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Effectivity of Aroma, Light, and Al'Quran Therapy to Enhance Driver's Level of Awareness in Malaysia

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The effectiveness of fatigue therapy toward drivers was measured with three treatments using an aroma therapy (the odor of lemon, cananga and stinking egg), sparkling lights therapy and Al 'Quran therapy. This repetitive experiment design was done in a driving simulator. The level of fatigue was measured using a fatigue questionnaire. The drivers (N = 20 males) were asked to stop their driving when they got tired, and the result shows that the driving duration was shorter when the stinking egg therapy was given compared to the other therapy treatments. Driving period by using Quran therapy was longer than aroma therapy and the sparkling light therapy. The therapy of stinking odor strongly stimulates the sleepy driver to awaken compared to the other treatments. The therapy of listening to Al 'Quran passages increased persistence and keep the drivers to be awake when they took a long drive compared to the other treatments.

Keyword : aroma therapy, lemon, cananga, stinking egg, sparkling lights, Quran passages, driving fatigue

Efektivitas terapi kelelahan pada pengemudi diukur dengan tiga jenis perlakuan, berupa terapi aroma (bau limau, kenanga, dan bau telur busuk), terapi lampu kerlip, dan terapi bacaan Al 'Quran. Penelitian dengan desain eksperimen berulang ini dilakukan dalam simulator mengemudi. Tingkat keletihan subjektif diukur dengan angket keletihan. Para pengemudi (N = 20 pria) diminta berhenti bila telah merasa lelah. Hasil menunjukkan waktu mengemudi lebih singkat bila diberi bau telur busuk dibanding bau limau, kenanga, dan kerlipan lampu, serta bacaan Al 'Quran. Waktu mengemudi dengan terapi bacaan Al'Quran lebih lama dibandingkan ketika mendapat terapi aroma dan terapi lampu kerlip. Perlakuan bau busuk lebih cepat menyadarkan pengemudi yang mengantuk dibandingkan perlakuan bau limau, bau kenanga, lampu kerlip, dan bacaan Al'Quran. Perlakuan bacaan Al'Quran dapat meningkatkan ketahanan dan menjaga kesadaran pengemudi ketika mengemudi dalam waktu lama dibandingkan perlakuan bau limau, bau kenanga, bau busuk, dan perlakuan lampu kerlip.

Kata kunci: terapi aroma, limau, kenanga, telur busuk, lampu kerlip, bacaan Al'Quran, lelah mengemudi

Traffic accidents are one of the most crucial problems faced by a lot of countries especially in a developing country such as Malaysia. The World Health Organization (WHO) presumes that traffic accidents stand at the sixth level of the world mortality causes, and assumed to be the second factor of human disabilities in developing countries in 2020 (Murray & Lopez 1996). The mortal accident in some developing countries since 1975 until 1998 showed that there is a 44% increase (Elisabeth & Cropper 2003) and the highest mortality was caused by traffic accidents.

In 1999, there were approximately 750,000-880,000 people died because of traffic accidents worldwide, and the damage caused by those accidents was US$ 5 billions (Jacobs, Aeron-Thomas, & Astrop, 2000). For instance, almost every year United States government spent US$ 100 billions to overcome traffic jams, and US$ 70 billions to overcome the traffic accidents (IVHS 1992).

Malaysia is one of the Asian countries which has very high rate of traffic accidents. There are some causes of Malaysian traffic accidents as reported by the Polis Diraja Malaysia (PDRM). Some of the causes are the pedestrian fault, careless driving, high speed driving, moving to another line on the street without any signs, crossing the junction carelessly, following another vehicle in very close distance, less awareness while driving, driving against the flow of the traffic, drunken drivers, driving under influence of psychotropic drugs, using mobile phone or even texting messages while driving, overload freight, drowsy driving, and so on. Beside of these human factors, the environmental factors are also significantly causing the accidents such as the dangerous road, less illumination or even dark road, heavy rain, and car machine damage.

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Considering some factors which can cause traffic accidents, human factor is the major contributor of the traffic accidents (Grayson & Maycock, 1988). A study by Sabey and Taylor (1980) on 2,041 respondents found that 95 percent of traffic accidents were caused by human error. In Malaysia, 94 percent of accidents were caused by the carelessness of the drivers (Adnan, 1989). One of the problems that often have been overlooked by drivers is fatigue. Drivers usually do not take fatigue into account – especially the young or experienced drivers.

