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THE EFFECT OF STRETCHING AND AGE TOWARD MENTAL WORKLOAD OF CITY CAR TRANSPORTATION DRIVER

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Abstract: *This study aim was to test the effect of stretching on mental workload of city car transport driver. To achieve these objectives, the research involve 30 city car transport drivers, male with age between 25 to 65 years. The stretching system has 6 types of movement. Every day the stretching is done 2 times at 10 am and at 2 pm. The results showed that stretching can reduced mental workload about 4% at 10 am and 25% at 2 pm. Lower mental workload can increase the productivity and economic benefit of city car transportation driver.*

Keywords: *Stretching, Age, Mental workload.*

1. INTRODUCTION

The main factor causing an accident is often relates to reflect response decrease of driver. Driving a car at urban transportation need a special attention toward the visual changes that occur in front of driver related with looking for passengers, dropping passenger and controlling the car on highway traffics. This job is carried out continuously within a relatively long time from 6 am to 6 pm. Consequently, it may increase the mental workload and decreasing physical strength of a city transport car driver that can decrease in driver reflects response.

Related with mental aspects when driving a car, the survey found that driver concentration and ability to control the car becomes a major contribution factor to increase driver mental workload. The visual information received is the highway traffic dense, road user behavior become a stimuli of fatigue mental. If it lasts long and without any relaxation, it would result in boring and stress. Lasts a long time

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without any relaxation can cause stress and an increase the workload feeling [1]. No relaxation would affect not only on work result but also the workers mental workload level [2]. It can be concluded that increased intensity of physical and mental workload affect its accuracy rate become lower and longer response time [3]. Unsolved indifferent and boring could turn into stress (chronic or acute stress), for example anxiety, depression and personality which in a form of psychosocial and mental state [4]. The signs of fatigue include decreased attention, slowing and perception barriers, slow and hard thinking, decreased willingness to work and a lack of work efficiency by physic and mental activity and age that cause decreased alertness and cause accidents [5].

Studies related to effort to reduce fatigue is still limited to a decrease in fatigue mentally by listening to music while driving a car. The efforts to reduce physics fatigue is still focused on efforts of car instrument improvement in associated with needs physics of driver and have not touched on car driver treatment physic. Theories has been developed regarding with physics treatment at static workplace is by providing a rest break in effort of muscle recovery to avoid fatigue and strain [6], some studies relating to rest breaks relates to recovery physiological and biomechanical stress loading [7]. Work rest schedule for physical workload on back and legs relates to standing work [8]. Micro break relates to musculoskeletal problems, visual fatigue and job stress [9]. Frequent short rest breaks improve production rate, discomfort rating and stress rating [10]. Short break with frequency and rare long break frequency measures the heart rate, perceived exertion/ tension and fatigue feeling [11]. Rest break conducted by some researchers remain focused on determination of work-rest schedule for rest breaks and making recommendations focused on issue of physical recovery.

Other developments of muscle flexibility and Range of Motion (ROM) inspire an idea to incorporate stretching elements during rest breaks. The aim of stretching is to enhance performance, reduce injury, and develop flexibility and alleviating muscular soreness [12]. Stretching at work station is an effort to prevent muscle strain through flexibility improvement, improve overall flexibility profile, including: sit and reach; body rotation and shoulder rotation. Exercise program at a workstation, including Short term Exercise program (<10 days), Body Part Discomfort Scale (BPDS) measurement and In-Chair movement (ICM) reduce musculoskeletal discomfort and postural immobility [14]. Short Break therein do the stretching exercises on computer work at small work sitecan increase productivity, eye, leg and foot comfort [15]. Stretching and joint mobilization exercise is to reduce musculoskeletal discomfort and fatigue levels. Rests break intervention, stretching and exercise [16]. From research done, stretching and exercise could be able to give a positive impact on physics recovery and muscle stretching.

This study try to solve mental fatigue of public transportation car driver by providing a stretching exercise where at previous study the stretching is measured only on physical recovery. This study will measure the impact on mental workload.

2. METHODS

2.1. Subjects

Subjects or participants are transport drivers in Malang city area, East Java-Indonesia. Participants are taken randomly about 30 male participant with an age between 25 to 65 years old, who are working on a trajectory that has a high levels traffic density at an average about 2 meters per second.

2.2. City Transportation Car

The transportation carsused are an All Purpose Vehicle (APV) car with an engine volume of 1600 cc (Figure 1). Interior design is the front seat could be occupied by two passengers and on rear vehicle capacity is approximately 10 passengers. There are also an additional seat for more passengers. A medium sized load speaker is also mounted on rear passenger room. A Compact Disk (CD) player is mounted on driver dashboard and also a small load speaker and another box for storing other things.

