IDENTIFICATION OF FACTORS CAUSING WORK FATIGUE AND ITS IMPACT ON DRIVING SAFETY AMONG MORNING AND NIGHT SHIFT DRIVERS ON PUBLIC TRANSPORTATION IN JAKARTA

Yusime Fitasari[1]*, I Gusti Bagus Eka Nitiyasa[1], Budi Mardikawati[2]
[1]Automotive Technology, Politeknik Transportasi Darat Bali, Jl. Cempaka Putih, Sam-sam, Kerambitan, Tabanan, Bali 82111, Indonesia
[2]Road Management Transportation, Politeknik Transportasi Darat Bali, Jl. Cempaka Putih, Sam-sam, Kerambitan, Tabanan, Bali 82111, Indonesia
*yusime@poltradabali.ac.id

ABSTRACT

Jakarta, as the center of national activity, faces an increasing population and motorized vehicle population, which adds to traffic safety challenges. Public transportation drivers, including Transjakarta , work shifts that can potentially lead to fatigue, particularly the night shift, which is more susceptible to circadian rhythm disruption. This study aims to analyze driver fatigue levels, compare fatigue between morning and night shifts, and examine the effect of fatigue on driving safety and the possible moderating role of shift work. The study used a quantitative approach using the Swedish Occupational Fatigue Inventory (SOFI) instrument, adapted into Indonesian, and demonstrated good validity and reliability (CVI > 0.80; Cronbach's Alpha > 0.70). The sample consisted of 223 public transportation drivers in DKI Jakarta, and analyzes were conducted using descriptive statistics, the Mann–Whitney difference test, Pearson correlation, and multiple linear regression. The results showed that sleep time was the most significant contributing factor to differences in fatigue, while differences in fatigue levels between shifts were not significant. Pearson correlations showed that fatigue dimensions, particularly sleepiness and lack of motivation, were strongly associated with decreased driving safety. Regression analysis confirmed that both dimensions were significant predictors of safety.

Keywords: drivers; fatigue; public transportation; safety; shift work

INTRODUCTION

Jakarta as Mother the city of Indonesia is center government , economy , and activities ongoing social experience growth significant . Based on data from the Central Statistics Agency (BPS), the number of the population of DKI Jakarta in 2023 will reach more from 11 million soul , with mobility daily involving more from 20 million movement humans , including commuter from the Bodetabek area (BPS DKI Jakarta, 2023).

For respond challenge mobility urban this , the Government DKI Jakarta Province is developing system transportation public more mass reliable and integrated , one of them through service Transjakarta . Since launched in 2004 , Transjakarta has become bone back transportation public in Jakarta with an average number of passenger daily reached 800 thousand up to 1 million people by 2023 (Transjakarta , 2023). Operational Transjakarta covers service for 24 hours in shift work system for drivers , namely morning shift and night shift , to ensure affordability service for public whenever needed .

However thus , behind importance role driver transport general , especially Transjakarta bus drivers , there are challenge big related with aspect health and safety work , especially fatigue work (fatigue). Causes main occurrence accident Work that is fatigue work (fatigue). Fatigue is reason main death worker every year . Of the 58,115 samples studied , 32.8 % experienced fatigue work . This happened Because fatigue Work can become reason decline performance , as well as can cause error in work and in the end happen accident in doing the work (Regiana , MA et al. , 2024). Conditions Work in shift system , especially night shift , is known in a way scientific own potential risk more fatigue tall consequence disturbance rhythm

circadian and quality poor sleep (Akerstedt , 2003) . Night shift worker experience quality more sleep bad , level more fatigue height , and increase injury compared to day shift workers (Tandfonline , 2024). This become crucial when associated with not quite enough answer big driver in transport passenger in amount big every day .

