

# Prevalence and Association of Daytime Sleepiness among Commercial Vehicle Drivers in Southwestern Ethiopia: A Descriptive Cross-Sectional Study

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## Research article

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# Abstract

**Background:** Sleepiness, the most frequent sub-type of sleep disorders, is an excessive daytime sleepiness which commonly affects commercial drivers than the general population. It contributes to the high prevalence of Road Traffic due to its impact related to psychological stress, decreased productivity and increased risk of accidents both in & out of Ethiopia. Therefore, the current study was designed to elucidate the level of daytime sleepiness and its attributes to contribute to the prevention actions of country's strategy.

**Objective:** To describe the prevalence and associated factors of daytime sleepiness among commercial vehicle drivers in Ethiopia

**Methods:** Data were collected from 398 randomly selected participants using a validated and pretested questionnaire to assess socio-demographic characteristics and the Epworth Sleepiness Scale (ESS), which assesses daytime sleepiness prevalence. All data were entered into EpiData and analyzed using Statistical Package for Social Science (SPSS) version 22 software whereby measurements of central tendencies and logistic regressions were used to report the results.

**Results:** Overall, 398 public drivers were enrolled into the study making 99% response rate with the mean age of 32.1 years (SD  $\pm$  9.1) and 20-29 year modal class. The driving years of the majority (47%) were reported in 0-4 year class. The prevalence of the daytime sleepiness was 21.7% among the study subjects. In final model of logistic regression drivers' work experience (AOR=13.96, CI=1.18, 11.1,  $p=0.04$ ), substance users like Tobacco (AOR=2.9, CI=1.1, 7.6,  $p=0.03$ ) & Alcohol (AOR=6.12, 95% CI=2.32, 6.12,  $P=0.00$ ), and drivers' monthly income (AOR=2.49, 95%CI=1.02, 6.06,  $P=0.04$ ) were demonstrated an association with day time sleepiness.

**Conclusions:** The prevalence of day time sleepiness was relatively high in the studied population group, and factors linked to the problem are driving experiences, substance use and middle level of monthly income. Therefore, we recommend further studies on impacts of day time sleepiness and strategic action on the reduction of the relation.

## Background

Sleepiness, the most frequent sub-type of sleep disorders commonly named excessive daytime sleepiness, is an important and known cause of road traffic injuries worldwide. Excessive daytime sleepiness (EDS) affects 4 to 12% of the general population with higher rate among commercial vehicle drivers, and it is one factor to contribute to high prevalence of Road Traffic Accidents (RTAs). Even though the causes of EDS remain unclear (1, 2), People with EDS frequently reported to suffer psychological stress, decreased productivity at work or school and increased risk of accidents(3). Excessive daytime sleepiness, reduced number of sleep hours, shift work, excessive driving time, use of alcohol and other drugs are predictive factors of automotive accidents(4). Recent epidemiological studies reported the prevalence of EDS to be 15–26% in the general adult population(5), 13% in Brazil(6), and it was considered to be a major causal factor in transportation-related accidents. Roughly, 16–20% of all traffic accidents and 29–50% of deaths, and serious injuries related to motor vehicles are reported have an association with driver sleepiness(7). A systematic review found that as many as 20% of traffic accidents were associated with sleep deprivation(8). Most RTAs occur at night (54%) (9), in people having sleep disorders the frequency with which they fall asleep while driving was between 30 and 93%, depending on their pathology (10), (11). For sleep apnea patients, accident rates of 31–93% have been reported, for narcoleptics, studies have

reported that 40–48% had fallen asleep at the wheel and 25% had had accidents related to their sleepiness(12), (13). Sleep related vehicle accidents comprised 16% on major roads in southwest England, and over 20% on midland motorways in which about half these drivers were men under 30 years; few such accidents involved women(14). Being younger; higher average weekly driving hours; never/rarely getting enough sleep and reporting any chance of dozing in a car while stopped in traffic and snoring regularly whilst sleeping at night or who were obese an scores on the Epworth daytime sleepiness scale had higher accident liabilities in road traffic accidents than those not exhibiting these characteristics(15).

