



UNIVERSITI PUTRA MALAYSIA

***EFFECT OF SELECTED ENERGY DRINK ON DROWSINESS AND
DRIVING PERFORMANCE AMONG YOUNG MALE ADULT CAR
DRIVERS***

**BY
MOHD SHAZWAN BIN SAMJAN**

**Ip
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ABSTRACT

Introduction: Road crash is one of a global major death contributors including in Malaysia. Road crash are caused by various factors including vehicle defects, human failures, and environment. Human failure is generally related to poor driving performance and drowsiness during driving. In this context, young male adult with average age 19-25 generally involve in road crash. Some studies also found that the consumption of energy drink may lead to reducing of drowsiness as well improve driving performance. **Methodology:** This was an experimental pre-post study design. A total of 40 male respondents were selected to participate in the study. Respondents were selected according to their Epworth Sleepiness Scale (ESS) score and Body Mass Index (BMI) measurement. They were asked to drive using driving simulators for one hour. Then, take rest for about 15 minutes and at the same time they were required to drink 250ml of energy drink. After rest, respondents were asked to continue driving for another 1 hour. To measure drowsiness, IOWA questionnaire had been given for 3 times at different phases which were at pre-driving, after 1 hour driving, and at post driving. Driving performance was measured using special software where it measured Large Speed Variation index (LSV) and Running off Road Index (RORI). **Results:** The results showed that there was significant association between the consumption of energy drink and reduction in drowsiness among respondents. For LSV index, results also showed that the significant association between the effect of energy drink and LSV index score. However, there was no significant association between energy drink consumption and RORI index score. **Conclusion:** Energy drink has been proven to reduce drowsiness during prolongs driving. However, energy drink is not much helpful to improve driving performance.

Keywords: *Energy drink, Drowsiness, Driving Performance*

ABSTRAK

Pengenalan: Kemalangan jalan raya adalah salah satu penyumbang utama kematian global termasuk di Malaysia. Kemalangan jalan raya adalah disebabkan oleh pelbagai faktor termasuk kerosakan kenderaan, kesilapan manusia, dan alam sekitar. Kesilapan manusia umumnya berkaitan dengan prestasi pemanduan yang tidak baik dan mengantuk semasa memandu. Dalam konteks ini, didapati bahawa lelaki muda dewasa dengan purata umur 19-25 amnya terlibat dalam kemalangan jalan raya. Beberapa kajian juga mendapati bahawa pengambilan minuman tenaga boleh membawa kepada mengurangkan mengantuk dan meningkatkan prestasi memandu. **Metodologi:** Ini ialah kajian eksperimen pra-post. Seramai 40 orang responden lelaki telah dipilih untuk mengambil bahagian dalam kajian ini. Responden telah dipilih berdasarkan skor “Skala mengantuk Epworth mereka (ESS)” dan pengukuran Indeks Jisim Badan (BMI). Mereka telah diminta untuk memandu menggunakan simulator memandu selama satu jam. Kemudian, berehat untuk kira-kira 15 minit dan pada masa yang sama mereka perlu minum 250ml minuman tenaga. Selepas rehat, responden telah diminta untuk meneruskan pemanduan untuk 1 jam berikutnya. Untuk mengukur mengantuk, borang kaji selidik IOWA telah diberikan selama 3 kali pada setiap fasa berbeza iaitu pra-memandu, selepas memandu 1 jam, dan pada selepas pemanduan untuk jam kedua. Prestasi memandu telah diukur dengan menggunakan perisian khas di mana ia mengukur indeks variasi kelajuan (LSV) dan Pemanduan Jalan Indeks (RORI). **Keputusan:** Hasil kajian menunjukkan bahawa terdapat hubungan yang signifikan antara pengambilan minuman tenaga dan pengurangan mengantuk dalam kalangan responden. Untuk indeks variasi kelajuan (LSV), keputusan juga menunjukkan bahawa hubungan yang signifikan antara kesan minuman tenaga dan LSV markah indeks. Walau bagaimanapun, tiada terdapat hubungan yang signifikan antara penggunaan minuman tenaga dan Pemanduan Jalan Indeks (RORI) markah. **Kesimpulan:** Minuman tenaga telah terbukti untuk mengurangkan mengantuk semasa pemanduan panjang. Walau bagaimanapun, minuman tenaga tidak banyak membantu meningkatkan prestasi memandu.

Keywords: *Tenaga minuman, Rasa mengantuk, Prestasi Memandu*

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LIST OF ABBREVIATIONS

\leq	Less than or equal
%	Percentage
F	Repeated ANOVA
t	Dependant Sample Paired t-test
p	Significant value
ESS	Epworth Sleepiness Scale
LSV	Large Speed Variation
PDRM	Polis Diraja Malaysia
RORI	Running Off the Roads Index
SD	Standard Deviation
UNESCO	United Nations Educational, Scientific and Cultural Organizations
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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CHAPTER ONE

INTRODUCTION

1.1 Background

The rising number of people involved in the road crash is now conceded to be a global phenomenon concerned by authorities of all countries of the world. For this responsibility, multiples agencies have made researches to reduce the rate of road crash occurrence and to improve more on road safety (Nurkhaliesa, 2010).

Based on PDRM data 2001-2010, vehicles involve in road crashes were increase from 483 351 in year 2001 to 760 433 in year 2010 (PDRM, 2011). A study was done by Radin Umar (2005) said that it might be due to increasing of population from 19.5 million to 25.6 million between year 1994 to 2004.

It is similar with increasing of average growth rate for about 3% of population per year. At the same time, total length of paved roads increased from 60,734 to about 71,814 kilometres while registered vehicles increased from 7,210,089 to 13,878,000 vehicles in 2004 (Radin Umar, 2005).

Furthermore, according to the study by Radin Umar too, the increasing of population and increasing of vehicles number led to high number of road crash. For example, 148 801 road crash cases recorded in 1994 while the number was doubled in 2004 which recorded 326 817 cases (Radin Umar, 2005).

There are many factors lead to increasing of numbers of road crash such as vehicle defects, environment such as road and human attitude (Ministry of Public Works and Transport, Cambodia). Human factors such as falling asleep during driving are one of the contributing factors. According to National Sleep Foundation in (2006), 23 percent of drivers were found feeling asleep while driving vehicles on the road. Another study found that about 24,000 people die each year in road crashes caused directly or in part by falling asleep at the wheel (Eberhart, 2000).