The result of Frank's study (2002) on the time of the occurrence of accidents shows us that 77 % of the accidents happened between 11 pm until 7 am, and 60 % happened between 4 am to 6 am. Insufficient resting time of the driver causes fatigue and drowsiness while driving. A driver should have enough resting time for at least six to eight hours (Lay, 1990). Many traffic safety experts and researchers believe that fatigue increases the risk of traffic accidents. Brown (1994), for instance, says some factors contributing to driver's fatigue are duration of work (driving), unfixed working time, duration of rest and sleep in one day. Nilsson et al. (1997) believe that fatigue plays a significant role to the fault made by the drivers. A fatigue driver can make an inaccurate judgment while driving, loose focus, slow in giving respond, and indifferent attitude.

Rest is needed to reduce fatigue and recover physical condition. This is because human body transmits nutrition to the muscles and excretes the unused materials or residuals when taking a rest (Grandjean 1979). Physical fatigue is identical with muscle fatigue, which comes from the lactic acid in the muscle and decrease of glucose. Physical fatigue can be seen in situations in which the performance of body muscles decrease after some pressures to the muscle, indicated by decrease in movement and muscle strength. Muscle fatigue influences body coordination and increase the possibility to make errors, even accidents (Grandjean 1979).

Morris and Chevalier (1961) analyzed physical fatigue based on artery beat per minute. They said that 130 artery beat per minute is considerably high for individuals who engage in an ordinary task. The opinion of Morris and Chevalier was also supported by Suggs and Splinter (1961) who said that 130 artery beat per minute is too high for individuals who work at industrial field, and they said 110 artery beat per minute is the maximum for an employee to do his/her job properly.

A fatigue driver often looses focus and easily falls asleep while driving. Therefore, a treatment or a therapy is needed to keep drivers awake and maintain their concentration when they are driving. The treatments or therapies which were developed in this research were odor treatment or aroma therapy, illumination treatment, and sound treatments.

A study conducted by Ballard et al. (2002) analyzed the positive impact and safety level of the use of Melissa officinalis (Lemon balm) aroma therapy oil. The result proved that Melissa officinal's oil is safe to use and effective for clinical care in reducing aging and increasing quality of life.

A study by Lie (2005) focused on the effectiveness of massage using aroma therapy oil in reducing constipation among the elderly. The result showed that a colon activity of the experimental group (the group which was given a massage using aroma therapy oil) is higher compared to the control group (the group which was given a massage but not using aroma therapy oil). The aroma therapy massage effect can be effective up to 2 weeks while the placebo massage only up to 7 to 10 days.

Another treatment which could be used to reduce fatigue, especially when driving is sparkling light treatment. The effectiveness of light therapy has been known long ago and some physical diseases can be healed by this kind of treatment, such as insomnia, fatigue, circadian rhythm problems, bulimia, depression, menstruation cycle problems. Lewy (Holisticonline, 2005) in 1980 conducted a phototherapy research to human, and found that the production of melatonin can be reduced by illuminating someone with an artificial bright light produced by a special kind of lamp (not the usual lamp in houses).

Another study by Golden et al. (2005) aimed to measure the effectiveness of light treatment in handling patient with emotional disorders. They analyzed academic literatures in PubMed journal and summarized a number of articles in that journal. The result showed that bright light treatment among emotional disorder patients was effective and the success level of this treatment was as good as antidepressant drugs.

Shimai et al. (1990) defined the pleasant and unpleasant sound. The definition came from a survey on university students in Japan (596 male and 136 female students). The result showed that pleasant sounds are human voice (talking, laughing with family, and crowd), musical instrument (violin, flute, classical music and harp), bird and insect, rain and wind. While unpleasant sounds are noisy sound (roller coaster, airport noisy sound, waterfall), human voice (female scream, heavy breath, nasal sound), mechanical tools (gear sound, noisy at construction area), broken glass, microphone, and ambulance siren.

A study conducted by medical unit of Allama Iqba, Lahore, Pakistan, aimed to find the effect of "*Tahajid Salat*" (Moslem midnight pray) on the ability to control depression. The result showed that 25 of 33 respondents in the experiment group were very significantly healed from their depression when they were given the treatment of listening to Quran passages, praying, and *dzikir*-ing; compared to the control group which was not showing significant changes in their depression recovery process (Majid 2002).