Similarly, it was reported in America as Commercial drivers suffer from excessive daytime sleepiness due to age, body mass index and alcohol consumptions(16). Alcohol-impaired driving accidents due to sleepiness also contribute to approximately 31% and 34.1% of all traffic fatalities in the USA and china(17) respectively with common alcohol related crash reports in UK from similar cause(18). A prospective cohort study conducted in Japan showed the other predator for excessive daytime sleepiness to be cigarette smoking(19)(20) (21). Similarly a survey conducted among Canadian (22) from 2002 to 2014 indicate cigarette smoking as cause of RTA associated daytime sleepiness. Monthly income, female gender and low schooling level remained positively and independently associated with EDS as shown by the study conducted in Brazil(6) where the study conducted in An-Nahah showed no association of daytime sleepiness with any socio-demographic factors(23).

In Ethiopia, road traffic accident from daytime sleepiness has been one of the top ten causes of death(24). Therefore it has been the key public health and development challenges of the country and will continue to adversely affect the livelihood of community and the economy of the country unless effective measures are taken to control the problem(25). Therefore, the current study was designed to elucidate the level of daytime sleepiness and its attributes in Ethiopia to contribute to the prevention actions of country's strategies.

## Methods

A cross-sectional study was carried out on randomly sampled licensed commercial drivers from March 25, 2019 to June 25, 2019. Registration log of the zone was used as a frame to enroll study subjects under consideration of 95% CI, 80% power, 50% prevalence (not the prevalence of the area ) and a 5% margin of error. To this end, a correction formula was deployed with a 10% non-response rate added and summing a total of 402 final samples following a granted approval from Jimma University and transportation authority of the area. Socio-demographic related data were included by semi- structured questionnaires while daytime sleepiness was measured using the Epworth Sleepiness Scale (ESS), a frequently used subjective sleepiness scale that consists of eight items(26). In the present study the ESS was properly adapted to measure drivers falling asleep. Possible ESS scores range from 0 to 24. Higher scores in the ESS represent greater propensity for sleepiness. In the final result, EDS was defined as an ESS score of Less than 8: indicates reported normal daytime alertness, 8 to 11: to indicates mild sleepiness, 12 to 15: to indicates moderate sleepiness and 16 to 24: to indicates severe sleepiness(27).

All data were entered and analyzed using Statistical Package for Social Science (SPSS) version 22 software where  $X^2$  test was used to test for differences between proportions. To explore the association of socio demographic and sleep-related factors with EDS, prevalence rates of EDS within subgroups for each variable were estimated. Quality was assured through translation of the questionnaire to & retranslation from the local language and adequate training of data collectors after pretest was assured at separate area of similar characteristics.

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## Results

### Description of Socio-demographic characteristics of the study subjects

Overall, 398 public drivers were enrolled into the study making 99% response rate with the mean age of 32.1 years ( $SD \pm 9.1$ ) and 20–29 year modal class. Of these enrolled only 5(1.3%) of respondents were females. More than half (53.4%) of the participants were married. Concerning educational status, 218(54.8%) of respondents were attended primary education followed by high school graduates, 154 (38.7%) with the remaining 26(6.3%) higher education complete. From the total participants, 47% were reported & identified to be the majority group related to work experiences of 0–4 years. Similarly from all studied subjects the average monthly income was identified to be 4446.12 ETB (with  $SD \pm 4775.18$ ) with the majorities (72%) reported to earn up 5000 ETB monthly (Table 1).

Table 1  
Description of Socio-demographic characteristics and ESS distribution among the study participants

Variables	Categories	Total	
		#	%
Age Of Drivers in years	0–19	6	1.5
	20–29	186	46.7
	30–39	128	32.2
	40–49	56	14.1
	50–59	14	3.5
	60–69	8	2.0
Sex	Male	393	98.7
	Female	5	1.3
Educational Status	Elementary	218	54.8
	High School Graduate	154	38.7
	Diploma & above	26	6.5
Marital Status	Married	213	53.7
	Single	174	43.8
	Widowed	4	0.8
	Divorced	7	1.8
Drivers work Experience in years	0–4	187	47.1
	5–9	109	27.5
	10–14	60	15.1
	15–19	18	4.5
	20–24	18	4.5
	≥ 25	6	1.5
Substance Use	Yes	187	47.0
	No	211	53.0%
Tobacco Products(Cigarettes)	Yes	32	17.1
	No	155	82.9
Alcoholic Beverages (Beer, Wine, Other Alcohols, Etc.)	Yes	81	43.3
	No	106	56.7
Cannabis (Marijuana, Grass, Etc.)	Yes	3	1.6

	No	184	98.4
Khat	Yes	162	86.6
	No	25	13.4
Drivers Monthly Income in ETB	Up To 5000	288	72.5
	6000–15000	104	26.2
	Above 15000	6	1.5

From all study subjects, 53% were identified to use either of substances with the remaining counterpart to be free of these substances. Majority of the substance users were linked to khat (86.6%) where a few proportion has reported cannabis users (1.08%).

