impact of fatigue on truck drivers becomes a crucial concern for public policy. Reiman *et al.* (2018) found that fatigue is a probable cause or contributing factor to accidents

and incidents in all forms of transportation. Fatigue is linked to decreased physiological arousal, slow sensorimotor functions, and impairs information processing, making it difficult for drivers to respond to unexpected or emergency situations. This can lead to an increase in the frequency, severity, or variability of mistakes made by drivers while operating a vehicle (Cardoso *et al.*, 2019).

The main objective of this paper is to carry out a comprehensive literature review of the scientific production, seeking to synthesize the evidence related to the factors that influence the fatigue of truck drivers. The research is justified by the scarcity of literature on the analysis of the impacts of fatigue on the work of truck drivers, confirming the need to identify opportunities for research on this topic. Truck drivers are a representative group of workers who perform an essential activity in the Brazilian economy, which is heavily dependent on road transport. It is expected that the results of this study provide valuable contributions to the identification of strategies and development of countermeasures to control the fatigue risks involved in driving trucks.

Methodology

The methodology adopted for the development of this study, according to Gil (2019), is, by approaching the problem, qualitative, as it has a dynamic relationship between the real world and the subject, through interpretation without numerical representation; for its purpose, it is exploratory, as it intends to familiarize itself with the problem and present hypotheses; and by technical procedures, it is a literature review, which gathers and examines publications on fatigue and driver safety. To this end, this methodology uses inclusion and exclusion criteria to identify the articles to be included in the review, and then synthesize the results found (Xiao and Watson, 2017).

For this research, scientific articles collected from the Scopus, Web of Science, ProQuest, PubMed and Springer Link databases were used, which have the largest sets of results in the areas of knowledge of Engineering, Health and Administration, considered in the study (Gusenbauer and Haddaway, 2020). To search for articles aligned with the proposed theme, the following keywords were adopted: (“Safety” AND “Health” AND “Truck Driver”) OR (“Accident Risk” AND “Fatigue” AND “Truck Driver”) OR (“Crash” AND “Work Environment” AND “Truck Driver”).

These words were used in the five databases mentioned, in English and Portuguese, and the articles should have some of the keywords used in the title, abstract or throughout the text.

The literature review thoroughly analyzed the selected publications on the topic to determine the answers regarding the fatigue and occupational safety of truck drivers. For this purpose, all articles were reviewed with an emphasis on methodological and classifying aspects of the object of study. Only studies published from 2015 to 2022 were considered. Publications that were not accessible in full text in the database they were linked to, and that did not adhere to the format of scientific articles, chapters, or books, were excluded in order to maintain the scientific rigor of the study. During the research, filters for date, type of document, source, language and theme were used in the analyzed databases.

The works selected in the databases were exported to Mendeley, a bibliographic reference management tool, to eliminate duplicated studies. With the final set of articles in hand, a complementary approach to the review, entitled “Snowballing” was used (Mourão *et al.*, 2020). This technique aims to analyze the bibliographic references of selected works, seeking to identify classic articles in the study area, with the purpose of inserting them in the research.

The first step of this technique is to go through the bibliographical references of the selected works and exclude articles that do not meet the basic criteria, such as language, year of publication and type of publication. The next step is to remove articles that have already been analyzed from the list. Once removed, the remaining studies are candidates for inclusion. When the article is identified, the abstract is read first and then other parts of the article, until a definitive decision can be taken to include or not the publication (Mourão *et al.*, 2020). Figure 1 below illustrates the eight steps involved in constructing the literature review.

After completing this survey, the research related the information provided and its contributions to the discussion of the main aspects of the effects of fatigue during the working hours of truck drivers in road freight transport. The content of the documents was evaluated through a descriptive analysis, extracting: (1) what are the main factors that can influence the manifestation of fatigue? (2) what are the effects of fatigue on the truck driver's activity? (3) what are the challenges of conducting a comprehensive literature review on the

