

Excessive Drowsiness among Truck Drivers in Benin in 2023: Associated Factors and Risk of Crashes Occurrence

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Abstract

Introduction: Over-drowsiness is a condition with serious consequences, including road accidents. The condition, however, is often ignored both by carers as well as victims themselves. The aim of the present study was to investigate the factors associated with excessive drowsiness in Cotonou, Benin 2023, along with its influence on the occurrence of crashes among truck drivers. **Methods:** This was a descriptive and analytical cross-sectional study, held from March 13 to April 10, 2023, focusing on large truck drivers over 18 years of age, selected by convenience from parking lots in and around the city of Cotonou. Data collected using questionnaires on socio-demographic and behavioral factors, sleeping habits and working conditions were processed using Stata 15.0 software. Excessive drowsiness was defined by a score above 10 on the Epworth scale. Associated factors were found by multiple logistic regression, at a threshold of 0.05. **Results:** Altogether 304 drivers, all male and aged 35.98 ± 8.42 years, were surveyed. The prevalence of excessive drowsiness was 29.2%. The associated factors identified were not practicing sport OR = 2.27, CI95% = [1.33; 3.86], $p = 0,002$; sleep duration per working day OR = 1.82; CI95% = [1.06; 3.11], $p = 0,027$ and average distance travelled per day OR = 3.40; CI95% = [1.53; 7.56], $p = 0,003$. Excessive drowsiness was associated with a 1.73-fold increased risk of road accidents (CI95% [1.04; 2.87]; $p = 0.03$). **Conclusion:** Communicating excessive drowsiness and its associated factors to all the stakeholders in the haulage chain is essential to help prevent road accidents.

Keywords

Drowsiness, Large Trucks, Accidents, Benin

1. Introduction

Drowsiness is difficulty staying awake and an increased propensity to fall asleep at an inappropriate or even dangerous time [1]. It's an intermediate physiological state between wakefulness and sleep [2]. It can however become pathological (excessive drowsiness) if it occurs at a time when the person had not expected to sleep, during waking hours; when there is an unwanted and sometimes uncontrollable urge to sleep throughout the day [3] [4]. This condition affects many people around the world, and can be the root of accidents in everyday life, at work or on the public highway. In fact, excessive daytime drowsiness is responsible for around 10% to 30% of road accidents worldwide [5].

Excessive drowsiness is common, with a prevalence of 33.32% worldwide [6]. Among people in the United States, 27.8% are affected [7]. In Africa, daytime sleepiness was 31.07% in 2020 among Ethiopian students at the University of Gondar [3].

The prevalence of excessive drowsiness among truck drivers was 23.4% in the city of Parakou, Benin, in 2014 [8].

Road crashes are frequent in Benin; in 2021, the incidence of traffic accidents in the country stood at 85,298, or 6.8 per 1000 inhabitants [9]. And the number of people killed in 2019 varied between 8% and 20% of those injured [10].

Despite the numerous causes of crashes, those related to drowsiness among drivers of large trucks in Cotonou are poorly documented. Consequently, the present study was initiated to investigate the factors associated with drowsiness among drivers of large trucks in Cotonou in 2023, and the risk of crash occurrence.

2. Materials and Methods

2.1. Study Framework

The study took place in the city of Cotonou, the economic capital of Benin, which makes up the Littoral County, one of the country's twelve counties. In addition to the tertiary sector (trade and services) supported by a number of manufacturing industries, the town also benefits from the activities of the port sector (Port Autonome de Cotonou), the most important of which is that of second-hand vehicles. It is also the point of departure for large trucks carrying goods inland or to countries bordering Benin, such as Burkina-Faso and Niger [9]. A number of parking lots have been created for them in and around Cotonou. These include parking lots in Cotonou, Allada, Godonmè-gare and Sèmè Podji.

2.2. Study Type

This was a cross-sectional, descriptive and analytical study held in March 2023.

2.3. Participants

The study focused on drivers of large trucks in the parking lots of Cotonou, Al-

lada, Godonmè-gare and Sèmè Podji, whether employed by transport companies or working on their own account.