## Description of sleep characteristics of the study participants

With the regards to the measurements of the chance of dozing at eight different situations, participants were found to demonstrated similar characteristics of dozing at sitting & reading, and watching TV situations. In these situations, the majorities of the subjects would never fall asleep in 52.3%, with a slight chance of falling asleep in 16.8%, a medium chance of in 17.8% and a high chance of falling asleep in 13.1%. While Sitting, inactive in a public place like at a theatre or a meeting a total of 317 (79.6%), 46 (11.6%), 32 (8.0%) & 3 (0.8%) were respectively found to be never, slight, moderate and higher dozers. Similarly, while in travelling as a passenger in a car for an hour without a break, 88.7% of the study subjects were remains never dozing, with slight chance of in 6.3% with the remaining moderate (4.8%) & higher dozers (1.3%). In each remaining four situations, the dozing characteristics of the study subjects were recognized to take a similar characteristics or descending order from never to higher chances of dozing. Lying down to rest in the afternoon when circumstances permit 73.4% never dozes with 7.5% higher chance falling asleep in this situation. In sitting and talking to someone, 91.2% would never fall asleep in that situation while 1.5% reported a high chance of falling asleep. Finally, 90.7% while sitting quietly after a lunch without alcohol and 93.5% in a car, while stopped for a few minutes in the traffic were reported as would never dozers with the remaining proportions to be either slight, moderate or higher dozers in each situation as indicated in Table 2.

Table 2  
Description of sleep characteristics of the study subjects

Variables	Corresponding Sleepiness score(0–3), in increasing order within the categories	Frequency	%
Sitting and reading			
	Would never doze	208	52.3
	Slight chance	67	16.8
	Moderate chance	71	17.8
	Higher chance	52	13.1
Watching TV			
	Would never doze	207	52.0
	Slight chance	57	14.3
	Moderate chance	82	20.6
	Higher chance	52	13.1
Sitting, inactive in a public place (e.g. A theatre or a meeting)			
	Would never doze	317	79.6
	Slight chance	46	11.6
	Moderate chance	32	8.0
	Higher chance	3	0.8
As a passenger in a car for an hour without a break			
	Would never doze	353	88.7
	Slight chance	25	6.3
	Moderate chance	19	4.8
	Higher chance	1	0.3
Lying down to rest in the afternoon when circumstances permit			
	Would never doze	292	73.4
	Slight chance	54	13.6
	Moderate chance	22	5.5
	Higher chance	30	7.5
Sitting and talking to someone			
	Would never doze	363	91.2
	Slight chance	22	5.5
	Moderate chance	7	1.8

Variables	Corresponding Sleepiness score(0–3), in increasing order within the categories	Frequency	%
	Higher chance	6	1.5
Sitting quietly after a lunch without alcohol			
	Would never doze	361	90.7
	Slight chance	22	5.5
	Moderate chance	12	3.0
	Higher chance	3	0.8
In a car, while stopped for a few minutes in the traffic			
	Would never doze	372	93.5
	Slight chance	15	3.8
	Moderate chance	10	2.5
	Higher chance	1	0.3

In summary, the result of the current measurements indicated that of the responding commercial drivers, 87 subjects (21.7%) reported they scored more than 10 in ESS with the remaining 78.3% counterpart as illustrated in Fig. 1.

From the aforementioned data in Table 1, 30–39 years of age (46.3%), less driving experience or 0–4 years (39%), khat chewing (96.9%) and lower monthly income (76.2%) showed higher values for EDS as compared to their respective classes.