Remember service Transjakarta operate for 24 hours, the difference condition Work between morning shift and night shift No only determined by duration work , but also by factors biological and environmental which are significant influence level fatigue driver . Night shift in a way natural put driver in condition conflicting work with rhythm circadian body , namely system biological regulation pattern sleep , alertness , and function cognitive human . Disturbances in the rhythm circadian known can lower quality sleep , inhibit recovery physical , as well as increase accumulation fatigue that ultimately impact on the decline performance and safety work (Alqahtani et al., 2024; Zhang et al., 2023). In addition , night shift drivers must face challenge addition like condition a better way monotonous , level vigilance physiological decline in late hours night , and greater potential for micro-sleep high . On the other hand , morning shift drivers face to face with density Then cross , pressure time , and demands high operational , but still is at in normal human biological clock range . Differences characteristics challenge between these shifts show that second group driver own risk different fatigue fundamentally . Therefore that , analysis comparative between morning and night shifts become important For understand How factor biological and operational the contribute to level fatigue as well as the implications to safety driving in context transport common in Jakarta.

Study previously show that driver transportation general own prevalence high fatigue, especially when Work in long shift system and not balanced (Yazdi et al., 2018). Fatigue No only impact on health term long driver , but also contribute to improvement incident accident Then cross . Based on KNKT data (2021), several incident bus accidents in Jakarta and surrounding areas allegedly strong related with factor fatigue driver. With background behind said , it is important For do study comparative between morning and night shift drivers in matter level fatigue work and its impact to safety driving as well as For know factor dominant influence to safety driving .

METHOD

Study This is study quantitative comparative and correlational with approach Cross-sectional . This research will be conducted by distributing forms or questionnaires to drivers in the DKI Jakarta area. The sampling method for this study was carried out using the Sampling Determination Method (Power Analysis) . results calculation obtained minimum sample of 79,14 or 80 samples. The instrument in this study was the Swedish Occupational Fatigue Inventory (SOFI) which has been adapted to in Indonesian through a forward–backward translation process. Validity content instrument confirmed by a panel of experts with The CVI value for all items is above 0.80 . Validity test construct refers to the five- dimensional structure of SOFI which is consistent across various research in Indonesia. Reliability instrument tested using Cronbach's Alpha, and all dimensions own alpha value is above 0.70, so instrument stated reliable. In the data analysis in this study, Descriptive Tests, Difference Tests (Mann–Whitney U Test), Pearson Correlation Tests , Multiple Linear Regression Tests will be carried out.

RESULT AND DISCUSSION

Spread questionnaire conducted to the drivers transport general in the DKI Jakarta area is obtained results sample as many as 223 drivers . With characteristics respondents based on type transport generally that is the most there were 119 respondents as driver transport Mass Where

in implementation work respondents drive Bus vehicles and drivers Microtrans with the total number of 104 respondents in his job using vehicle passenger general .

Table 1
Analysis Results Descriptive

	N	*Minimum*	*Maximum*	*Mean*	*Standard Deviation*	*Skewness*		*Kurtosis*	
	Statistics	*Statistics*	*Statistics*	*Statistics*	*Statistics*	*Statistics*	*Std. Error*	*Statistics*	*Std. Error*
Age	223	19.00	72.00	40.1300	9.85143	.059	.163	-.456	.324
length of working	223	0.00	51.00	9.7668	7.86710	1,553	.163	3,428	.324
shift	223	1.00	2.00	1,3049	.46141	.853	.163	-1.284	.324
average sleep	223	2.00	12.00	6.6592	1.47669	.180	.163	.704	.324
stimulan	223	1.00	2.00	1.2152	.41192	1,395	.163	-.054	.324
tdkenergy_energy	223	1.00	5.00	1.7354	.90392	1,435	.163	2,327	.324
exhausted_energy	222	1.00	5.00	1.9234	.90673	.814	.163	.434	.325
lack of energy	223	1.00	5.00	1.6547	.82858	1,151	.163	1,100	.324
weak_energy	223	1.00	5.00	1.6951	.86801	1,219	.163	1,415	.324
physical tension	223	1.00	5.00	2.0628	.97980	.569	.163	-.212	.324
physical neck	221	1.00	5.00	2.2534	.98121	.405	.164	-.325	.326
physical sitting	223	1.00	5.00	2.1256	.95503	.560	.163	-.032	.324
physical_physical	222	1.00	5.00	2.1216	.94586	.564	.163	-.110	.325
sleepy	223	1.00	5.00	2.1525	.94157	.703	.163	.560	.324
physical eyes	223	1.00	5.00	1.5291	.82626	1,840	.163	3,736	.324
physical napping	223	0.00	5.00	1.9327	1.01784	1,015	.163	.788	.324
lack of physical sleep	223	1.00	5.00	1.9283	.91251	.897	.163	.772	.324
interest_motives	222	1.00	5.00	1.3964	.71543	2,165	.163	5,700	.325
lazy_motives	222	1.00	5.00	1.4505	.69567	1,562	.163	2,619	.325
spirit_motives	222	1.00	5.00	1,5000	.77722	1,721	.163	3,290	.325
coercion_motives	221	0.00	5.00	1.4932	.85610	1,885	.164	3,618	.326
tired_essertion	223	0.00	5.00	2.3363	1.05219	.369	.163	-.420	.324
drained_essertion	223	1.00	5.00	2.3453	1.07890	.449	.163	-.426	.324
tired_essertion	222	1.00	5.00	2.3198	.99840	.617	.163	.186	.325
able_essertion	222	1.00	5.00	1.9414	1.09346	1,186	.163	.833	.325
lostfocus_congratulations	223	1.00	5.00	1.5561	.81387	1,538	.163	2,362	.324
near miss	223	1.00	5.00	1.6323	.86433	1,464	.163	2,161	.324
safe_violator	223	1.00	5.00	1.5202	.81556	1,594	.163	2,359	.324
accident_safety	223	1.00	2.00	1,5067	.50108	-.027	.163	-2.017	.324
Valid N (*listwise*)	215								