Furthermore in United States, data indicate 80 000 individuals fall asleep at the wheel each day and there are more than 250 000 road crash cases recorded due to falling asleep during driving each year (American Academy of Sleep Medicine, 2012). It is estimated that twenty percent of all serious transportation injuries on the nation's highways are related to sleep (American Academy of Sleep Medicine, 2012). According to a survey in United States, nine of 10 police officers reported stopping a driver who they believed was drunk but turned out to be drowsy.

Sleepiness also refers to drowsiness or urges to fall sleep. Drowsiness include sleepiness and fatigue. Drowsiness occurs as a result of physical or mental exertion or a prolonged period of performing the same task (Douglas, 2005). Drowsiness during driving may result from many underlying causes, including excessive sleepiness, sleep deprivation and changes in circadian rhythm.

1.2 Problem Statement

According to MIROS (2008), road crash in Malaysia has contributed to lose of overall country income for about 1.5 from overall country incomes. It is equal to 7.8 billion money lose. A major factor of the scenario is carelessness while driving the vehicles. Carelessness is important factor that contribute to high prevalence of road crash mortality in Malaysia. Drowsiness including sleepiness, restless and lose of alertness while driving can be categorized under carelessness.

According to a survey made by National Sleep Foundation of United States, half of American adults consistently report that they have driven drowsy. In addition, approximately 20% admit that they have actually fallen asleep at the wheel in the previous year (National Sleep Foundation, 2007).

A study conducted by Corner (2002) found that there was an eightfold increased risk if drivers reported sleepiness and almost a threefold risk for drivers who were driving after five hours or less of sleep. Besides that, through the observation in many routine surveillance systems confirmed the increased risk of an injury crash associated with driving in the early hours of the morning.

Incidentally, most other simulator studies show a rather strong increase in sleepiness and performance impairment during the first 20 to 40 minutes and 37 presumably as a response to the relative monotony of the task (Philip, 2005).

In order to reduce the effects of drowsiness during prolong driving, energy drink consumption is suggested as many studies found that it is helpful in reducing drowsiness. Research studies have been conducted on the main ingredients found in energy drinks. It was found that energy drink helpful in increasing performance, endurance, concentration, reaction time, and enhanced mood. Researchers noted a synergistic affect when the individual ingredients within energy drinks are mixed together and improvements beyond what caffeine alone will provide (Fanjoy, 2010).

1.3 Study Justification

Based on road crash data in Malaysia, the trend of car drivers who are involve in road crash is continuously increasing since 2002 until 2010 (Polis Diraja Malaysia, 2010). Based on the study, drowsiness during driving is one of the important causes that contribute to road crash. One of the tactics to avoid drowsiness during driving is to have caffeinated drinks including energy drinks (ROSPA Literature review, 2011).

Based on the available data, it was found that drowsiness is one of the contributing factors that lead to the occurrence of road crash on the road. Energy drink is claimed to give some positive effects in reducing fatigue and increase performance. However, energy drinks is not totally work in all persons. Besides that, some study found that energy drink also give negative or side effect.

Thus, this study is important in order to investigate whether energy drink is helpful in reducing drowsiness during driving among young adult car drivers. Furthermore, this study also to measure the effectiveness of energy drink in influencing driving performance while driving using driving simulator machine.

1.4 Conceptual Framework

Figure 1.1 shows the conceptual framework that related to this study. Prolong driving for more than one normally will cause the development of drowsiness among drivers. However, drowsiness development is depends on driver's age, health status, sleep quality and also driving time. In addition, prolong driving also may lead to reducing in driving performance among drivers.

For this study, energy drink was tested to see either energy drink is helpful in reducing drowsiness during prolong driving or not. Thus, energy drink was given after one hour drive using driving simulator. Development of fatigue was measured by using IOWA fatigue scale questionnaire. Besides that, driving performances measured through Running off the Road Index (RORI index) and Large Speed Variation Index (LSV). Prolong driving normally will develop drowsiness and cause in reducing driving performance. As a result, it will cause road crash. However, there are some related factors that lead to road crash including alcohol effects, stress and medicine intake. Besides that, environmental factors such as types of road and weather condition also need to be considered. Vehicles condition also one of factors that cause road crash among road users. Vehicles with poor maintenances have high tendency to involve in road crash.