## Association of variables with the EDS score

After the detail description of the characteristics of the study subjects all variables were evaluated by bivariate logistic regression or association with an outcome variable of ESS score at p-value of 0.25. As to this educational status ( $P = 0.06$ , UOR = 0.6), work experience years ( $P = 0.05$ , UOR = 2.74), Tobacco use ( $P = 0.03$ , UOR = 5.2), Alcohol consumption ( $P = 0.001$ , UOR = 7.0 and monthly income in ETB ( $P = 0.001$ , UOR = 2.83) were reported for the association. These variables were further entered into multivariable logistic regression and finally four of their categorical were showed an association with the dependent variable and reported as the final model as displayed in Table 3. In the table drivers of work experience ranged from 10–14 years are 13.96(AOR = 13.96, CI = 1.18, 11.1,  $p = 0.04$ ) times more likely to suffer an Excessive daytime sleepiness as compared to drivers of 0–4 years of work experiences.

Substance users like Tobacco and alcohol are the other identified groups to show 2.9 (AOR = 2.9, CI = 1.1, 7.6,  $p = 0.03$ ) and 6.12(AOR = 6.12, 95% CI = 2.32, 6.12,  $P = 0.001$ ) times higher risk than their counter parts in respective orders. Finally, drivers who earn 6000–15000 monthly ETB were demonstrated to have more relation (AOR = 2.49, 95%CI = 1.02, 6.06,  $P = 0.04$ ) than their colleagues earning more than 15000 ETB per month. Generally the current study identified, driving experiences of 10–14 years, tobacco or alcohol use and middle level of monthly income were the revealed to be the factors of daytime sleepiness.

Table 3  
Association between EDS and some characteristics of study subjects

Variables	Categories	ESS Score		Unadjusted		Adjusted		
		≤ 10	> 11	P-Value	UOR	P-Value	AOR	95% CI
Educational status	Elementary	163(52.4)	55(63.2)	0.81	0.89	0.001	1.00	
	High School Graduate	21(6.8)	6(6.9)	<b>0.06</b>	<b>0.61</b>	0.99	1.01	[0.10,10.24]
	Diploma & above	127(41.8)	26(29.9)	0.001	1.00	0.03	0.38	[0.16, 0.95]
Drivers work Experience in years	0–4	149(48.1)	38(43.7)	0.98	1.00	0.06	1.00	
	5–9	87(28.1)	22(25.3)	0.30	1.43	0.07	9.45	[0.81, 11.3]
	10–14	44(14.20)	16(18.4)	<b>0.05</b>	<b>2.74</b>	<b>0.04</b>	<b>13.96</b>	<b>[1.18, 11.1]</b>
	15–19	10(3.2)	7(8.0)	0.71	0.78	0.07	14.18	[0.84, 16.5]
	20–24	15(4.8)	3(3.4)	0.83	0.78	0.45	3.62	[0.13, 23.9]
	≥ 25	5(1.6)	1(1.1)	0.98	0.99	0.06	10.05	[0.89,10.2]
Tob <sub>a</sub> cco Products(Cigarettes)	Yes	16(11.0)	16(39.0)	<b>0.001</b>	<b>5.20</b>	<b>0.03</b>	<b>2.90</b>	<b>[1.1, 7.60]</b>
	No	130(89.0)	25(61.0)	0.001	1.00	0.001	1.00	
Alcoholic Beverages (Beer, Wine, Other Alcohols, Etc.)	Yes	49(33.6)	32(78.0)	<b>0.001</b>	<b>7.04</b>	<b>0.001</b>	<b>6.12</b>	<b>[2.32, 6.12]</b>
	No	97(66.4)	9(22.0)	0.001	1.00	0.001	1.00	
Drivers Monthly Income in ETB	Up To 5000	241(77.5)	47(54.3)	0.001	1.00	0.001	1.00	
	6000–15000	67(21.5)	37(43.0)	<b>0.001</b>	<b>2.83</b>	<b>0.04</b>	<b>2.49</b>	<b>[1.02, 6.06]</b>
	Above 15000	3(1.0)	2(2.3)	0.19	3.41	0.05	17.09	[0.94,30.98]

## Discussion

In this community-based study of commercial drivers, we observed a prevalence of daytime sleepiness and its positive relationship with some factors. The identified prevalence looks a bit higher than the prevalence reported by similar studies in among Turkey drivers where day time sleepiness is 15.3% with ESS and sleepiness among heavy vehicle drivers in Sri Lanka which is 14.4% and 13.2in Korea(28,29,31,) . Whereas, this report prevalence is lower than reports among Brazilians 28%, among Chinese drivers 22.16% and among Australian commercial vehicle drivers 24% (31, 22, and 30). The reported variations between different studies may be idiosyncratic to different socioeconomic demands and cultural habits among the different population groups. Due to different factors such as sleep habits, sleep hygiene, cultural and racial differences, life-style, life quality and stresses.