Based on prone to age with results amount respondents most 80 people are vulnerable aged 40 – 49 years . Most second 69 people are vulnerable age 30 – 39 years , 39 people are vulnerable aged 50 – 59 years , 33 people are vulnerable aged 19 – 29 years and at least at the age of more from 59 years as many as 2 people. Based on length of service most is vulnerable working 1 – 7 years as many as 108 people, 8 – 15 years old as many as 79 people, 16 – 23 years old as many as 22 people, 24 – 31 years old as many as 12 people and the least with the number of 2 people who have Work during vulnerable 32 years until with 39 years . Based on average hours of sleep in a day , that from results questionnaires were obtained from 133 people in a day Sleep Between 5-7 hours, 77 people sleep an average of 2-4 hours and at least 77 people sleep an average of 8-10 hours per day . Based on work shifts obtained lower most position respondents

155 people are when in the morning shift and the remaining 68 people in the afternoon / night shift . Based on whether consume stimulan moment Work such as coffee, smoking and drugs (vitamins or drink energetic) 191 people were found to consume stimulan either one or both of them or all three . While the rest as many as 32 people did not consume stimulan moment work.

Study this involving 223 respondents (*valid listwise* 215), with various characteristics individuals and indicators fatigue measured work use SOFI (*Swedish Occupational Fatigue Inventory*) instrument and indicator safety driving.

Table 2
Results of the Difference Test (Mann – Whitney) on 5 dimensions fatigue

Description	*Lack of Energy*	*Physical Discomfort*	*Sleepiness*	*Lack of Motivation*	*Physical Exertion*
Mode Type	0.320	0.559	0.230	0.279	0.227
Age	0.586	0.277	0.064	0.039	0.546
Length of work	0.680	0.475	0.785	0.841	0.296
Shift	0.213	0.455	0.951	0.474	0.461
Sleep Time	0.013	0.001	0.000	0.073	0.015
Stimulant	0.185	0.247	0.312	0.102	0.464
Safety	0.663	0.549	0.040	0.364	0.699

A p-value < 0.05 indicates there is significant difference. Based on table above bedtime own significance to *Lack of Energy, Physical Discomfort, Sleepiness* and *Physical Exertion* with p - values 0.013, 0.001, 0.000 and 0.015.