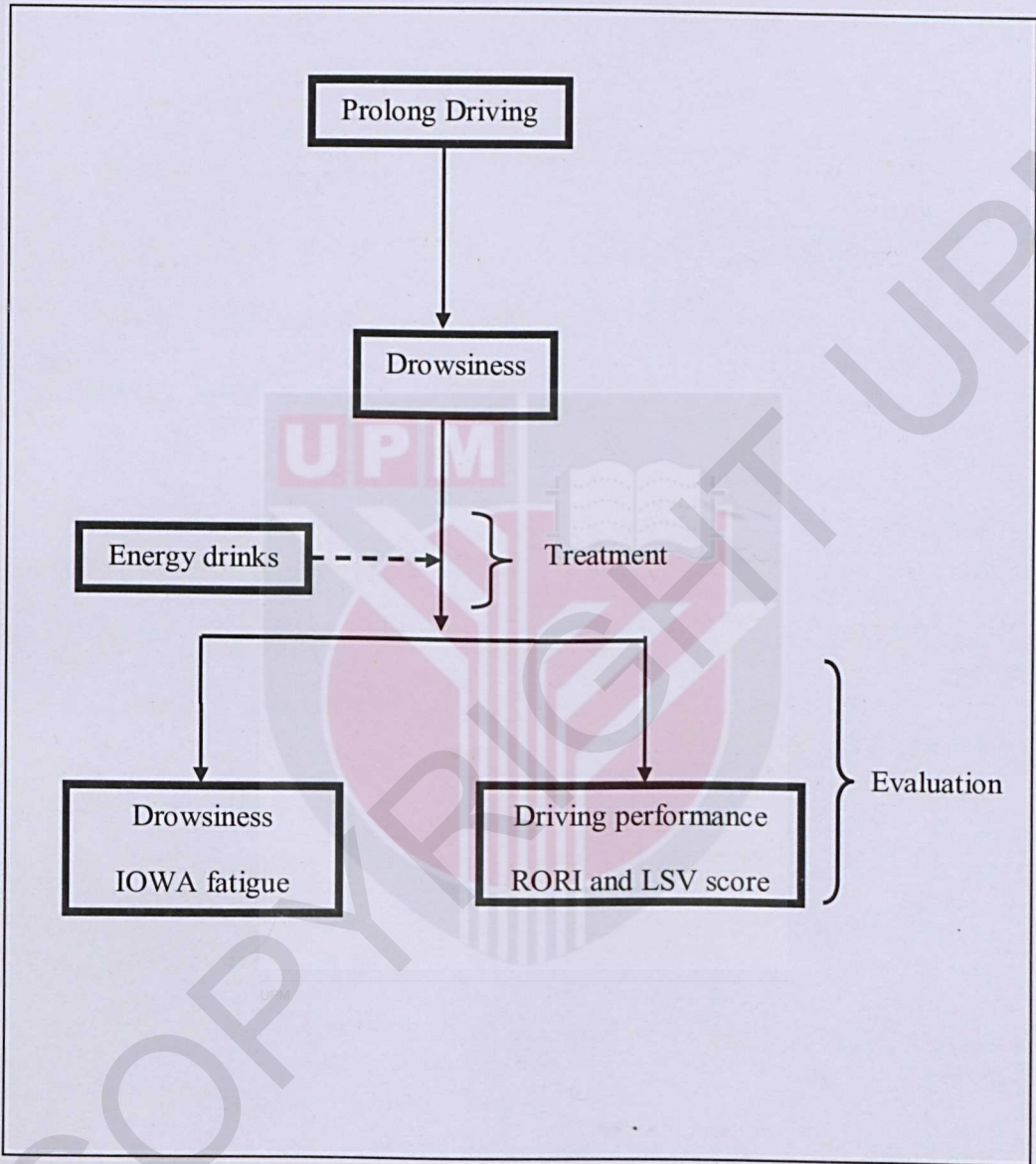


Figure 1.1: Conceptual framework

1.5 Definitions of Terms

1.5.1 Energy Drink

- **Structural Definition**

Energy drinks are typically meant to supply mental and physical stimulation restoring alertness and wakefulness when fatigued or drowsy (The Road Safety Monitor, 2004).

- **Operational Definition**

Energy drinks give extra energy, increase alertness, and improve mental and physical performance (The Road Safety Monitor, 2004).

1.5.2 Drowsiness

- **Structural Definition**

Drowsiness refers to sleepiness and result of fatigue. Drowsiness also refers to urge fall asleep (Douglas, 2005).

- **Operational Definition**

Drowsiness refers to the reluctance to continue a task as a result of physical or mental exertion or a prolonged period of performing the same task (Douglas, 2005).

1.6 Variables

1.6.1 Dependent Variables

- i. Driving performance
- ii. Development of drowsiness

1.6.2 Independent Variable

Selected energy drink (energy drink)

1.7 Objectives

1.7.1 General Objective

To examine the effects of energy drink on drowsiness and driving performances during prolong driving among young adult car drivers.

1.7.2 Specific Objectives

- i. To determine the effects of energy drink on drowsiness among youth by using driving simulator.
- ii. To determine the effects of energy drink on driving performance among youth by using driving simulator.
- iii. To compare the differences of respondent's degree of drowsiness before energy drink given and after energy drink given.
- iv. To compare the differences of respondent's driving performance before energy drink given and after energy drink given.

1.8 Hypothesis

- i. There is no significance difference in respondents' drowsiness level before and after consumption of energy drink.
- ii. There is no significance difference in driving performance before and after consumption of energy drink.



CHAPTER TWO

LITERATURE REVIEW

2.1 Road crash

Road crash is a serious problem in Malaysia. Recently, PDRM was reported that total road crash in Malaysia was increase from 265 175 in 2001 to 414 421 in year 2010 (PDRM, 2010). The road crashes in 2010 also lead to 6872 fatalities. Moreover, the number of fatalities due to road crash in Malaysia has consistently been above 6,000 since year 2003. At the same time, the indices used for road safety indicator has shown only slight decline over the year of 2008 (Hanis, 2008).

An analysis carried out on the crash data for the year 2003 in India shows that the main causes of road crash were drivers' fault (77.91%), pedestrian fault and fault of passengers (1.36%), mechanical defect in vehicles (2.01%), and conditions of the roads (1.32%). Besides that, outside factors such as bad weather, cattle, absence of

rear reflectors, road signage and non-functioning of road signals also contribute to road crash scenario (17.40%) (Mishra, 2003).

Other study of road crash in North Carolina between 1990 and 1992 found 5,104 crashes in which the driver was judged to have fallen asleep (The Road Safety Monitor, 2004). According to the research made Hour (2007), under Royal Government of Cambodia, Ministry of Public Works and Transport (2007), road crash caused by three main factors:

a) Human Factors (Road Users)

The statistics showed that 92% of road crash has been caused by road users who infringed the traffic law. Most acts that contribute to crash are driving faster than limited speed, driving carelessly and getting drunk during driving (Hour, 2007).

b) Road Defect

One part of road crash has been caused by road/bridge infrastructure, which is not yet in the appropriate safety to standard, for examples potholes in the road (Hour, 2007).

c) Vehicle Defect

Vehicles have caused road crash because of the owner itself. Usually the owners did not properly maintain and regularly inspect the vehicle during the operation (Hour, 2007).

Based on report by PDRM in 2010, it was reported that youth with range of age between 16 to 25 recorded high numbers involved in road crash as compared to other age group. Table 2.1 showed the data of drivers involved in road crash by age group.

Table 2.1 Number of drivers involved in road crash by age group in 2010

Age of driver	Fatal	Serious	Minor	Total
6-10	0	0	0	0
11-15	260	376	581	1217
16-20	1336	1641	2949	5926
21-25	1464	1585	2798	5847
26-30	1235	1265	2190	4690
31-35	954	934	1600	3488
36-40	921	927	1531	3379

(PDRM, 2011)

2.2 Youth

Youth is defined in various ways by different official organization. According to UNESCO, youth is defined as people with age between 15-24 years old. UNESCO understands that young people is a heterogeneous group in constant evolution and that the experience of 'being young' varies enormously across regions and within countries (UNESCO, 2011).

Besides that, UNICEF also defined youth as people under range of age between 15 to 24 years old (UNICEF, 2001). Another definition by US national highway of traffic safety administration, group of people with range age between 16 to 29 years old is categorized under youth. Young people under the age of 25 years account for over 30% of those killed and injured in road traffic crashes. Of the 383 046 road traffic deaths that were recorded in this age group in 2002 around the world. From this, males are more likely to be involved in road traffic crashes than young females. Among drivers, young males under the age of 25 years are almost three times as likely to be killed as their female counterparts (Chan, 2005).