Related to factors associated with daytime, work experience which is 10-14 years has shown positive relation among the study subjects. In contrast with young drivers or less experienced, the collisions of older drivers more often involve driver error at intersections and when making turns found that failure to yield right of way, failure to comply with signs and signals, failure to see objects, and improper turns and lane changes were commonly reported in road accident records for collisions of older drivers(15). Older driver errors may in part result from age-related decline in visual, cognitive, and mobility functioning in older age

Study also reported the existence of linkage between daytime sleep and smoking as like in Japan (20) and Canada (22) . This result would take a knowledge lead as there could be the distraction or impaired attention for the fact that smoking was associated with difficulty initiating sleep, difficulty waking up and cause drowsiness to a person during the routine day activity. Alcohol intake in similar way identified to have relation with daytime sleepiness among commercial drivers. This positive relation resembles study reports of countries like America, China and UK (16)(17)(18). Alcohol consumption at almost any level can cause sleep disturbance and induce sleep disorders. Drinking alcohol can disrupt the structure and duration of sleep states, alter total sleep time, and affect the time required to fall asleep. Many people suffering from insomnia will take a drink before bedtime to help them fall asleep. After an initial stimulating effect, alcohol's sedating effects can reduce the time required to fall asleep. Whereas this study does not agree with the study conducted in USA which state alcohol use (more than seven beverages per week) reduced the risk for excessive sleepiness in a robust. Finding found in all analyses was that drinking seven or more alcoholic beverages a week reduced the risk for sleepiness. It is unclear why in-cresed alcoholic beverage consumption was found to be associated with reduced risk, as alcohol consumption is sometimes implicated as a factor associated with sleep disruption but the most parsimonious explanation is that the with awareness of excessive sleepiness learn to appreciate the negative impact of alcohol on their sleep, and hence reduce alcohol intake.

Monthly income was another socio demographic factor that showed relation with excessive sleepiness among drivers our study agrees with study conducted in Brazil In relation to the general socioeconomic context, our study demonstrated that individuals with lower income have excessive sleepiness that individuals with higher socioeconomic status (26, 32). Indeed, lower socioeconomic condition is related to many intrinsic factors that can cause poor sleep such as illness, fewer support systems, depression, anxiety, lower quality of life, and less motivation to see sleep as a priority.

## Conclusions

The result of the current measurements indicated that majority of the responded commercials drivers have non-severe ESS. Whereas, the prevalence of day time sleepiness was relatively high in the studied population group, and factors linked to the problem are driving experiences, substance use and middle level of monthly income. Therefore, we recommend further studies on impacts of day time sleepiness and strategic action on the reduction of the relation.

## Abbreviations

**AOR:** Adjusted Odd Ratio

**EDS:** Excessive Daytime Sleepiness

**ESS:** EXCESSIVE SLEEPINESS

**ETB:** Ethiopian Birr

**RTA:** Road Traffic Accident

**SD:** Standard Deviation

**TV:** Television

**USA:** United State of America

**UOR:** Unadjusted Odd Ratio

## **Declarations**

### **Ethics approval and consent to participants**

This study was reviewed and approved by the Ethics Committee of Jimma University (committee's reference number IHRPGD/467/2019). Written informed consent was obtained from all participants.

### **Consent for publication**

Not applicable

### **Availability of data and materials**

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

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Jimma University funded the study until result. Dissemination through publication and other expense is there for the academic work the author to reach wider community through the journal.

### **Competing interests**

The authors declare they have no competing interest.

### **Authors' contribution**

All authors constructed the study conception, design and substantively revised it. HB, AA<sup>1</sup>, EM recruited participants, HB, DG, WR, ZM & AA<sup>2</sup> were involved in statistical analysis. HD, DG, EM and WD were responsible for the critical revision of the manuscript. All authors have agreed both to be personally accountable for the author's own contributions and any questions related to the accuracy or integrity of any part of the work. Finally, all the authors have read and approved the submitted version. The work presented here has not been published previously and is not being considered for publication elsewhere. The author (s) read and approved the final manuscript.