Table 2.
Correlation on 5 dimensions fatigue

		average_safety	shift	fatiq_energy	physical fatiq	fatiq_sleep	motives fatiq	essertion
average_safety	Pearson Correlation	1	-0.039	.510 **	.493 **	.579 **	.571 **	.493 **
	Sig. (2-tailed)		0.560	0.000	0.000	0.000	0.000	0.000
	N	223	223	223	223	223	223	223
shift	Pearson Correlation	-0.039	1	0.059	0.037	-0.038	0.021	0.073
	Sig. (2-tailed)	0.560		0.380	0.580	0.572	0.756	0.280
	N	223	223	223	223	223	223	223
fatiq_energy	Pearson Correlation	.510 **	0.059	1	.544 **	.661 **	.560 **	.475 **
	Sig. (2-tailed)	0.000	0.380		0.000	0.000	0.000	0.000
	N	223	223	223	223	223	223	223
physical fatiq	Pearson Correlation	.493 **	0.037	.544 **	1	.608 **	.494 **	.563 **
	Sig. (2-tailed)	0.000	0.580	0.000		0.000	0.000	0.000
	N	223	223	223	223	223	223	223
fatiq_sleep	Pearson Correlation	.579 **	-0.038	.661 **	.608 **	1	.618 **	.628 **
	Sig. (2-tailed)	0.000	0.572	0.000	0.000		0.000	0.000
	N	223	223	223	223	223	223	223

fatiq_motives	Pearson Correlation	.571 **	0.021	.560 **	.494 **	.618 **	1	.460 **
	Sig. (2-tailed)	0.000	0.756	0.000	0.000	0.000		0.000
	N	223	223	223	223	223	223	223
fatiq_essertion	Pearson Correlation	.493 **	0.073	.475 **	.563 **	.628 **	.460 **	1
	Sig. (2-tailed)	0.000	0.280	0.000	0.000	0.000	0.000	
	N	223	223	223	223	223	223	223

**. *Correlation is significant at the* 0.01 level (2-tailed).

work shift variables No show connection significant with all over dimensions fatigue and safety. *Pearson Correlation Value* with safety namely r = – 0.039 and significant p = 0.560. Meanwhile, in dimensions fatigue *Pearson Correlation* (r) values range from 0.021 – 0.073.

Table 4
Model Summary of Analysis Regression

				Standard Error of the	Change Statistics				
Model	R	R Square	Adjusted R Square	Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.670 [a]	0.449	0.423	0.51904	0.449	17,274	10	212	0.000

a. *Predictors: (Constant), stimulant , shift, fatigue_sleep , length of work , average hours of sleep , age , fatigue_physical , fatigue_motives , fatigue_essertion , fatigue_energy*

The R value = 0.670 which shows that connection simultaneous between all variables independent (factors) fatigue, age, length of work, shift, average hours of sleep , and use stimulant) with variables dependent is in the category strong.

Table 5
Coefficients of results Analysis Regression

		Unstandardized Coefficients		*Standardized Coefficients*		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	0.211	0.317		0.665	0.507
	Lack of Energy	0.126	0.074	0.123	1,702	0.090
	Physical Discomfort	0.099	0.062	0.112	1,603	0.110
	Sleepiness	0.172	0.079	0.185	2,165	0.032
	Lack of Motivation	0.310	0.074	0.287	4,193	0.000
	Physical Exertion	0.100	0.054	0.132	1,859	0.064
	age	-0.003	0.004	-0.043	-0.734	0.464
	length of working	9.476E-05	0.005	0.001	0.019	0.984
	shift	-0.077	0.078	-0.052	-0.984	0.326
	average sleep	0.019	0.025	0.041	0.750	0.454
	stimulan	0.011	0.086	0.007	0.125	0.901

a. *Dependent Variable* : rata_selamat

Influential variables in a way significant with p value = < 0.05 , namely for *Sleepiness* (Drowsiness) with value B = 0.172, t = 2.165 and p = 0.032. In addition also seen in the value *Lack* of Motivation Motivation) with value B = 0.310, t = 4.193 and p = 0.000.

Overall, the descriptive analysis results indicate that respondents were of productive age with varying lengths of service. Sleep patterns tended to be suboptimal (averaging <7 hours). Fatigue dimensions were generally low to moderate, but a small group experienced more severe symptoms.