Figure 1. The city car shape and its freight and road passenger density

2.3. Instrument Measurement

Subjective Workload Assessment Technique (SWAT)Software, version 3.1., 1996, Dayton, Ohio, is used to proceed the data collected from the Mental workload SWAT Rescale. The data was obtained from the scale development by combining all possibilities of 3 levels for each of 3 dimensions that contain 27 cards. Every participant must be organized in sequent. Next is the event-scoring is an actual rating workload for an activity that is carried out. The SPSS V.17 is used for statistical processing and Microsoft Office Excel 2007 is used to process and calculate the data to depicts graphic.

2.4. Experiment

The study was conducted with stretching and without stretching. Stretching is done for 10 minutes which include: the stretching time refers to Subaru-Izuzu an

automotive plant for 5 minutes and then adjusted plus 5 minutes for the rest [13]. It was done two times every day in 10 am and 2 pm. This treatment and measurements of driver's mental workload for city transport was taken for drivers with a working hours beginning at 6:00 to 17:00.

Stretching is done 2 times a day, held in rest place (base) in a standing position for 5 minutes and 5 minutes of rest, without music. Stretching movements include movements for neck, back, hands, fingers, hips and legs (see figure 2): for neck flexibility (1) (5) (6): moving the neck left to right, fore-rear and left-turning head to right, then rotate the head from right to left, for 75 seconds; for back flexibility (2) (4) (12): rotate the hands with a bent position from front to back, and then vice versa, right hand left-aligned moves left to right, for 75 seconds, for hand flexibility (3) (7): moving the hands forward backward a straight position by hand parallel to shoulder, the hand position flexed moved forward and backward for 75 seconds, the leg flexibility (8) (9) (10) (11): running in place, followed by lifting the left leg and right hand alternately, walking backward and forward for 75 seconds, bringing the total 5 minutes for stretching.

Figure 2. Stretching movement

2.5. Data Processing

Data of Mental Workload was obtained from sequencing of 7 cards taken from 30 drivers. The data is entered to Software Subjective Workload Assessment Technique (SWAT), Version 3.1., 1996, and Dayton, OHIO, to get the event scoring. The next

step is conducting an interview to get every 3 dimensions of job at a time before the break and time they finish their work. Finally, is filling the numeric score by referring to event scoring result.

Driving car includes seven activities as follow: Heating up the car (act. 1); Driving Cars (act. 2); controlling the car against traffic and weather (act. 3); Looking for passengers (act. 4); Dropping Passenger (act. 5); Fuel filling (act. 6); turn off the car engine (act. 7).

3. RESULT AND DISCUSSION

Table 1
The SWAT value at 10 am and 2 pm

	N	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
Without stretching 10 AM	7	5,00	69,00	26,1429	22,96685
Without stretching 2 PM	7	3,00	84,00	35,7143	26,91786
Stretching 10 AM	7	4,00	67,00	25,0000	22,65686
Stretching 2 PM	7	1,00	77,00	26,7143	26,11331
Valid N (listwise)	7				

Table 1 shows SWAT value to describe the mental workload conditions at 10 am without stretching and with doing stretching, and at 2 pm without stretching and with doing stretching. Average value shows that doing stretching can decrease mental workload either in morning or in afternoon about 4% at 10 am and 25% at 2 pm.

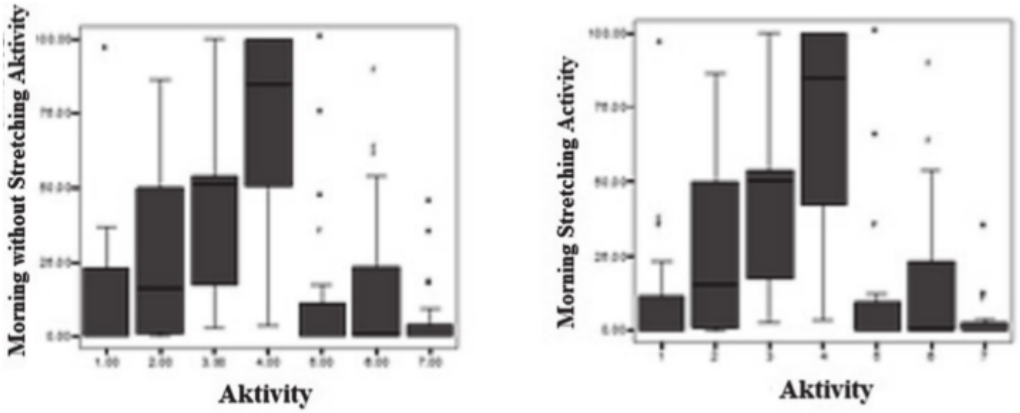

Figure 3. SWAT value for 7 activities at 10 am

Figure 3 illustrates that SWAT value for 7 activities at 10 am without stretching and with doing stretching. It shows that third activity (act. 3) and fourth activity