In 2009, eight teens ages 16 to 19 died every day from motor vehicle injuries. Per mile driven, teen drivers ages 16 to 19 are four times more likely than older drivers to crash. The motor vehicle death rate for male drivers and passengers ages 15 to 19 was almost two times that of female (CDC, 2010). This may reflect the fact that males are more likely to be on the roads, often because of socio-cultural reasons, as well as a greater propensity to take risks, compared to females. The median age of people who are involving in road accident in other countries such as Canada is 23.

2.3 Energy Drink

Energy drink is a type of drink which functions to supply mental and physical stimulation, restoring alertness and wakefulness when fatigued or drowsy (Canadian Beverages Association, 2009). Main ingredients of energy drink are caffeine. With combination with others ingredients such as taurine and carbohydrate, energy drink claims to help in reducing drowsiness during driving or any other repetitive activities. Laboratory studies have documented that energy drink is helpful for sleep-disruptive effects. It clearly enhances alertness and performance in studies with explicit sleep deprivation, restriction, or circadian sleep schedule reversals (Roehrs, 2010).

The effects of energy drink, which includes taurine, glucuronolactone, and caffeine amongst the ingredients, were examined over 3 studies in a total of 36 volunteers (Alford, 2001). Significant improvements in mental performance included choice reaction time, concentration (number cancellation) and memory (immediate recall), which reflected increased subjective alertness (Alford et al., 2001).

Instead of many studies found that caffeine in energy drink will be helpful in reducing drowsiness energy drink also contribute to some negative effects to human body. Energy drink may lead to intoxication which may lead to further increase in high risk taking behaviour. Some of people may experience symptoms including dehydration, restlessness and decrease in reaction time (Drug Arm Resource Center, 2010). Higher doses can cause anxiety, irritable, and anxious. Some people can consume large amounts of caffeine without bad effects (Ashleigh, 2011b).

2.4 Basic Ingredients of Energy Drink

All the ingredients that added into the energy drink are based on the previous research made by many researchers. Combinations of all the ingredients was made the energy drink. These are the summary of main ingredient that contains in energy drink are shown below

2.4.1 Caffeine

The consumption of moderate amounts of caffeine

- i) increases energy availability
- ii) increases daily energy expenditure
- iii) decreases fatigue

- iv) decreases the sense of effort associated with physical activity
- v) enhances physical performance
- vi) enhances motor performance
- vii) enhances cognitive performance
- viii) increases alertness, wakefulness, and feelings of “energy”
- ix) decreases mental fatigue
- x) quickens reactions
- xi) increases the accuracy of reactions
- xii) increases the ability to concentrate and focus attention
- xiii) enhances cognitive functioning capabilities and neuromuscular coordination

(Glade, 2010)

2.4.2 Taurine

Taurine was found to exhibit diverse biological actions, including protection against ischemia-reperfusion injury, modulation of intracellular calcium concentration, and antioxidant, antiatherogenic and blood pressure-lowering effects (Yan-Jun Xu, 2008).

2.4.3 Sucrose and Glucose

The combination of sucrose and glucose will give extra energy because it is found to help in immediate reserves of glycogen (<http://www.redbull.com>).

2.4.4 Vitamin B

Vitamin B plays roles in blood formation, energy metabolism, and amino acid metabolism (Schiff, 2009).

2.5 Drowsiness during Driving

Drowsy driving is known to be a potential hazard for road crash. A study done in Korea, found that drowsiness, especially for heavy truck drivers could result in life-threatening critical road crash (Lim, 2007). The sleepy or drowsy driving problems have always been there but have not been recognized and even become accustomed to it. The causes of drowsiness were attributed to working long hours without days off, working multiple shifts, watching TV/movies late at night, and attending party late at night (Leechawengwongs, 2007).

A laboratory study by using driving simulator found that, the analytical results of Sleepiness Rating (SSS) scores, reaction times and unstable driving performance significantly increased over time. The result indicates that excessive driving time was a significant drowsiness factor and potential cause of road crash (Ting, 2008).

2.6 Energy Drink and Drowsiness

Reyner study found that 250 ml of the energy drink was beneficial in reducing sleep related driving incidents and subjective sleepiness during the afternoon in young adults. The effects of energy drink shown after the first 90 min of the drive (Reyner, 2002). In addition, study done by Curtiss on simple reaction time also found the similar result. There is a significant difference between the consumption of energy drink on reaction time (Curtiss, 2006). A study of evaluation of the effects of a functional energy drinks on post launch and early evening driving performance also record the same result. After 40 km drive by using driving simulator, 250 ml given and it is found to increase driving performance (Parkes, 2003).

2.7 Driving Performance

A study of the Effects of Partial and Total Sleep Deprivation on Driving Performance was done to examine the effects of progressive sleep deprivation on simulated driving performance in the laboratory. The result shows that the performance of driving was reducing after increasing of driving time (Peters, 1999). Incidentally, most other simulator studies show a rather strong increase in sleepiness and performance impairment during the first 20 to 40 minutes and 37 presumably as a response to the relative monotony of the task (Philip, 2005).

The extent to which sleepy drivers are aware of sleepiness has implications for the prevention of sleep-related crashes, especially for drivers younger than 30 years old who are most at risk (James, 2003).

2.8 Energy Drink and Driving Performance

A simulator study on energy drink and driving performance found that energy drink significantly improves driving performance during prolonged driving (Monique, 2011). As the main ingredient in energy drink is caffeine, a study on caffeine and sleep restriction was done. Researcher found that, Caffeine resulted in significant improvements across all measures. Subjective measures were found to be significantly correlated after sleep restriction and prior to caffeine. Thus, Caffeine had a beneficial effect on all measures (Ashleigh, 2011a).

CHAPTER THREE

METHODOLOGY

3.1 Study Location

The study was held in a room at the Environmental and Occupational laboratory, Faculty of Medicine and Health Science, Universiti Putra Malaysia. Temperature of the room was set according to respondents' comfortability.



Figure 3.1: Environmental and Occupational Laboratory

3.2 Study Instruments

3.2.1 Energy Drink

The energy drink was used to determine the reducing of drowsiness or increasing driving performance. It was given to respondent after 1 hour of driving using simulator.