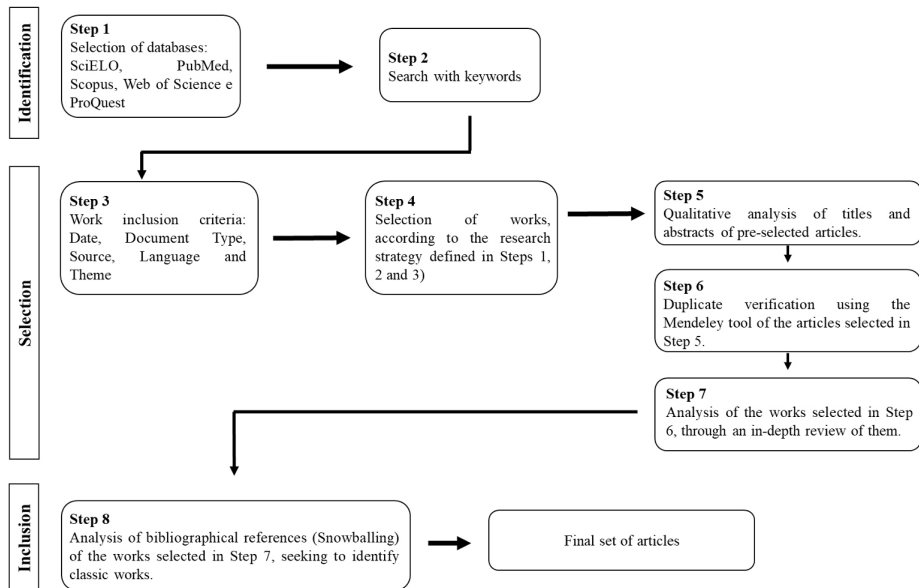


Figure 1. Literature review diagram. Source: Authors (2023).

effects of fatigue on the category of truck drivers?

Results and Discussion

Based on the review conducted, the initial literature search resulted in the selection of 14,217 references (2,607 in Scopus, 1,589 in PubMed, 1,892 in Web of Science, 4,724 in ProQuest, and 3,405 in Springer Link). With the application of the exclusion criteria, 9,788 articles were eliminated by publication date, 1,139 by the type of document, 490 by the type of source, 110 by the language and 1,906 due to the topic addressed, leaving 784 articles. Subsequently, a qualitative analysis of the titles and abstracts of these publications was carried out, resulting in 163 selected. This group of articles was processed by the Mendeley Reference Management tool, which excluded 18 duplicate works, reducing the sample to 145 articles.

A thorough review of the 145 selected articles was carried out with a complete reading of the materials, excluding 89 works because they did not align with the objective of this study. Thus, the study analyzed 56 articles, of which 48 were published between 2015 and 2022, and 8 were classic works obtained through the Snowballing method, written between 1996 and 2013. Next, Figure 2 presents a diagram illustrating the results obtained in the steps of the review process.

An examination of the literature on the consequences and hazards

of fatigue in truck driving reveals a heightened risk of accidents resulting from long working hours, correlated with the quantity of uninterrupted time spent carrying out job duties.

Fatigue and Driving

The fast growth of the economy and urbanization over the past 20 years has resulted in a substantial rise

in truck usage in Brazil, with the number of registered trucks growing from approximately 1,761,659 in 2006 to 2,879,080 in 2020, as reported by the Brazilian Institute of Geography and Statistics (IBGE, 2020). Trucks are commonly utilized for commercial purposes, requiring drivers to maintain focus and alertness while driving for extended periods, leading to fatigue (Belzer and Sedo, 2018).

Fatigue has been recognized as a contributing cause of accidents, injuries, and fatalities in various work settings, as tired individuals are less likely to carry out their duties safely (Lemke *et al.*, 2021). This holds true for transportation operations, including road transportation as well as other modes of transportation like air, rail, and waterway, as well as other professions that require irregular working hours (Williamson and Friswell, 2011). The consequences of fatigue, including delayed reactions, diminished concentration, reckless behavior, or even falling asleep at the wheel, have been implicated in many serious accidents (Cardoso *et al.*, 2019).

While driving long distances, particularly at night, truck drivers are more prone to feeling fatigue, leading to a decrease in attention on the road and slower reaction times, resulting in sluggish driving responses and drowsiness while behind the wheel (Soliani and Bueno, 2021). These symptoms negatively impact the driver's performance, thereby raising the likelihood of failure while driving (Shams *et al.*, 2020).