Drivers aged 18 and over who were present in the above-mentioned parking lots during the data collection period and who had given their free and informed consent were included in the study.

2.4. Sampling

The sample size was calculated using the Schwartz formula, based on the prevalence of excessive drowsiness in Parakou, Benin, of 23.4% [8] and a precision of 0.05, then increased by 10%, giving a sample size of 304 drivers.

Drivers included in the study were selected for convenience. Parking lots were visited one after the other, in descending order of their capacity in terms of surface area. When all eligible and available drivers in a parking lot had been found, we moved on to the next parking lot.

2.5. Variables

The dependent variable was excessive drowsiness among large truck drivers, measured by the Epworth Sleepiness Score (ESS), developed and published by John. Drivers with Epworth scores above 10 were classified as excessive drowsiness [11].

The independent variables are five groups of factors, namely:

- Socio-demographic factors: age, marital status and level of education;
- Health factors: history of diabetes, hypertension, musculoskeletal pathologies, vision disorders and epilepsy;
- Sleeping habits: daily sleep duration, number of naps per week and snoring or nocturnal respiratory discomfort;
- Behavioral factors: daily practice of sport, consumption of coffee, tea, tobacco, alcohol, cannabis and medication;
- Working conditions: working hours, average driving time before a rest period, average daily driving time, seniority as a truck driver, average distance covered per day, number of substantial meals per day, habitual overweight, remuneration and night shifts.

2.6. Data Collection

Data were collected by administering a questionnaire designed to incorporate the Epworth Drowsiness Scale. This consists of ten questions, each with four modalities, scored from 0 to 3 points (0 = never dozing, 1 = little chance of dozing, 2 = good chance of dozing and 3 = very high chance of dozing).

2.7. Data Analysis

Collected data were recorded on an Excel 2019 sheet, processed and analyzed using Stata 15.0 software. Analysis was performed in two phases, one descriptive and the other analytical.

Parameters for central tendency and dispersion were used in the descriptive phase. The following thresholds were used for variable transformation:

- Average daily sleep duration: less than 6 hours of sleep per day puts you at risk of excessive drowsiness [12] [13] [14];
- Number of naps: less than 2 per week = risk of excessive drowsiness [15];
- Alcohol consumption: more than 2 standard glasses per day plus = excessive consumption [9] [10];
- Average driving time before taking a rest: less than 5 hours (4 h 30 minutes), in Benin [16];
- Average daily driving time: 10 hours [17] [18];
- Average distance covered daily: less than 500 kilometers (464 km) [3] [18] [19].

The analytical phase consisted of a bivariate and then a multivariate analysis. For the bivariate analysis, simple logistic regression was used. The multivariate analysis was a top-down stepwise multiple logistic regression, at a significance level of 5%. Variables with a p-value less than or equal to 20% at the end of the bivariate analysis were included in the initial logistic regression model. Baseline modalities were those with the lowest risk.

The fit of the final model was tested, and we concluded that there was a "good fit" because the p-value of the Hosmer-Lemshow test was greater than 5%.

Once the factors associated with drowsiness had been identified, we investigated the link between drowsiness as an exposure and accident history (occurrence of accidents in drivers' past) as an event. To this end, a comparison of proportions was made, using Pearson's test, with a threshold of 5%.

2.8. Ethical Concerns

Authorization was granted by the administrative authorities in charge of transport. An information note was presented to drivers prior to the abstention of their consent. Data were collected and processed with respect for anonymity and confidentiality.

3. Results

3.1. Sample Description

Altogether 304 truck drivers were surveyed, all male, aged 35.98 ± 8.42 years. Average daily sleep duration on the working day was 4.28 ± 1.79 hours. There was one driver with epilepsy and one with impaired vision. The socio-demographic features of the drivers are presented in **Table 1**.

3.2. Prevalence of Drowsiness among Large Truck Drivers in Cotonou in 2023

The mean Epworth drowsiness test score was 9.89 ± 2.83 , with a range of 2 to 21. Of the 304 large truck drivers surveyed, 89 (29.2%) had an Epworth drowsiness scale score of over 10. The prevalence of excessive drowsiness among long-haul truck drivers in Cotonou in 2023 was therefore 29.2%.