Figure 3.2: Selected Energy Drink

3.2.2 Driving Simulator

The simulator consisted of an immobile car with an interactive full-size computer-generated monotonous roadway having some gradual bends, projected on to a 2.0m x 1.5-m screen located 1.5 m from the windscreen. The simulator consists of a car unit with adjustable car seat and a dashboard and includes a steering wheel, turn sign indicators, brake, and gas pedals for vehicle control. The system generates realistic roadway scenery. Auditory feedback is provided by speakers and included sound of the engine, braking, speeding in curves, and driving off-road. Whenever a

collision occurs, a broken windshield and the sound of braking glass are presented. Subsequently, the car is placed back in the middle of the right traffic lane and the test continues.



Figure 3.3: Driving Simulator

Driving simulator is important to measure driving performance of driver before treatment and after treatment given. Performance was measured based on Running off Road Index (RORI) and Larger Speed Variation (LSV).

3.2.2.1 Running off the Roads (RORI index)

RORI index was measured each second by the amplitude of exit and it consists of crossing over emergency lane or continuous white lane crossing. The penalty is calculated for 1 min and corresponds to the square root of the sum of the RORI amplitudes squared for each second. The formula is shown as below.

$$\text{Running-off-the-road index: Penalty / min} = (\sum \text{amplitude}^2)$$

(Sze Seen Kee, 2010)

3.2.2.2 Large Speed variation (LSV) index

Large Speed Variation (LSV) was measured calculating each second's difference between vehicles speed. For LSV, a subject was penalized if an absolute difference between the vehicle speed and the highest speed authorized in the segment of road considered is calculated for each second. The formula is shown below.

$$\begin{aligned} &\text{If } \Delta \text{ speed} > 20, \text{ then penalty (per second)} \\ &= (\Delta \text{ speed} / 10) - 1 \end{aligned}$$

(Sze Seen Kee et al., 2010)

3.2.3 Questionnaires

For this study, two questionnaires were used. First is Epworth Sleepiness Scale (ESS) questionnaire where it was given before the test been conducted. IOWA fatigue scale questionnaire then was used on the experiment day.

3.2.3.1 Epworth Sleepiness Scale Questionnaire (ESS)

ESS questionnaires were distributed to all respondents to screen them either they are qualify enough to be involve in this study or not. The Epworth Sleepiness Scale (ESS) was administered to assess general levels of daytime sleepiness. Subjects with ESS scores above 10 were excluded from respondents (Monique et al., 2010).

3.2.3.2 IOWA Fatigue Scale Questionnaire

Lists of 14 questions were generated by various experts in the field to reflect physical and mental fatigue. The scale was based on a similar questionnaire which has been applied to a hospital-based case control study. The purpose of this questionnaire designed is to measure respondent's response to the treatment. IOWA fatigue scale questionnaire were given to respondents for three times (Trudie, 1993).

First round of questionnaire was performed before the test. The score was recorded as baseline score. Second IOWA score was calculated after 1 hour driving. Finally, respondents are given third IOWA form after complete second driving session. Score was calculated based on the formula provided by Trudie (1993). In conclusion, the more score obtained by the respondents, the more drowsy experienced by the drivers.

Scoring

Total score

$$= Q1 + (6-Q2) + Q3 + (6-Q4) + Q5 + Q6 + (6-Q7) + Q8 + Q9 + (6-Q10) + (6-Q11)$$

Subscales score

$$\text{Cognitive} = Q3 + Q5 + Q9 + (6-Q11)$$

$$\text{Fatigue} = Q1 + Q6$$

$$\text{Energy} = (6-Q2) + (6-Q7) + (6-Q10)$$

$$\text{Productivity} = (6-Q4) + Q8$$

3.3 Study Populations

Male respondents were randomly selected to be the respondents and they were chosen based on certain criteria. Based on study conducted in Canada, median age of people who are involved in road crash is 23 years old. Thus, only respondents

with aged between 19 to 25 years old were chosen to participate in this study. All respondents are representing young adult in Malaysia.

3.4 Sampling Size

Sample size was calculated using specific software based on formula:

$$\begin{aligned}\text{Sample size (n)} &= \frac{Z^2 (p) (1-p)}{c^2} \\ &= \frac{1.96^2 (0.5) (1-0.5)}{0.16^2} \\ &= 37.5\end{aligned}$$

As a result, sample size chosen is **38**

5 % value was added and new sample size is **40**

(<http://www.surveysystem.com/scalc.htm>)

3.5 Respondents Criteria

3.5.1 Inclusive Criteria

- i) Respondents who were volunteered to participate in this study must be a healthy individual.
- ii) Respondents with age range between 19 and 25 years old.
- iii) For the screening purpose, only respondents with normal Body Mass Index (BMI) were chosen as respondent. The value for normal BMI is between range 18.50 to 24.9 (WHO, 2004).
- iv) The evaluation of Epworth Sleepiness Scale (ESS) score among respondents also has been considered for screening purpose. ESS score was given a few days before the test been conducted. Respondents with score less than 10 were rejected.

3.5.2 Exclusive Criteria

- i) Alcohol consumers were automatically eliminated for this study.
- ii) Smokers also have been rejected to be a part of the study.
- iii) Respondents with regular caffeine intake also been rejected. Regular caffeine intake is classified as taking more than 2 cup of caffeinated drinks per day.
- iv) Besides that, respondents having chronic disease such as diabetes also been rejected.

3.6 Study Flow

Study flow was described the each steps that applied in this experiment. It was started with selection of respondents. Respondents must be volunteered to be a part of this study. Then they were being selected based on certain required criteria. For qualification criteria, respondents were asked to fill Epworth Sleepiness Score (ESS) questionnaire form and measured their Body Mass Index (BMI).

On the experiment day, respondents were asked to take any meals before perform the test. If they consume any foods before the test, they were rejected automatically and the test postponed. During the experiment day, respondents were given minimum 5 minutes to do pre-test to ensure they can adapt with the equipments. Then, experiment was started for about two and half hours for both sessions. It was included baseline phase, after one hour phase, and post phase. Finally, data was calculated for data analysis. The summary of experimental study flow is shown in Figure 3.4.