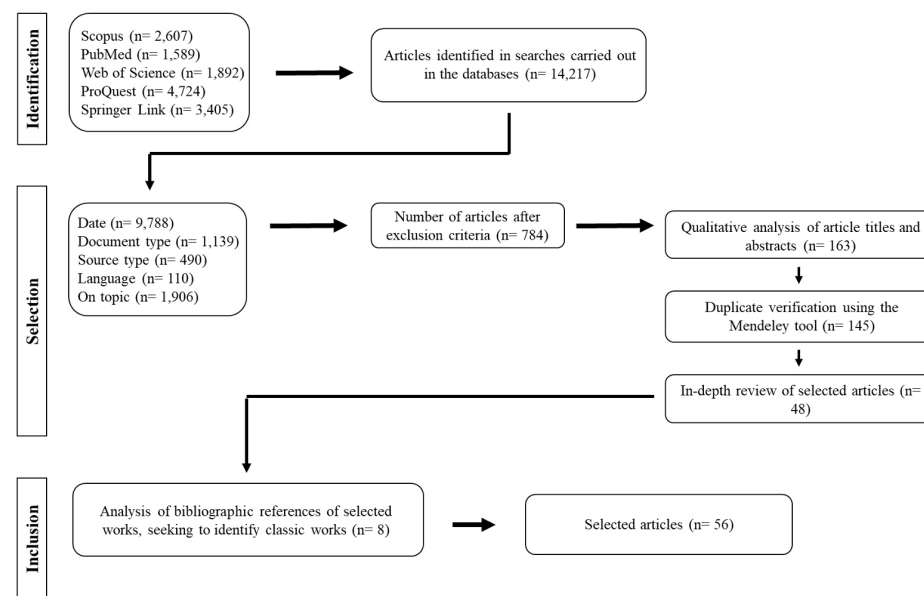


Figure 2. Diagram with the results of the literature review process. Source: Authors (2023).

In some studies, the terms fatigue and drowsiness are used interchangeably (Sparrow *et al.*, 2019). According to Liu *et al.* (2009), drowsiness is a condition where a person struggles to stay awake and alert. It can also be referred to as the feeling of "needing to sleep", resulting from a biological requirement. Fatigue, on the other hand, is a state that arises from prolonged activity (Williamson *et al.*, 1996). Although fatigue and drowsiness stem from different causes, they are often evaluated together in transportation operations due to their close relationship in hindering driver performance (Doudou *et al.*, 2020).

The literature review recognized three main factors that can influence the manifestation of fatigue. Figure 3 presents the articles selected for review divided into three groups of fatigue-influencing factors.

Studies have shown that fatigue refers to the decline in driver performance resulting from insufficient sleep, physical exhaustion, long working hours, and other factors. In addition to the potential impact on a professional's safety, poor sleep can lead to a range of health problems, including hypertension, diabetes, obesity, depression, and cardiovascular disease (Garbarino *et al.*, 2018; Ladeira *et al.*, 2017; Lemke *et al.*, 2017; Riva *et al.*, 2018). These health issues not only affect the driver's alertness and safety, but also their overall quality of life and life expectancy.

Next, the three main factors identified (sleep, work and health) that can influence the manifestation of fatigue are discussed, in which an attempt is made to concisely summarize the relevant literature on each topic.

Sleep-related factors

The circadian rhythm plays a critical role in driver fatigue. Many truck drivers experience a disruption of their biological rhythm due to their irregular work schedules, working during times when they would typically be asleep and sleeping during times when they would normally be awake (Anderson *et al.*, 2017; Hege *et al.*, 2015; Simonelli *et al.*, 2018). According to Williamson and Friswell (2011), fatigue is not a single phenomenon, but rather it can be differentiated into three aspects: 1) physiological (reduced physical capability), 2) objective (decreased work performance), and 3) subjective (the feeling of fatigue and exhaustion).

Davidović *et al.* (2018) distinguish between muscular and mental fatigue, with the latter being a pervasive sensation that is accompanied by feelings of apathy and aversion towards any activity. Nevertheless, the authors state that fatigue can be remedied through adequate rest.