Driving safety indicators showed a relatively low incidence of incidents, but a number of drivers still experienced near misses or frequent loss of focus. Fatigue factors that have difference significant based on level safety is "Sleepiness". This means that the driver with level different sleepiness also indicates difference behavior or risk safety. This strengthens literature that drowsiness is form the most dangerous fatigue in driving . There is no difference fatigue based on work shift , type mode , age , length of service, or use stimulant . Sleep time is the most significant factors , especially to drowsiness, fatigue physical and feeling of being lacking energy .

Correlation Test Results show that all over dimensions fatigue Work based on SOFI includes lack of energy , physical discomfort , sleepiness , lack of motivation , and physical exertion own connection positive and significant with level safety driving . Findings This show that the more tall level fatigue experienced driver , increasingly low level safety driving they . This is consistent with literature previously stated that fatigue is one of the determinant main accidents to drivers . For example , Zhang et al. (2021) found that fatigue physically and mentally significant increase risk of near-misses and accidents actual on the driver transport general . Another study by Amiri et al. (2022) also showed that dimensions fatigue like drowsiness and lack of energy correlated strong with decline alertness , response slow , and errors taking decision moment driving . Dimensions sleepiness show strongest correlation to safety driving . Findings This in line with study Widyastuti & Putra (2020) which shows that drowsiness is factor dominant that causes micro-sleep , decrease attention , and mistakes operational on the driver transportation public . Sleepiness cause driver lost focus and reduce ability maintain speed safe (Jayawardena et al., 2021). Dimensions lack of motivation also shows connection strong with safety . Motivation low work can increase stress , reduce discipline , and reduce compliance to procedure safety (Rahman & Santoso, 2023). This support findings study previously that factor psychological like motivation and mental burden also contribute to performance safety driver (Abdullah et al., 2021).

Temporary that , the shift variable does not own connection significant with fatigue and safety, showing that shift pattern is not factor main influencing factors driver fatigue in context this . The results in tune with research by Fatema et al. (2020), which states that the effect of shifts on fatigue can is lost If driver has adapt self in a way physiological with timetable work . Personal factors such as quality sleep, condition physical and well-being psychological more dominant in predict fatigue. Analysis results multiple linear regression show that the model is built for predict level safety work (safe_average) based on factors fatigue , characteristics workers , as well as factor Work certain own good feasibility . The R value is 0.670 indicates that connection collective between all over variables predictor with safety Work is at in category strong . In addition , the value R Square is 0.449 show that 44.9% variation safety Work can explained by the variables in the model , while the remaining 55.1% influenced by other outside factors study This.

In a way partial through The results of the coefficient test found two variables that had an influence significant to safety work , namely sleepiness and lack of motivation. motivation). The sleepiness variable has p -value = 0.032, which indicates that level more sleepiness tall contribute significant to decline safety work . Conditions This can explained through theory fatigue that states that drowsiness reduce alertness , slowing down response , and reduce ability taking decision , so that increase risk errors and accidents . Variables the second most influential significant is a lack of motivation, with p -value = 0.000. Variable it also has standardized beta value highest ($\beta = 0.287$), so can it is said as the most dominant factor . Findings This show that workers who have motivation low tend not enough comply procedure safety , less be careful , and have low commitment to safety. In a way overall , results analysis show that fatigue in form drowsiness and factors psychological in the form of motivation is component important things that need to be done noticed in effort improvement safety work . Both of them can become focus main in compilation policy management

fatigue , improvement program motivation work , as well as strengthening strategies culture safety in the environment Work.

CONCLUSION

Based on results data analysis , the following conclusions were obtained : following :

1. No significant differences were found in all dimensions of fatigue (lack of energy , physical discomfort , sleepiness , lack of motivation , and physical exertion) between morning shift and night shift drivers (p = 0.213–0.951).
2. All dimensions of fatigue (SOFI) namely lack of energy , physical discomfort , sleepiness , lack of motivation , and physical exertion have a positive and significant relationship with the level of driving safety. So the higher the fatigue, the lower the driver's safety. Two fatigue factors were proven to have a partial significant effect on driving safety, namely Sleepiness (drowsiness) p = 0.032 which is influenced by the sleep time factor and Lack of motivation (lack of motivation) p = 0.000 (most dominant).

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