(act. 4) is an activity that has the most highly rated in SWAT. The SWAT average grade for activity 3 (act. 3) without stretching at 10 am is 44 and for fourth activity (act. 4) without stretching at 10 am has a score of 69, for third activity (act. 3) with doing stretching at 10 am has a score of 43 and fourth activity (act. 4) by doing stretching at 10 am has a score of 67.

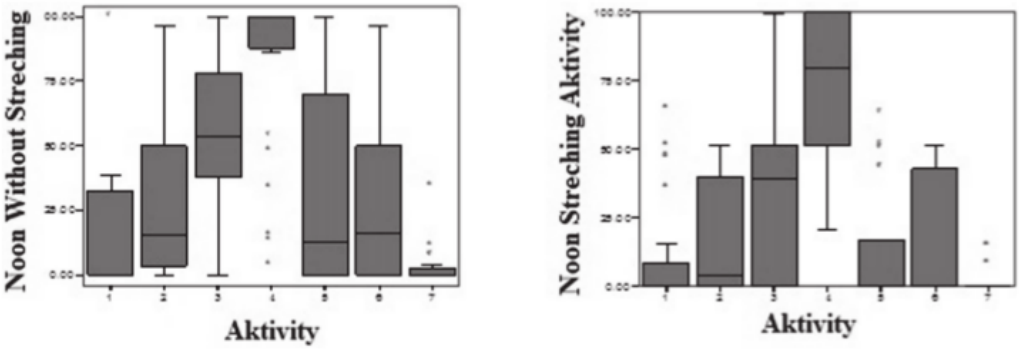

Figure 4. SWAT value for 7 activities at 2 pm

Figure 4 shows that the deployment of SWAT value for 7 activities at 2 pm for without and with stretching. It appears that activity 3 (act. 3) and activity 4 (act. 4) are activities with most highly rated SWAT. The SWAT average grade for activity 3 (act. 3) without stretching at 2 pm has a value of 55 and for activity 4 (act. 4) without stretching at 2 pm has a value of 84, for activity 3 (act. 3) by doing stretching at 2 pm give a value of 38 and for activity 4 (act. 4) by doing stretching at 2 pm has a value of 77.

Table 2
The city car transportation driver age frequency distribution

No	*Interval Class (Driver Age)*	*Frequency*	*Cumulative Frequency*	*Percentage (%)*
1	25 – 31,5	6	6	20
2	31,6 – 38,1	3	9	30
3	38,2 – 44,7	4	13	43
4	44,8 – 51,3	10	23	77
5	51,4 – 57,9	2	25	83
6	58 – 64,5	5	30	100
		30		

Table 2 shows that driver ages of city car transportation are divided into 6 classes. The most is spread between 44 years to 51 years old (10 drivers). Drivers with an age of ≥ 51 years until 65 years are 7 drivers.

Table 3
SWAT scale at 10 am without stretching

No	Interval Class	Frequency	SWAT Scale	
			Activity 3	Activity 4
1	25 – 31,5	6	36,2	54,9
2	31,6 – 38,1	3	41,9	60,5
3	38,2 – 44,7	4	57,45	77,25
4	44,8 – 51,3	10	57,71	79,75
5	51,4 – 57,9	2	60,25	80,25
6	58 – 64,5	5	60,90	80,9

Table 4
SWAT scale at 10 am with stretching

No	Interval Class	Frequency	SWAT scale	
			Activity 3	Activity 4
1	25 – 31,5	6	32,183	54
2	31,6 – 38,1	3	40,467	33,93
3	38,2 – 44,7	4	54,625	61,95
4	44,8 – 51,3	10	35,4	51,58
5	51,4 – 57,9	2	8,25	73,2
6	58 – 64,5	5	22,325	18,18

The SWAT value scale comparison at 10 am in Table 3, a SWAT scale value is obtained from a 51 year old driver at act. 3 at an average of about 48 and SWAT scale value on act. 4 is around 68. For a driver age of ≥ 51 years on act 3, has an average value of about 61 and SWAT scale value on act. 4 is around 81. On Table 4, the swat scale values obtained for driver age ≥ 51 years old on act. 3 has an average value of about 41 and SWAT scale value on act. 4 has a value of around 50. For drive age ≥ 51 years old act. 3 has an average value of about 15 and SWAT scale value on act. 4 is around 46.