As for drowsiness, it is described as the urge to sleep or the likelihood of falling asleep due to both biological factors and external influences (Sparrow *et al.*, 2019). While rest can alleviate fatigue, drowsiness only disappears after sleep (Chen *et al.*, 2016). Drowsiness is a physiological need, similar to hunger and thirst, and is caused by the stimulation of certain brain regions and parts of the central nervous system that regulate sleepiness. Unlike drowsiness, fatigue is a more comprehensive concept and is a signal from the body to stop all activities (physical and mental) and rest, not necessarily requiring sleep (Mutifasari and Ramdhan, 2019).

As per Lemke *et al.* (2016), our circadian rhythm is the 24-hour cycle that regulates our internal biological processes and bodily functions. Studies analyzed during the systematic literature review reveal that accidents and mishaps are more likely to occur when drivers had only 4 to 6 hours of sleep in the 24 hours leading up to the event (Lemke *et al.*, 2021; Liu *et al.*, 2009; Mccartt *et al.*, 2000; Mizuno *et al.*, 2020; Shams *et al.*, 2020; Umar and Bashir, 2020). The research conducted by Davidović *et al.* (2018) suggests that a minimum of 6 hours of sleep per night is necessary, with almost 8 hours being ideal.

According to Valenzuela and Burke (2020), while there are laws in many countries that regulate the maximum number of working hours, it is widely recognized that many workers, particularly drivers, work beyond these limits, which significantly raises the danger of drowsiness while driving. Narciso and De Mello (2017) consider driving for more than 12 hours and sleeping for less than 6 hours to be a high-risk situation.

In consonance with Islam and Ozkul (2019), drivers should have the option to rest in order to protect their well-being, however, many continue to drive for commercial reasons, putting themselves at risk of accidents. A substantial portion of the reviewed studies assess the efficacy of various methods to reduce fatigue, known as fatigue countermeasures, such as taking naps, consuming caffeine, and taking breaks for rest (Anderson *et al.*, 2017; Narciso and De Mello, 2017; Valenzuela and Burke, 2020).

Work-related factors

The transportation industry poses a significant risk of fatigue for its workers due to the prolonged working hours they often face (Sullman *et al.*, 2016). This can be attributed to the need for drivers to work irregular shifts, which negatively impacts their ability to get enough restorative sleep and thereby increases their risk of accidents (Heaton *et al.*, 2021).

The long-haul road transportation industry faces a significant risk of fatigue for its workers due to factors such as alcohol consumption during driving, drug use, lack of adequate sleep, disturbances in sleep, prolonged working hours, and fatigue. These factors increase the likelihood of accidents, collisions, or other fatal road incidents (Anderson *et al.*, 2017; Dawson and Reid, 1997; Filomeno *et al.*, 2019; Garbarino *et al.*, 2018;

Sleep-related factors: circadian rhythm disorders caused by disruption of sleep patterns

Alvaro *et al.*, 2016; Chen *et al.*, 2016; De Mello *et al.*, 2013; Filomeno *et al.*, 2019; Heaton *et al.*, 2017; Heaton *et al.*, 2020; Jeong *et al.*, 2018; Lemke *et al.*, 2016; Liu *et al.*, 2009; McCartt *et al.*, 2000; Naderi *et al.*, 2018; Serrano-Fernandez *et al.*, 2021; Shams *et al.*, 2020; Sparrow *et al.*, 2019; Williamson and Friswell, 2011.

Work-related factors: long driving hours and not enough time to recover from work

Anderson *et al.*, 2017; Belzer and Sedo, 2018; Çankaya and Sezen, 2019; Faulkner and Belzer, 2019; Friswell and Williamson, 2019; Hege *et al.*, 2015; Iseland *et al.*, 2018; Islam and Ozkul, 2019; Ladeira *et al.*, 2017; Lemke *et al.*, 2021; Meng *et al.*, 2016; Messias *et al.*, 2019; Reiman *et al.*, 2018; Simonelli *et al.*, 2018; Soliani, 2021; Soliani, 2022; Soliani and Bueno, 2021; Sullman *et al.*, 2017; Umar and Bashir, 2020; Valenzuela and Burke, 2020; Williamson *et al.*, 1996; Williamson and Friswell, 2013; Wolff and Caldas, 2018.