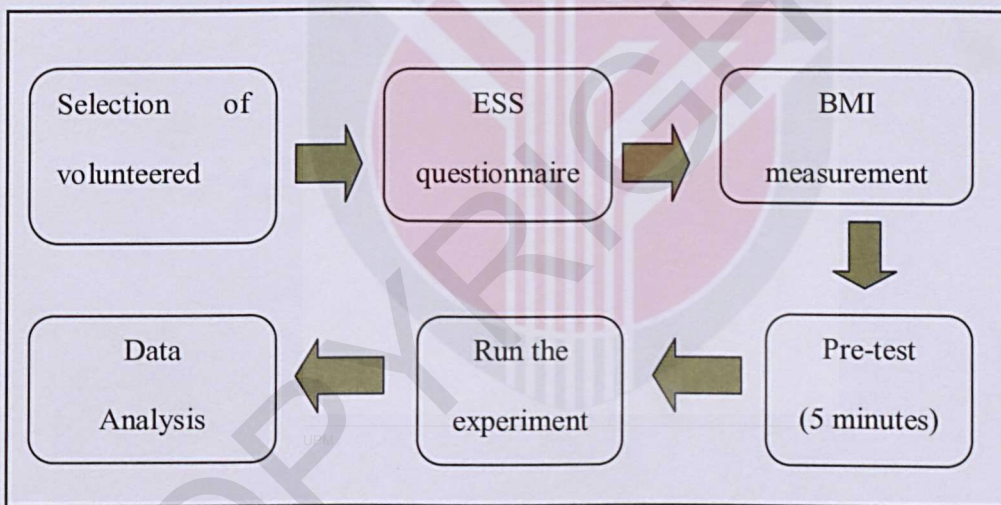


Figure 3.4: Experimental study flow

3.7 Study Design

This study is an experimental study design which measures the effectiveness of treatment before given the treatment and after respondents used it. The summary of the experiment was described in figure 3.5.

First, respondents who volunteered to participate in this study undergoes screening process. In this process, respondents asked to fill Epworth Sleepiness Scale (ESS) questionnaire form. ESS questionnaire were given a few days before they were performed the test. Besides that, the Body Mass Index (BMI) values of respondents were measured. Respondents who having BMI value out of normal range, they were rejected.

On the experiment day, respondents were asked to drive for one hour. Then, they need to fill the IOWA fatigue scale questionnaire. In addition, treatment (energy drink) also been given. After that, respondents were asked to drive for another 1 hour. Finally, at the end of the experiment, they were required to fill up other IOWA questionnaire form.

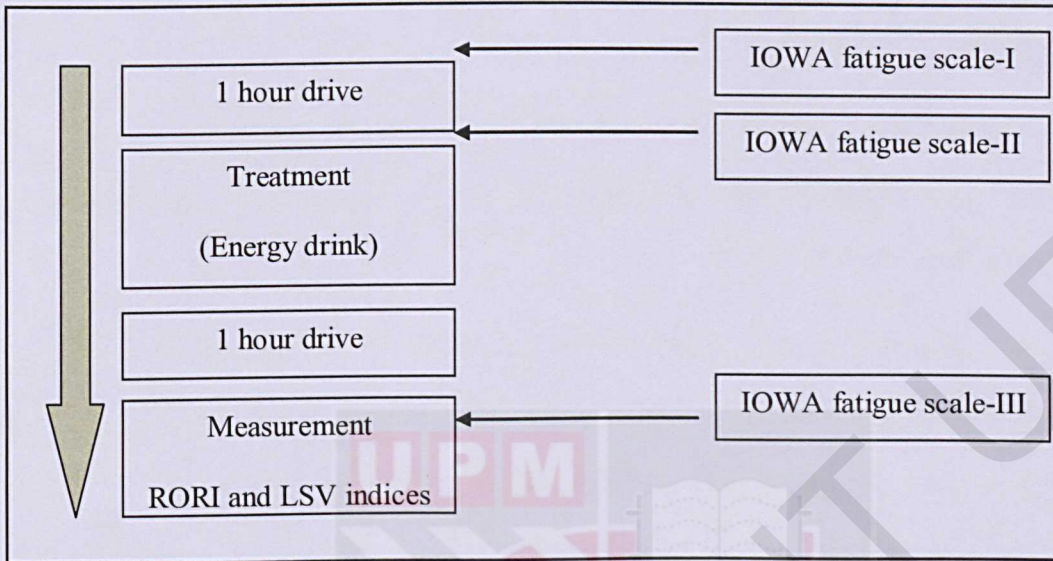


Figure 3.5: Summary of study design

3.8 Data Analysis

Data was analysed by using SPSS 19.0 software. Analysis was analysed in order to find the relationship between the consumption of energy drink and drowsiness during driving. To see the relationship between these two variables, repeated ANOVA measure test. To see the relationship between energy drink and driving performances (LSV index and RORI index), dependant sample paired t-test were used.

3.9 Quality Control

Quality control was applied in order to reduce the effects of confounders which can affect the result. Quality control was first done before the test was conducted.

- i. Respondents were required to have enough sleep in the night (at least 6 hours) before they performed the test. Respondents with not enough sleep hours were rejected. However, they were asked to come and perform the test at the following day.
- ii. To see the effectiveness of energy drink, respondents were asked to not consume any foods 3 hours before test.
- iii. Respondents were allowed to get familiar with the driving simulator for at least five minutes before performing the real task.
- iv. Before the real test was conducted, respondents were explained about the study protocol. Respondents were also required to fill the agreement form to ensure they agreed to participate in this study.

Second quality control was done during test ran

- i. After completed an hour drive, each respondents asked to drink 250 ml of energy drink.
- ii. Respondents were prohibited to use cellular phone during performing the test.
- iii. Respondents were not allowed to listen for music or chat with other people.

CHAPTER FOUR

RESULTS

4.1 Backgrounds

Data collections were carried out from December 2011 and completed on April 2012. Based on the calculation, there are 40 respondents who volunteered to participate in this study. Respondents have been selected based on the specific criteria to fulfill the requirement of the research.

4.2 Data Description

4.2.1 Socio-Demographic of Respondents

There were three important variables (race, age, and education level) being studied. As reported in Table 4.1, majority of respondents are Malay (82.5%).

Meanwhile, age of respondents are around 20 to 25 years old as stated by the UNESCO youth definitions. In terms of education level, most 82.5% of the respondents were holders of Matriculation certificate. Then, it followed by Diploma, STPM and “Foundation” certificate holders.