Table 5
SWAT scale at 2 pm without stretching

No	Interval Class	Frequency	SWAT Scale	
			Activity 3	Activity 4
1	25 – 31,5	6	48,58	39,68
2	31,6 – 38,1	3	51,67	65,5
3	38,2 – 44,7	4	75	81,45
4	44,8 – 51,3	10	76,4	82,89
5	51,4 – 57,9	2	79,45	95,7
6	58 – 64,5	5	83,32	96,48

Table 6
SWAT scale at 2 pm with stretching

No	*Interval Class*	*Frequency*	*SWAT Scale*	
			Activity 3	*Activity 4*
1	25 - 31,5	6	43,35	34
2	31,6 - 38,1	3	34	57,4
3	38,2 - 44,7	4	56	79
4	44,8 - 51,3	10	45,04	78,63
5	51,4 - 57,9	2	57,3	75
6	58 - 64,5	5	25,75	69,9

Table 7
ANOVA with and without stretching at 10 am

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	2857,111	1	2857,111	9,756	0,005
Within Groups	6443,137	22	292,870		
Total	9300,248	23			

Table 8
ANOVA with and without stretching at 2 pm

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	3679,523	3	1226,508	4,298	0,017
Within Groups	5707,310	20	285,366		
Total	9386,834	23			

Comparing the SWAT value scale at 2 pm in Table 5, a SWAT scale value is obtained for age ≥ 51 years old on act. 3 at an average of about 63 and SWAT scale value act. 4 is around 67. For ages ≥ 51 years old on act. 3 at an average of about 81 and SWAT scale value of act. 4 is around 96. In Table 6, SWAT scale values for age > 51 years old on act. 3 is at an average of about 45 and SWAT scale value on act. 4 is around 62. For age of ≥ 51 years old on act. 3 has an average of about 41 and SWAT scale value on act. 4 is around 72.

Table 7 and 8 explained that stretching treatment given at 10 am and 2 pm, would resulted a significant influence on mental changes in workload as in Table 7 with a value of $p = 0.005$ (<0.05), and in Table 8 a value of $p = 0.017$ (<0.05).

4. DISCUSSION

Stretching treatment for city car transport driver would decrease the mental workload either in morning or on afternoon, about 4% at 10 am and 25% at 2 pm,

as shown in Table 1. This statement was strengthen as seen on tables 7 and 8. One of driver tasks as a public transportation driver is associated with mental tasks that involve the driver concentration and reflect of response to visual information received. With length of work, the mental workload would increase, if there is no rest brake given it would lead to be a boring and stress [4] and of course may reduce the accuracy level and reflect response time would be longer [3]. With mental workload decline, surely it would increase the reflect time response so it will be more alert and can reduce the accident likelihood. The higher the skill requirements, precision and concentration, the higher the mental workload would be, but the increase in mental workload concentration and accuracy is greater than the skill [17].

Mental workload will be influenced by age and experience factor [18]. Old age does not guarantee a lower workload. A greater effort should be made compared with young age. In this study, the city transport drivers which was measurements at 10 am with an age of ≥ 51 years old had a higher level of mental workload than the driver on an age of < 51 years old. The SWAT scale value difference is by 27% on act. 3 and 19% on act. 4 as seen in Table 3. After a given a stretching treatment mental workload declines for driver of ≥ 51 years old by 75% for act. 3 and 43% for act. 4, as seen in tables 3 and 4, for drivers with an age of < 51 years old has a level of 16% to 26% for act. 3 and for act. 4, seen in table 3 and 4 as well as the measurement at 2 pm as seen in table 5 where a SWAT scale value difference 28% for act. 3 and 43% for act. 4. After given a stretching treatment, the mental workload declines for driver with an age of ≥ 51 years old by 49% for act. 3 and 25% for act. 4 as shown in Table 5 and Table 6.

5. CONCLUSION

Stretching treatment in 10 am and 2 pm at city transport drivers can reduce the mental workload. The mental workload decline is greater if stretching is done at 2 pm. The city transport driver's activity which contributes most mental workload is on activity of controlling the car against traffic and weather (act. 3) and looking for passengers (act. 4).

Related to age factor, the greatest mental workload at city transport are drivers with an age of ≥ 51 years, after being given a stretch treatment, the city transport driver's mental workload decline for driver age of ≥ 51 years old is greater than the driver with an age of < 51 years old.

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Exhibit

Abbreviations	
BPDS	Body Part Discomfort Scale
ICM	In-Chair movement
APV	All Purpose Vehicle
CD	Compact Disk
SWAT	Subjective Workload Assessment Technique
Act	Activity

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