Health-related factors: sleep problems, general health and lifestyle issues

Bachmann *et al.*, 2018; Cardoso *et al.*, 2019; Davidović *et al.*, 2018; Dawson and Reid, 1997; Doudou *et al.*, 2020; Garbarino *et al.*, 2018; Giroto *et al.*, 2016; Hege *et al.*, 2019; Lemke *et al.*, 2017; Mizuno *et al.*, 2020; Mutifasari and Ramdhan, 2019; Narciso and Mello, 2017; Oliveira *et al.*, 2020; Pal *et al.*, 2019; Riva *et al.*, 2018; Stern *et al.*, 2019; Taylor and Dorn, 2006; Wise *et al.*, 2020.

Figure 3. Selected works for the literature review. Source: Authors (2023).

Giroto *et al.*, 2016; Shams *et al.*, 2020; Wise *et al.*, 2020).

The Brazilian government has established laws aimed at reducing the risk of driver fatigue through the Driver's Law (Law 13.103/2015). This law sets guidelines for both cargo and passenger road transportation drivers, including a minimum of one hour for meal breaks and a rest requirement of 11 hours every 24 hours, as well as a weekly rest of 35 hours. For long journeys, the law requires a 30-minute break for every five and a half hours of continuous driving (Brazil, 2015).

The highest danger of accidents caused by fatigue in the transportation industry has been linked to common factors like prolonged working hours, irregular night shifts, and limitations on opportunities for rest and sleep (Cardoso *et al.*, 2019; Jeong *et al.*, 2018; Ladeira *et al.*, 2017; Soliani, 2021; Taylor and Dorn, 2006; Umar and Bashir, 2020). Other activities that lengthen the workday or restrict sleep were also noted, such as waiting in lines for loading and unloading, which have also been related to driver fatigue (Friswell and Williamson, 2019).

Often, drivers are required to wait in lines during both the loading and unloading processes (Williamson and Friswell, 2013). The act of waiting in line can contribute to fatigue in a number of ways. For example, if drivers are unable to use the waiting time to rest, they may need to drive the truck as the line progresses. Additionally, they may need to stay alert as they do not know exactly when it will be their turn to load or unload (Friswell and Williamson, 2019). This results in longer working hours and increases the risk of fatigue-related incidents while driving.

Additionally, drivers are not often compensated for the time spent in lines waiting for loading and unloading operations. This can lead to fatigue as they are paid based on productivity metrics such as distance traveled or number of deliveries, instead of the time they have worked. The lack of compensation for time spent waiting in lines can decrease their earning potential, forcing them to drive more hours to make up for this lost time, which increases the risk of fatigue (Belzer and Sedo, 2018; Faulkner and Belzer, 2019; Friswell and Williamson, 2019; Williamson and Friswell, 2013).

Health-related factors

There are various health factors that can contribute to fatigue while driving, including sleep-related issues,

overall health problems, and lifestyle factors (De Mello *et al.*, 2013; Lemke *et al.*, 2016; Riva *et al.*, 2018; Shams *et al.*, 2020; Wise *et al.*, 2020). The act of driving requires sustained focus and the ability to assess potential hazards in the surroundings, which can be impacted by feelings of fatigue and stress for drivers who regularly work irregular shifts and face heavy traffic to meet tight schedules (Belzer and Sedo, 2018; Cardoso *et al.*, 2019; Garbarino *et al.*, 2018; Hege *et al.*, 2019; Iseland *et al.*, 2018; Serrano-Fernandez *et al.*, 2021).

According to Lemke *et al.* (2017), an individual requires an average of 8 hours of sleep in every 24-hour period. The study by Heaton *et al.* (2017) highlights that the amount of sleep prior to work is a critical factor in determining a driver's level of alertness. Alvaro *et al.* (2016) found that sleep deprivation can take place either suddenly or over an extended period of time, and its effects can be significant.