Table 4.1: Socio-demographic

Variables	Frequency (%)
Race	
Malay	33 (82.5)
Others	7 (17.5)
Age (years)	
20	4 (10.0)
21	8 (20.0)
22	5 (12.5)
23	16 (40.0)
24	5 (12.5)
25	2 (5.0)
Level of Education	
STPM	1 (2.5)
Matriculation	33 (82.5)
Diploma	5 (12.5)
Foundation	1 (2.5)

N = 40

4.2.2 Respondents Qualification

Respondent's qualification was calculated by using BMI measurement and ESS questionnaire. BMI standard valued was referred from WHO reference value (WHO, 2005). Only respondents with normal BMI score were qualified to participate in this study. For ESS questionnaire, score was calculated using software provided. Respondents with score more than 10 were having no sleep problems. As a result, they are qualified to participate in the study.

Table 4.2: Respondent Qualification

Variables	Mean \pm SD
Height (cm)	1.6635 \pm 0.08481
Weight (kg)	59.462 \pm 21.4590
Body Mass Index (BMI)	21.459 \pm 2.17720
Epworth Sleepiness Scale score	15.03 \pm 3.534

N = 40

4.2.3 Driving Experience among Respondents

Driving experience was evaluated from questionnaires. There are four questions asked in Malaysia language to make easy understanding for the respondents. For the first question, respondents were asked to answer when they are officially licensed with car driving license. Based on Table 4.3, most of the respondents got their license within the 2007 until 2009 years.

Then, second question was about how long time that their spent for driving since the first day they got license. With mean 2.38 and Standard Deviation 0.984, majority of them drive within 1 to 2 hours (50%). Then it followed by only 15 of the respondents experience driving for more than 3 hours (37.5%).

For question three, question asked about the drowsiness feeling experienced by respondents during driving. This question is not limited to respondents who were experience driving for more than one hour. Based on the result, 70% of respondents say yes, while 30% say no when asked about drowsiness during driving. Next, question four asked about the activities that respondents done when experience drowsy. Majority of them chosen to take rest (32.5%) and followed with was taken caffeinated drinks to eliminate drowsy after prolong driving.

Table 4.3: Driving Experience among Respondents

Variables	Frequency (%)	Mean \pm SD
First date driving license has been obtained		2008 \pm 1.847
2004 – 2006	7 (17.5)	
2007 – 2009	20 (50.0)	
2010	13 (32.5)	
Longest Duration Since First day driving license has been obtained		2.83 \pm 0.984
< 1 hours	1 (2.5)	
1 – 2 hours	20 (50.0)	
2 – 3 hours	4 (10.0)	
> 3 hours	15 (37.5)	
Did you experience drowsy		1.30 \pm 0.464
Yes	28 (70.0)	
No	12 (30.0)	
What you did when experienced drowsy during driving		2.20 \pm 1.114
Drink caffeinated drink	13 (32.5)	
Stop and take rest	14 (35.0)	
Continue driving	5 (12.5)	
Others	8 (20.0)	

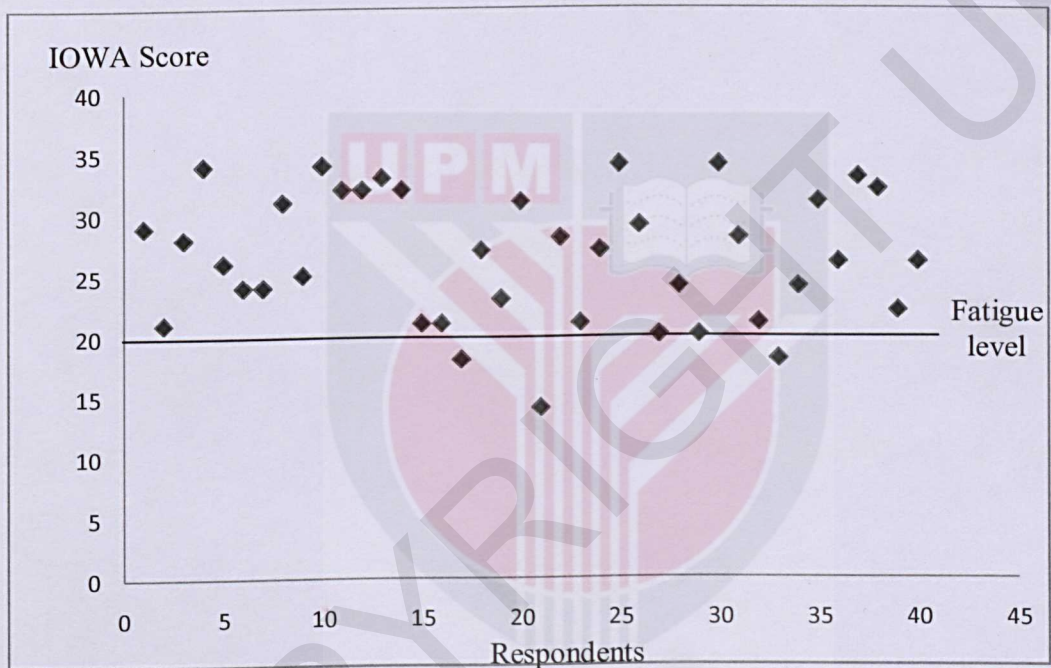
N= 40

4.2.4 Distributions of IOWA Score among Respondents

The distributions of IOWA score are present through scattered graph where it can show the distribution of respondents' score for IOWA. Respondent with score more than 20 were considered as experiencing drowsiness. Three graphs were used to present the scores of respondents. It is including, before perform test (phase one), after perform one hour test (phase two), and finally after perform second hour test or after energy drink given (phase three).

4.2.4.1 Phase I: Before Perform Test

Before the test conducted, each of the respondents was required to fill the first IOWA questionnaire. First score is important as a baseline to compare with next scores after perform test.