A Dutch psychologist, Van der Hoven (Islam Fact, 2003) studying the effect of the repetition of the word "*Allah*" among

patients of psychological problems. This study was conducted for three years and the patients involved are not Moslems and not familiar with Arabic language. The respondents were trained to say "Allah" clearly and correctly. The result showed that patients indicated significant decrease in their psychological problems such as the feeling of sadness, gloom, disappointed, and tension. Qadri (1996) said that reading Quran can facilitate the process of recovery from physical illness and mental problems. His research was a literature study to test the effectiveness of Quran-based treatment on physical and mental problems. Based on his analysis, it is proved that specific parts of Quran are effective in facilitating the healing process; for instance, Quran chapter 112 (*Al-Ikhlash*) for migraine and chapter 21 (*Al-Ambiyaa*) verse 69-70 for fever.

Problem Statement and Purpose of Study

The issue of fatigue among drivers has been identified in the background. Fatigue can reduce driving performance, as indicated by the decrease of the ability to identify and remember signs on the road during a long-duration driving (Naatanen & Summala as cited in Job, 1999). Other indications of fatigue are infrequent gear change and slow reaction to environmental and traffic signs (Hartley, 1995). The level of risk or danger due to fatigue can be seen from the kind of error or incorrect judgment, such as the error in predicting distance and delay in pressing the brake. Mabbott and Hartley (1999) found that the increase of errors and reaction time are common among drivers who drive on a long distance. The lack of knowledge and awareness during the initial stage of fatigue is one of the causes of drowsiness-based traffic accidents. The drivers were not aware of their fatigue, so that they keep driving until they fall asleep and the accident is likely to take place.

In many developing countries like Malaysia, research on fatigue is still lacking. This is perhaps due to the deficiency in awareness on the danger of driver fatigue. Therefore, the main problem of this study was to identify conditions in which a driver tends to be drowsy. If a driver accurately identifies his/her level of fatigue, he/she will decide to take a break before continuing his/her journey. The parameters of fatigue among drivers, both physiological and psychological, have been studied by health experts, psychologists, and traffic safety expert worldwide. However, research on the effectiveness of certain treatments of fatigue to keep the awareness of the drivers is still rare in Malaysia. Creating effective treatments of fatigue to support drivers in keeping their awareness in fatigue condition is a new thing which needs to be developed in traffic safety studies, particularly in the field of transportation psychology.

Currently, there are many treatments used to support driver's awareness in fatigue condition. However, it is not known which treatment is the most effective one. This research aims to measure the effectiveness of aroma therapy, light therapy and Quran therapy in increasing driver's awareness, especially in fatigue condition.

Methods

The experiment design used in this study is repeated measurement design (within subject design). The advantages of this design are: it is more economical and have higher control over extraneous variables. Before conducting the experiment, the author has done two preliminary experiments to estimate how long the experiment would take place. On the first preliminary experiment, subjects were asked to drive for two hours (subjects were not in fatigue condition), while on the second preliminary experiment, subjects were asked to drive for one and a half hour in fatigue condition. These two preliminary experiments were used to determine the duration of the experiment.

During the experiment the author did not limit the duration of driving as each person has their own physical endurance. By doing this, the author could recognize individually when the fatigue took place.

Subject

The subjects in this study are 20 drivers, aged 20 to 55 years old. These subjects are in good condition both physiccally and mentally - which make them ready to drive for a long duration, posses driving license, have minimum 5 years experience as driver, and have no sleeping problems like insomnia. During the experiment they have to comply to all conditions, such as: had enough sleep (approximately six hours every day) before the experiment; not taking isotonic drinks, coffee, or any medication that can cause drowsiness like fever medicine. Subjects were allowed to have a meal two hours before the experiment. If they failed one of the conditions noted above, the experiment was postponed to the following day. The subjects were given RM 30 (approximately Rp 83,400) as reward and they must follow seven series of the experiments in this study. All the subjects are male, with Malay ethnicity. This is because not many non-Malay subjects applied to be the participants, and they do not satisfy the necessary conditions. Male participants were used because there was no female researcher or research assistant involved in this study and the procedure requires putting some biofeedback equipments on participant's body.

The equipments was PlayStation 2 (PS 2), used to play Zero-One (01) driving game. This game was used

because its scenario is relevant to the purpose of this research, and can be easily controlled by the researcher. A dark side at the front of simulator is used to make the screen seemed clearer, so that it created close-to-real driving condition. It aimed to help subjects focus their attention while driving. It is brighter on the driver side compared to the front of the simulator to make the head and eye movement recording easier – using Face Lab and web camera. Both equipments need bright light to produce clear and high-quality recordings. In this simulator there is a fan control to comfort the subjects. Air control in this simulator is very important to keep fresh air circulation in-and-out of the simulator, help the subjects to maintain their focus, and reduce health problems including the dizziness and nausea.