Lack of sleep often stems from sleep disorders that disrupt the quality and amount of sleep a person receives. The most prevalent sleep disorder is Obstructive Sleep Apnea (OSA) syndrome, as indicated in several studies (Alvaro *et al.*, 2016; Anderson *et al.*, 2017; De Mello *et al.*, 2013; Garbarino *et al.*, 2018; Heaton *et al.*, 2017; Heaton *et al.*, 2021; Hege *et al.*, 2015; Lemke *et al.*, 2016; Naderi *et al.*, 2018; Shams *et al.*, 2020; Wise *et al.*, 2020). In addition to OSA syndrome, stress, heart disease, diabetes, and mental health disorders can also cause feelings of fatigue (Bachmann *et al.*, 2018; Garbarino *et al.*, 2018; Hege *et al.*, 2019; Lemke *et al.*, 2017; Narciso and De Mello, 2017; Riva *et al.*, 2018; Stern *et al.*, 2019; Wise *et al.*, 2020).

Cardiovascular diseases (CVDs) are the leading cause of death and illness globally (Lemke *et al.*, 2017). Similarly, CVDs have a substantial impact on the health and safety of truck drivers (Bachmann *et al.*, 2018; Riva *et al.*, 2018; Taylor and Dorn, 2006). According to Riva *et al.* (2018) and Taylor and Dorn (2006), the combination of a truck driver's lifestyle with certain occupational factors creates a unique set of risk factors for CVD in this profession. Several studies have identified the main causes of CVD in truck drivers, including high blood pressure, smoking, a sedentary lifestyle, heart disease, high cholesterol, diabetes, obesity, and emotional stress (Bachmann *et al.*, 2018; Lemke *et al.*, 2016; Riva *et al.*, 2018).

Truck drivers often have an unhealthy lifestyle, characterized by a poor diet, lack of physical activity, and

higher rates of smoking and alcoholism compared to other occupational groups (Garbarino *et al.*, 2018; Giroto *et al.*, 2016; Oliveira *et al.*, 2020). Furthermore, their workplace environment can contribute to their well-being with long working hours, stress, fatigue, and exposure to high levels of noise and pollutants (Belzer and Sedo, 2018; Friswell and Williamson, 2019; Islam and Ozkul, 2019; Lemke *et al.*, 2021). In some industries, they may also be exposed to chemicals being transported.

Conducting a comprehensive literature review on the impact of fatigue among truck drivers poses some difficulties due to the various effects studied. While some studies rely on accident data to assess the relative risk associated with the number of hours of driving, especially after 5 to 6 hours (Williamson and Friswell, 2011), others, such as the research by Alvaro *et al.* (2016), used alertness tests and analyzed truck instrument data to find a stronger correlation between tiredness at specific times of the day and a weaker correlation between fatigue and the number of hours of driving.

Meng *et al.* (2016) investigated the potential demand for Fatigue Warning Systems (FWSs) among professional drivers as a solution to decrease the risk of fatigue-related driving accidents, as well as the drivers' perceptions of the design of FWSs. Meanwhile, Hege *et al.* (2019) aimed to examine the relationships between work characteristics, stress, sleep quality, and health behaviors, and their effects on the physical and mental health of lorry drivers. Additionally, Faulkner and Belzer (2019) found that the value of experienced and safe truck drivers is significant, as the higher wages paid to them are offset by lower costs for recruitment, training, and fewer accidents, and higher productivity, which positively affects a company's financial performance.

Conclusions

The aim of this paper was to thoroughly review the literature on the factors that contribute to fatigue in cargo drivers. The goal was to gain a deeper understanding of the causes and mechanisms of fatigue and to identify any lacking areas in the current literature on fatigue research methods. It's important to note that there is a large body of literature on fatigue due to its study by many different fields of knowledge.

Several studies have linked fatigue and drowsiness to a high rate of road accidents across the world. Among professional drivers, it is estimated that anywhere from 20% to 50% of

road accidents are caused by driver weariness, depending on the country. Truck drivers, who spend long hours on the roads, are particularly at risk of being involved in road accidents. Delays at loading and unloading docks can further increase the risk of fatigue by extending work hours and hindering drivers' ability to rest. Research indicates that poor working conditions for truck drivers can significantly increase the risk of accidents unless road safety is addressed in relevant legislation.

The review has found three main contributors to the occurrence of fatigue. The first is sleep, as sleep deprivation can disrupt the circadian rhythm and increase the level of fatigue in drivers. The second is related to work-related factors, such as inconsistent work hours, which reduce the amount of restful sleep. The third factor is the health of the driver, where the working conditions and stress associated with the profession can negatively affect the health of truck drivers and also pose a threat to the safety of others on the roads. Long working hours can also lead to the development of sleep disorders, physical injuries, and even cardiovascular diseases.