Table 1. Socio-demographic features of truck drivers, Cotonou, 2023 (n = 304).

Features	Headcounts	%
Age (years)		
21 to 30	95	31.25
30 to 40	127	41.78
40 to 50	65	21.38
>50	17	5.59
Marital status		
Married/In relationship	258	84.87
Single/Widower/Divorced	46	15.13
Education level		
Out of school	85	27.96
Primary	127	41.78
Secondary	86	28.29
Higher	6	1.97

3.3. Identification of Associated Factor with Excessive Drowsiness among Large Truck Drivers through Bivariate Analysis

These results are shown in **Table 2** and **Table 3**, which demonstrate that factors associated with drowsiness were: daily sleep duration on the working day, high blood pressure, lack of daily exercise and average distance travelled per day.

3.4. Multivariate Analysis Results

The following **Table 4** presents the final model of the multivariate analysis.

The final model revealed three variables associated with drowsiness among Benin's large truck drivers in 2023: absence of sport, distance traveled per day by drivers and daily sleep duration on the working day.

Thus, knowing the fact of sleeping less than 6 hours on the working day and the distance traveled per day, drivers who did not practice sport were twice as likely to experience sleepiness as those who practiced it. Those who slept less than 6 hours per day were 3 times more likely to be sleepy than those who slept more than 6 hours per day, taking into account sports practice and distance traveled per day. Drivers who traveled more than 500 kilometers per day were 1.82 times more likely to have excessive sleepiness than those who traveled less than 500 kilometers, taking into account sleeping less than 6 hours per day and playing sports.

The Hosmer-Lemshov test had a p-value of 0.60, greater than 0.05, indicating that the model was adequate.

3.5. Link between Drowsiness and Accidents

The findings are given in the contingency **Table 5**.

Table 2. Association between drowsiness, sleeping habits factors and behavioral factors of large truck drivers, Cotonou, 2023; results of bivariate analysis (n = 304).

Features	n (%)	OR raw	CI 95%	p-value
Sleeping habits				
Sleep duration/working day (hours)				
≤6	237 (77.98)	3.82	[1.74; 8.40]	0.001
>6	67 (22.04)	1		
Sleep duration/day off (hours)				
≤6	62 (20.39)	0.89	[0.47; 1.66]	0.719
>6	242 (79.61)	1		
Nap				
Yes	179 (58.88)	0.85	[0.51; 1.40]	0.538
No	125 (41.12)	1		
Snoring or difficulty breathing at night				
Yes	65 (21.38)	1.66	[0.87; 3.17]	0.121
No	123 (40.46)	1		
Do not know	116 (38.16)	1.13	[0.63; 1.99]	0.673
Behavioral factors				
Night shift work				
Yes	204 (67.11)	0.94	[0.56; 1.60]	0.846
No	100 (32.89)	1		
Sports activities				
Yes	150 (49.34)	1		
No	154 (50.66)	2.48	[1.48; 4.15]	0.001
Coffee consumption				
Yes	109 (35.86)	1.07	[0.64; 1.80]	0.775
No	195 (64.14)	1		
Tobacco consumption				
Yes	60 (19.74)	1.67	[0.92; 3.03]	0.087
No	244 (80.26)	1		
Alcohol consumption				
Yes	108 (35.53)	1.17	[0.70; 1.96]	0.531
No	196 (64.47)			
Quantity of alcohol consumed per day				
≤2 glasses	52 (47.71)	1		
>2 glasses	57 (52.29)	0.87	[0.38; 1.96]	0.747
Cannabis consumption				
Yes	10 (3.29)	1.63	[0.45; 5.95]	0.453
No	294 (96.71)	1		

Table 3. Association between drowsiness, socio-demographic factors, health and working conditions of large truck drivers, Cotonou, 2023; results of bivariate analysis (n = 304).