This simulator also has exhaust fan located under the driver seat to clear out the odor in the simulator when subject is treated by aroma therapy. To control the laboratory and simulator equipments, the researcher measured the oxygen level in the laboratory and in the simulator, electromagnetic and electrical waves inside and outside the simulator, and noise level inside the simulator.

This research also used time reaction equipment to measure how quick the drivers react. Reaction time is one of the best measurements of human performance that has been used in the study of workload and the study of fatigue both physically or mentally. Korteling (1990) used the percentage of correct and incorrect responses to stimulus in the laboratory and on the road. The result of that study showed that old drivers and drivers with brain injury indicated longer reaction time compared to the younger drivers. The reaction time while driving on the road is also longer than reaction time while driving in the simulator. Another experiment done by Korteling (1994) showed also that there is a significant correlation between reaction to press the break and the winding roads

One of the fatigue level measurements used in this study is physiological change measurement. The physiological measurement equipment use was biofeedback equipment. This equipment is used to measure physiological changes in the body or changes in drivers' body reaction when they drive. The equipment used is ProComp Infiniti System or ProComp+ from Thought Technology Ltd, Canada. These equipments measure blood tension, skin conductance (SC), blood volume pulse (BVP), body temperature and breathe frequency.

The Treatment of Fatigue

The fatigue care treatments used in this experiment were orange aroma therapy oil, and cananga aroma therapy oil, based on inquiry to the subjects and literature review.

There were two kinds of aroma therapy used in this research, i.e. orange aroma therapy, which consist of several aroma therapy oils: four drops of lime cold pressed (citrus aurantifolias), four drops of lemon cold pressed (citrus limonum) and two drops of Australian peppermint. The composition of this mixture was determined by the researcher after passing a series of examinations. The cananga aroma therapy mixture was made from several aroma therapy oils: four drops ylang-ylang 1st (cananga odorata), two drops of rosemary (rosmarinus officinalis), two drops of basil (ocmum basillicum), and three drops of Australian peppermint. This mixture also has passed a series of examinations, as well. The third treatment is unpleasant odor (stink odor). This odor is made from rotten egg which has been rotten for about a week.

Another treatment used in this study was a sparkling light treatment. The length of a spark is 0.022 – 0.025 second, while the period between sparks is 0.065 second. The equipment used to measure light intensity is lux meter. The unit of measurement is Tungsten. The last fatigue treatment in this study was reading Quran passages combined with Nasyid songs. This collaboration was used to create a different atmosphere, not monotonous which may cause boredom. The letters used in this treatment is Al-Fatihah, Yasin, Al-Baqarah, and As-Sajdah. These letters were chosen based on the discussion with several people who understand the Quran well. The Nasyid songs used in this study were not chosen based on certain criteria, but because these songs are similar to the pop music. The Nasyid song used were: Alangkah indahnya hidup ini (collection of Raihan); Allah is the only one (collection of In Team); Antara dua cinta (collection of Saujana); Bismillah (collection of Hiijaz); Damai yang hilang (collection of Now See Heart); Doa Khatam Quran (collection of Mustika); Ya Nabi salam alaika (collection of Raihan); Fatamorgana (collection of Hiijaz); Jangan kita lupa (collection of In Team); Ojo Kelalen (collection of Amal); Pergi tak kembali collection of Rabbani); Selawat Badariyah (collection of Saujana); Thank you Allah (collection of Raihan); Pandangan mata (collection of Hiijaz); Iman Mutiara (collection of Raihan); Sutera kasih (collection of In Team); Teman sejati (collection of Amal); Kita saudara (collection of Saujana), and Lagu Kedamaian (collection of Amal).

Results

Research Room

The oxygen level in the simulator room was 20.9%. The lowest limit of oxygen level is 19.5% and the highest is 23.5%, while normal level is approximately 21.00%. Too high or too low oxygen level can be dangerous for human.

Electromagnetic wave level in the simulator was 10V/m, while the maximum limit is 100V/ m. The electric wave level in the laboratory was 1.5 V/m, while electric level in the driving simulator was 2 – 2.5 V/m. The maximum limit for electric wave is 10 V/m.

The noise level in the simulator was 56.7 dB. The maximum tolerable noise is ± 80dB. The measurement of this noise level was using Ono Sokki LA-5120 sound level meter equipment. The duration of measurement was 10 minutes.