In terms of future studies on health and safety in the road freight transport sector, the current emphasis is on reducing the risk of accidents. Nonetheless, it is important to conduct more research on how to adjust working conditions to technological advancements, such as implementing fatigue monitoring and prevention systems, and increasing knowledge on the impact of physical and mental health on the likelihood of accidents.

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LOS EFECTOS DE LA FATIGA EN LOS CONDUCTORES DE CAMIONES EN EL TRANSPORTE DE CARGA: UNA REVISIÓN DE LA LITERATURA

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RESUMEN

Los accidentes de tránsito han sido tratados como un problema de salud pública, ya que sobrecargan el sistema de salud de los países, trayendo consigo un alto costo social debido a que las principales víctimas son jóvenes económicamente activos. En Brasil, entre 2007 y 2018, 38.040 personas fallecieron en accidentes en los que estuvo involucrado al menos un camión. Se estima que entre el 20% y el 50% de los accidentes graves en el mundo, están vinculados con la fatiga. La fatiga puede aumentar la frecuencia, el alcance o la variabilidad de los errores cometidos por el conductor mientras conduce. El objetivo principal de este estudio fue realizar una revisión exhaustiva de la literatura, buscando recopilar las evidencias relacionadas con los factores que influyen en la fatiga de los camioneros. La revisión se realizó con una selección de 56 artículos. Se identificaron tres factores principales

que pueden influir en la manifestación de la fatiga, a saber, el sueño, el trabajo y la salud. Las investigaciones indicaron que la fatiga se refiere a una disminución en las habilidades del conductor debido a factores como falta de sueño, esfuerzo físico excesivo, horas de trabajo extendidas entre otros. Además del impacto potencial en la seguridad del conductor, la falta de sueño es un factor de riesgo que causa una amplia gama de problemas de salud. Las condiciones de trabajo y el estrés relacionado con la profesión no solo tiene el potencial de afectar negativamente la salud de los camioneros, sino que también ponen en riesgo la protección de los demás en las carreteras. Futuras investigaciones deben estar orientadas a investigar métodos que permitan alinear las condiciones de trabajo con los avances tecnológicos, incluido el uso de sistemas de control y prevención de la fatiga.

OS EFEITOS DA FADIGA EM MOTORISTAS DE CAMINHÕES NO TRANSPORTE DE CARGAS: UMA REVISÃO DA LITERATURA

Rodrigo Duarte Soliani, Luiz Bueno da Silva e Anrafel de Souza Barbosa

RESUMO

Os acidentes de trânsito têm sido tratados como um problema de saúde pública por sobrecarregarem o sistema de saúde dos países, trazendo um alto custo social, já que as principais vítimas são jovens economicamente ativos. No Brasil, entre 2007 e 2018, 38.040 pessoas morreram em acidentes, nos quais ao menos um caminhão estava envolvido. Estima-se que a fadiga esteja relacionada entre 20% e 50% dos acidentes graves no mundo. A fadiga pode aumentar a frequência, a amplitude ou a variabilidade dos erros cometidos pelo motorista durante a condução. Assim, o objetivo principal deste estudo é realizar uma abrangente revisão da literatura, buscando sintetizar as evidências relacionadas aos fatores da sua influência nos motoristas de caminhão. A revisão trabalhou com 56 artigos selecionados, identi-

ficando os três principais fatores que podem influenciar na manifestação da fadiga, sendo: sono, trabalho e saúde. A pesquisa identificou que a fadiga se refere à diminuição das habilidades do motorista devido a fatores como falta de sono, esforço físico excessivo, jornada de trabalho prolongada, entre outros. Além do potencial impacto na segurança dos motoristas, o sono insuficiente é um fator que causa uma ampla gama de problemas de saúde. As condições de trabalho e o estresse relacionado à profissão não impactam negativamente a saúde dos caminhoneiros, mas também colocam em risco a proteção de terceiros nas estradas. Pesquisas futuras devem investigar métodos para conciliar as condições de trabalho com os avanços tecnológicos, incluindo o uso de sistemas de monitoramento e prevenção de fadiga.