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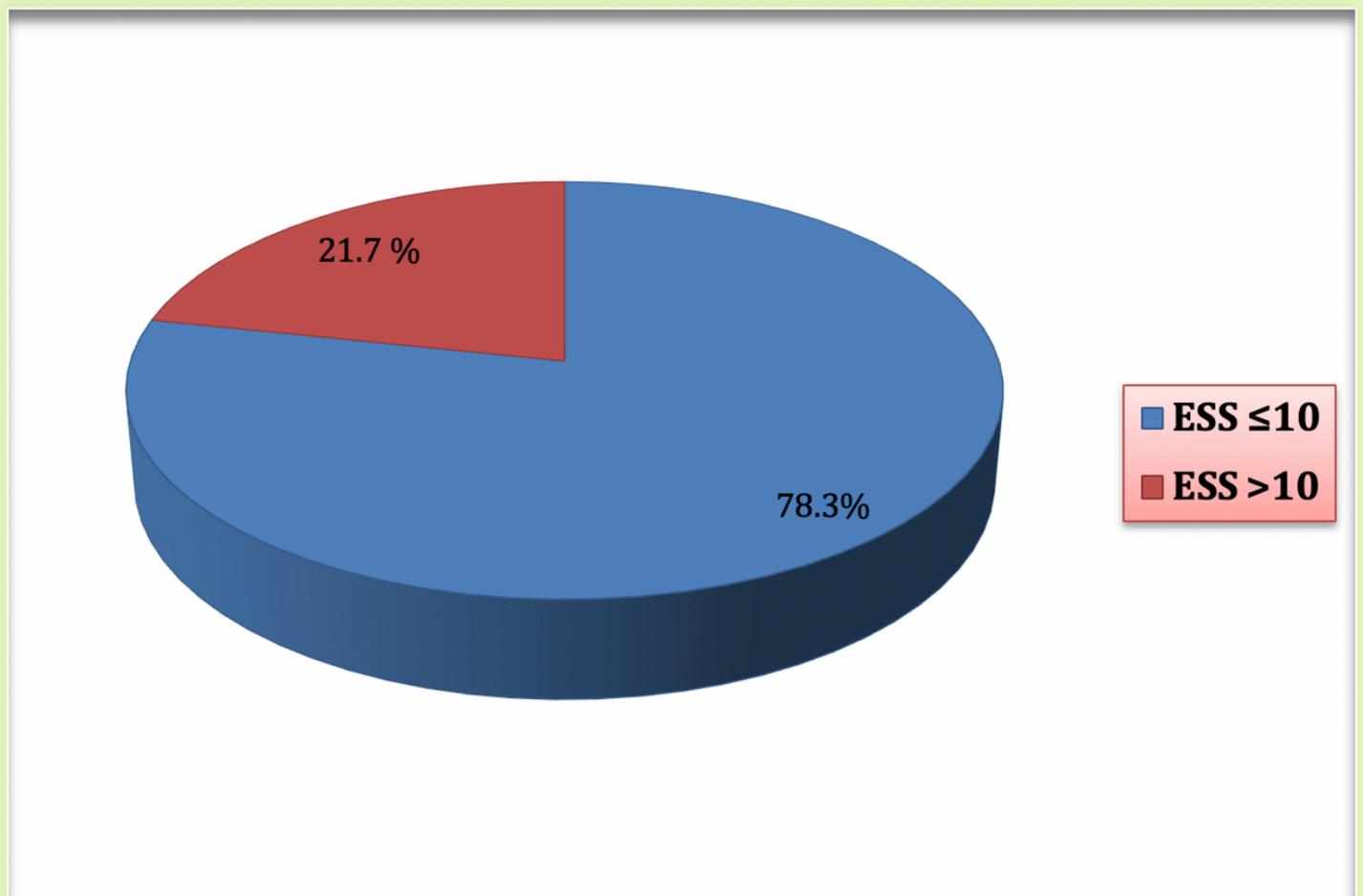
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## Figures



**Figure 1**

Epworth sleepiness scale score description of the study subjects