Beside these measurements, the measurements of temperature and humidity were also conducted, because extremely high or low temperature can disturb the concentration of the driver and influence the experiment results. The average temperature in the simulator was ± 24.6° C, and the humidity was 42%. The average room temperature is ± 22° C. It indicated that the condition in the simulator is comfortable. The temperature and humidity were measured using the equipment produced by Cole Palmer Company.

The result shows that the condition in the laboratory room and simulator was controlled, so the environmental factors (oxygen, electromagnetic wave, and noise level) were not influencing the results. When fatigue was experienced by the subject, it is due to internal factors, not external factors.

Driving Duration

The driving duration parameter was used to identify the effect of the treatments. This was conducted by comparing driving duration without fatigue treatment and with fatigue treatment.

Although there was driving time difference between groups without fatigue treatment and with orange odor treatment, but it is still unsure whether or not it is significant (see Table 1). Therefore, it is necessary to conduct a statistical analysis (within subject design). The result of the statistical analysis between groups without fatigue treatment and with orange odor treatment shows F value (1.19) = .352, $p < .05$, which means that there is no significant difference between groups without fatigue treatment and with orange odor treatment. The average driving duration without fatigue treatment was one hour 23 minutes, while driving duration with cananga odor treatment was one hour 19 minutes. The result of statistical analysis shows F value (1.19) = .224, $p < .05$, which means that there is no significant driving duration difference between groups without treatment and with cananga odor treatment.

The average driving duration without fatigue treatment was one hour 23 minutes, while subject's driving durations with stinking odor treatment were minimum 1 minute and maximum 10 minutes. The researcher stopped the experiment after 10 minutes for health reasons. The result of statistical analysis between groups without fatigue treatment and with stinking odor treatment shows F value (1.19) = 86.36*, $p < .05$, which means that there is a significant driving duration difference between groups with stinking odor treatment and without fatigue treatment. This result shows that stinking odor is very suitable and effective to "force" fatigue and sleepy drivers to stop their vehicle and take a rest.

The average driving duration without any treatments was one hour 23 minutes, while the group with sparkling light treatment was one hour four minutes. The result of statistical analysis shows F value (1.19) = 36.934*, $p < .05$, which means there is a significant driving duration difference between groups with sparkling light treatment and without treatment.

The average driving duration without any treatments was one hour 23 minutes, while the group with Quran passages treatment was two hours two minutes. The result of the statistical analysis shows F value (1.19) = 4.665*, $p < .05$, which means that there is a significant driving duration difference between groups with Quran passages treatment and without treatment.

Even though it is known that three of the treatments were effective to maintain driver's consciousness level, but it is unknown which one of the three treatments was the most effective one to keep the driver's awareness when they drive in fatigue condition. Therefore, it is necessary to conduct repetitive analysis to know the difference between these treatments.

The result of the statistical analysis between groups with stinking odor treatment and Quran passages treatment shows F value (1.19) = 70.941*, $p < .05$, which means that there is a significant driving duration difference between groups with stinking odor treatment and Quran passages treatment. The driving duration of the group with Quran passages treatment was longer than group with stinking odor treatment. The result of the statistical analysis between groups with sparkling light treatment and Quran passages treatment shows F value (1.19) = 38.283*, $p < .05$, which means that there was a significant difference of driving duration between groups with sparkling light treatment and

Table 1

The Average of Driving Duration without Fatigue Care Treatment and Driving Duration with Fatigue Care Treatment.

Driving situation	Average driving time
Without fatigue care treatment	1 hour 23 minutes
Orange odor treatment	1 hour 36 minutes
Cananga odor treatment	1 hour 19 minutes
Stinking odor treatment	0.33 minute
Light treatment	1 hour 4 minutes
Quran passages treatment	2 hour 2 minutes

Quran passages treatment. The driving duration of the group with Quran passages treatment is longer than driving duration with sparkling light

The result of the statistical analysis between groups with stinking odor treatment and sparkling light treatment shows F value (1.19) = 19.672*, $p < .05$, which means that there is a significant driving duration difference between the group with stinking odor treatment and sparkling light treatment. The driving duration of the group with sparkling light treatment was longer than driving duration with stinking odor. The group with Quran passages treatment indicates a longer driving duration compared to the group with stinking odor and sparkling light treatment. While the driving duration of the group with stinking odor treatment was shorter than groups with sparkling light and Quran passages treatment. Therefore, based on the driving duration measurement the stinking odor is the most effective treatment to awake the drowsy drivers, followed by the sparkling light. While the Quran passages treatment was the most effective one to keep the awareness of the drivers during a long duration drive.