Features	n (%)	OR raw	CI 95%	p-value
Socio-demographic factors				
Age (years)				
21 to 30	95 (31.25)	1		
30 to 40	127 (41.78)	1.36	[0.75; 2.46]	0.311
40 to 50	65 (21.38)	1.31	[0.65; 2.65]	0.444
>50	17 (5.59)	1.23	[0.39; 3.85]	0.719
Marital status				
Married/In relationship	258 (84.87)	1		
Single/Widower/Divorced	46 (15.13)	0.82	[0.40; 1.68]	0.606
Education level				
Out of school	85 (27.96)	0.81	[0.43; 1.54]	0.541
Primary	127 (41.78)	0.69	[0.38; 1.24]	0.217
Secondary and higher	92 (30.26)	1		
Health factors				
Diabetes				
Yes	6 (1.97)	2.46	[0.48; 12.45]	0.275
No	298 (98.03)	1		
Hypertension				
Yes	7 (2.30)	2.51	[1.09; 5.77]	0.029
No	297 (97.70)	1		
Musculoskeletal pathology				
Yes	10 (3.29)	1.63	[0.45; 5.95]	0.453
No	294 (96.71)	1		
Working conditions factors				
Driving experience (years)				
≤5	71 (23.36)	0.85	[0.46; 1.54]	0.595
>5	233 (76.64)	1		
Average distance driven per day (Km)				
<500	136 (44.88)	1		
≥500	167 (55.12)	1,88	[1.12; 3.14]	0.016
Working hours				
Daytime	11 (3.62)	1		

Continued

Alternating day and night	105 (34.54)	0.96	[0.24; 3.91]	0.966
Irregular rhythm	188 (61.84)	1.18	[0.30; 4.64]	0.803
Habitual overweight				
Yes	141 (46.38)	1.26	[0.77; 2.07]	0.347
No	163 (53.62)	1		
Remuneration (CFA francs)				
<50,000	61 (20.40)	0.60	[0.30; 1.17]	0.136
≥50,000	238 (79.60)	1		
Number of consistent meals per day				
≤2	86 (28.29)	1		
>2	218 (71.71)	1.66	[0.93; 2.98]	0.086

Table 4. Factors associated with drowsiness among truck drivers, Cotonou, 2023; multivariate analysis (n = 304).

Features	n (%)	OR adjusted	CI 95%	p-value
Sports activities				
Yes	150 (49.34)	1		
No	154 (50.66)	2.27	[1.33; 3.86]	0.002
Average distance travelled per day (Km)				
<500	140 (46.05)	1		
≥500	164 (53.95)	1.82	[1.06; 3.11]	0.027
Daily sleep duration on working day (hours)				
≤6	237 (77.98)	3.40	[1.53; 7.56]	0.003
>6	67 (22.04)	1		

Table 5. Relationship between drowsiness and prior crashes among truck drivers, Cotonou, 2023 (n = 304).

	Crashes occurrence		Total
	No n (%)	Yes n (%)	
Excessive drowsiness			
No	146 (67.91)	69 (32.09)	215
Yes	49 (55.06)	40 (44.94)	89
Total	195 (64.15)	109 (35.85)	304

OR: 1.73; CI 95% [1.04; 2.87]; $p = 0.03$.

Drivers of large trucks suffering from excessive drowsiness were 1.73 times more likely to have a road accident, compared to those without drowsiness. A significant association exists between drowsiness and the occurrence of accidents among drivers of large trucks in Cotonou in 2023.

4. Discussion

Prevalence of drowsiness

The prevalence of excessive drowsiness in the present study (29.2%) seems higher than those obtained by Houehanou in Parakou, Benin in 2014 (23.4%) and by Akkoyunlu, in Zonguldak, Turkey in 2013 (26.6%) [8] [20]. However, this is still below the 31.7% recorded in 2021 by Ahn in South Korea [21]. In the Democratic Republic of Congo, 42.7% of public transport bus drivers experienced daytime sleepiness in 2021 [22].