Reaction Time

Based on the reaction time measurement, there were significant differences of the drivers' reaction time during two hours driving between groups without and with treatments (orange odor, cananga, sparkling light, and Quran passages). During two hours driving, the subjects showed decrease in their average reaction time. In order to know which treatment stimulates the fastest reaction time, a repetitive statistical analysis was conducted. The statistical analysis shows that there were no significant reaction time differences between groups with orange and cananga odor treatment compared to sparkling light and Quran passages treatment. On the other hand, there is a significant reaction time difference between groups with sparkling light and Quran passages treatment.

Based on the reaction time measurement, it was known that the effectiveness of the four treatments were as follows: Quran passages treatment (one second 9 milliseconds), orange odor treatment (one second 15 milliseconds), sparkling light treatment (one second 17 milliseconds) and cananga odor treatment (three seconds 16 milliseconds).

Measurement of Subjective Drowsiness Level

Drowsiness level measurement used in this research was a drowsiness questionnaire consisting a range from scale 1 (very fresh and ready) up to scale 10 (very drowsy/ sleepy or fatigue). From this repetitive statistic analysis we know that: The difference of fatigue level when they drive without treatments and with orange odor treatment is F (1.19) = .31, $p < .05$. This result means that there are no significant differences for ones getting no treatments and ones getting orange odor treatment.

The difference of fatigue level when they drive without treatments and with cananga odor treatment is F (1.19) = 1.95, $p < .05$. This result means that there is no significant difference for ones getting no treatments and ones getting cananga odor treatment.

The difference of fatigue level when they drive without treatments and with stinking odor treatment is F (1.19) = 5.21, $p < .05$. This result means that there is a significant difference for ones getting no treatments and ones getting stinking odor or any unenjoyable odor treatment.

The difference of fatigue level when they drive without treatments and with sparkling light treatment is F (1.19) = .35, $p < .05$. This result means that there is no significant difference for ones getting no treatments and ones getting sparkling light treatment in fatigue condition.

The difference of fatigue level when they drive without treatments and with Quran passages treatment was F (1.19) = .65, $p < .05$. This result means that there were no significant differences for ones getting no treatments and ones getting Quran passages treatment.

Discussion

This research produces two kinds of treatments, a short term and a long term treatment. The short-term treatment used an unpleasant odor (stinking odor) and light treatment. This short-term treatment was used to stimulate with something shocking to awaken a sleepy driver, while the long term treatment such as orange/lemon odor, cananga odor, and Quran passages treatments were used to maintain awareness and consciousness of drivers when they drive.

Short term treatment is given when the driver seems to get sleepy and after they feel fresh again. Long term treatments are given to help drivers keep awake and maintain their consciousness when they drive.

To stimulate and maintain driver's consciousness the drivers were treated with listening to Quran passages and orange odor at the same time. After an hour, the orange odor was changed to cananga odor, while Quran passages remains. If the driver feels sleepy when they hear Quran passages and smell orange or cananga odor, the treatment must be stopped because it means that the driver is at the condition of drowsiness and really tired, and would be very dangerous to keep driving.

The first suitable fatigue care treatment given to the driver when they got tired is sparkling light treatment.

Then stinking odor treatment will be given when the driver is still not able to get ready or fresh again after a long enough light treatment. These treatments are short term ones which do not have a lasting effect. It is just to ignite the sleepy driver. Stinking odor would be very disturbing for the drivers if it is used too long, while sparkling light is also only temporary, because it is not effective to be used in long duration.

After having short term treatment, drivers will be on two conditions, get ready or back to fall asleep. The driver who got stinking odor usually stays awake compared to they who got sparkling light treatment. After they were fresh and ready, a long-term treatment was given to keep them still awake and not get sleepy again. There were three suitable long term treatments to maintain driver's awareness and consciousness. They were the orange odor, cananga odor and Quran passages treatment. The most suitable treatment to keep awake was listening to Quran passage, followed by orange odor, and the least was cananga odor treatment.

Conclusion

Fatigue care treatment with orange odor, cananga odor, stinking odor, sparkling light, and listening to Quran passages revealed that odor from stinking egg is very effective to awaken the sleepy drivers. After the drivers feel fresh and got ready to drive, the Quran passages treatment is very effective to maintain their consciousness and awareness during the drive. The subjective fatigue and drowsiness measurement results found that drowsiness level during the drive without any treatment was higher than the level with any fatigue treatment.

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