Beyond the mere comparison of the prevalence of drowsiness, the quality of road infrastructure and vehicles, so as the living and working conditions of drivers must be taken into account [23]. Thus, comparison is easier with Houehanou's results, as both studies were carried out in Benin, offering the same road infrastructure, living and working conditions. In addition, the town of Parakou is situated on the trajectory of the majority of truck drivers departing from Cotonou; it could be said that the two studies were carried out on the same population. With roughly the same sample size for both studies (304 and 316), we could explain the difference in prevalence by the time elapsed between the two studies. Indeed, from 2014 to 2023, nine years during which the whole world is going through an economic crisis, aggravated by the Covid-19 pandemic, and whose consequences spare no one and no sector of activity.

Associated factors to drowsiness

Furthermore, knowing the fact of sleeping less than six hours on the working day and the distance traveled per day, drivers who didn't practice sports had twice the risk of excessive drowsiness than those who did. This finding was also made by Houehanou in Parakou in 2014 ($p = 0.039$) [8]. As De Mello found in Brazil in 2013, regular exercise increases alertness and vigilance while driving in drivers who spend several hours behind the wheel. Exercise even reduces drowsiness and promotes recuperative sleep at night [24].

People sleeping less than six hours a day were three times more likely to be drowsy than those who slept more than six hours a day, taking into account the amount of sport and distance travelled per day. Querino Maia, found in 2013 in the USA that sleeping less than six hours was associated with excessive drowsiness, including at the wheel [25]. Failure to comply with the 24-hour time limit between delivery of the bill of lading and loading of the vehicle leads to the payment of penalties. It also depends on the time agreed to deliver the goods to the destination, which is often a long distance away [23], or on the lack of or failure to respect the service schedule, sometimes linked to a modest remuneration, the

payment of which is sometimes irregular or based on the number of journeys made.

Drivers who covered more than 500 kilometers a day were 1.82 times more likely to suffer from excessive drowsiness than those who covered less than 500 kilometers, taking into account the fact that they slept less than six hours a day and practiced sport. While living and working conditions are not the same, a similar result was also demonstrated by Rosso, in 2016 in Italy where , drivers who often travelled long distances and worked longer hours had excessive drowsiness [26].

Furthermore, the association between drowsiness and the occurrence of accidents among drivers of large trucks is consistent with data in the literature, such as the study by Rosso in 2016 in Italy [26] and by Cahit Özer in Turkey in 2014 [27].

Our study could be subject to information bias, as respondents might not give true answers to certain questions such as alcohol consumption, cannabis use, their health status in relation to a chronic illness, having experienced at least one accident and its possible causes, etc. To guard against such eventualities, we asked for and obtained the free and informed consent of the respondents, made it clear to them that the survey was anonymous, and reassured them that one of them would be present as an interviewer.

5. Conclusion

Based on this study, we identified average sleep time per working day, the average distance travelled per day and not practicing sports as factors associated with excessive drowsiness. These factors constitute behaviors which can only be modified by drivers themselves, but also by other transport stakeholders such as employers or truck owners, and customers whose goods are transported. A study of the latter two players will provide a clearer picture of their involvement, with a view to proposing the best communication strategy to contribute effectively to the prevention of road accidents.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Epworth Sleepiness Scale

Circle the most appropriate number for each situation:

- 0 = no chance of dozing or falling asleep;
- 1 = low chance of falling asleep;
- 2 = average chance of falling asleep;
- 3 = high chance of falling asleep.

It is important that you answer each question as best you can

SITUATION	CHANCE OF DOZING
Sitting and reading	0 1 2 3
Watching TV	0 1 2 3
Sitting, inactive in a public place (e. g a cinema, theater, meeting)	0 1 2 3
As a passenger in a car (or public transport) for an hour without a break	0 1 2 3
Lying down to rest in the afternoon when circumstances permit	0 1 2 3
Sitting and talking with someone	0 1 2 3
Sitting quietly after a lunch without alcohol	0 1 2 3
In a car, while stopped for a few minutes in the traffic	0 1 2 3

Total:

THANK YOU FOR YOUR COOPERATION