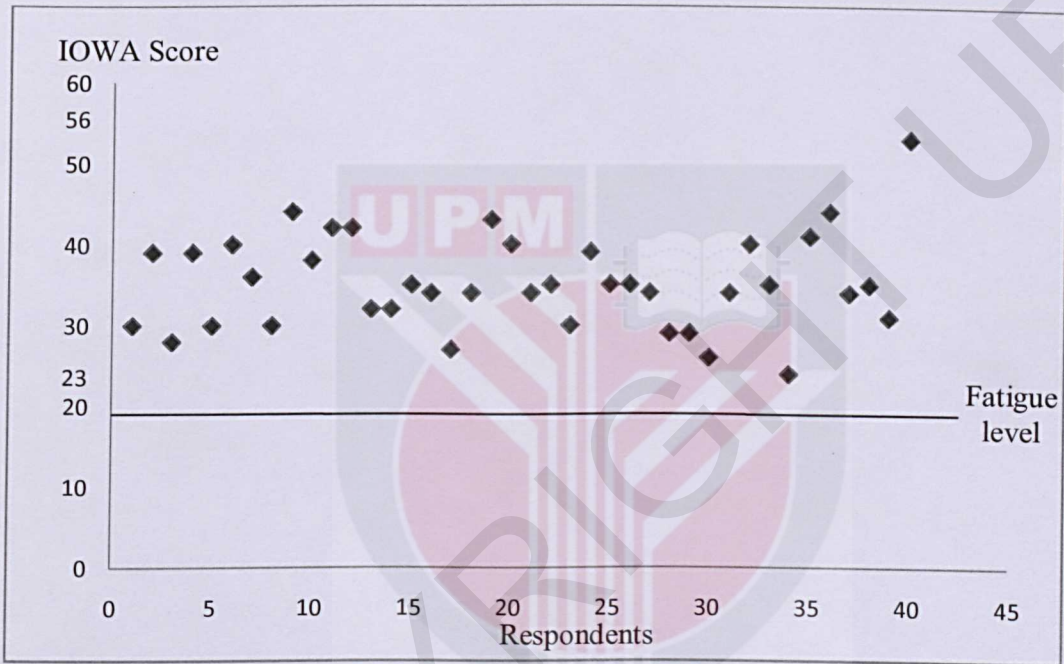
N=40

Figure 4.1: Distributions of IOWA score among respondents before do the test

Figure 4.1 showed the distributions of IOWA score among each of the respondents before they perform test. Based on the scattered graph above, scores are between 10 and 35. Majority of them were recorded score more than 20 and only 3 of them got scored below 20.

4.2.4.2 Phase II: After 1 Hour Test

After 1 hour drive using driving simulator, respondents then asked to fill second IOWA questionnaire in order to evaluate if they develop drowsy.



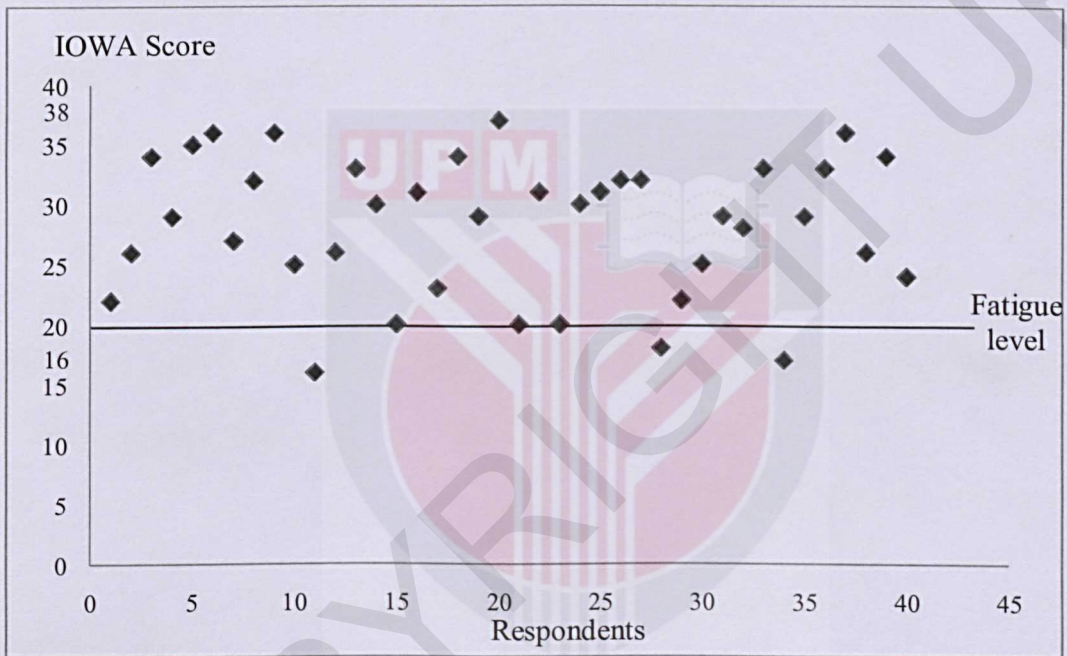
N=40

Figure 4.2: Distributions of IOWA score among respondents after 1 hour test

Figure 4.2 showed the distributions of IOWA score among respondents after 1 hour driving. From the graph, it clearly states that all respondents developed drowsiness. All scores are above 20 which are more than fatigue level. It is indicates that driving for one hour can contribute to the development of drowsiness.

4.2.4.3 Phase III: After Second Hour Perform Test

After completely perform second hour test, respondents are required to fill final IOWA questionnaire form to be compared with previous IOWA score.



N=40

Figure 4.3: Distributions of IOWA score among respondents after energy drink

Figure 4.3 showed the distributions of IOWA score among respondents after second hour driving or after energy drink has been given. Based on the graph, Distributions of score are in between 38 maximum and 16 minimum. Score looks different compare with baseline score and second IOWA score.

4.2.5 Mean Different in 3 Scores of IOWA in The Respondents

Effectiveness of energy drinks in influencing driving performance among respondents was determined through IOWA fatigue questionnaire and measurement of driving performance. Repeated ANOVA test were used to find the association between these three different score. Based on the result, it is shows that energy drinks are helpful to reduce drowsiness during prolong driving. Table 4.4 showed the comparison of mean for 3 different scores of IOWA fatigue score at different phase. Result showed that F value is 32.720 and p is 0.0005 which is less than 0.05. Therefore, there result was significant between energy drink intake and the reducing of drowsiness development.

Table 4.4: Repeated ANOVA measurements

Variables	Mean \pm SD	F value	p value
IOWA ^a	26.45 \pm 5.330	32.720	0.0005
IOWA ^b	35.30 \pm 5.863		
IOWA ^c	28.28 \pm 5.751		

N=40

Significant at $p \leq 0.05$

*IOWA= IOWA fatigue score

4.2.6 LSV and RORI Score among Respondents

LSV and RORI indices are calculated automatically by the software as the respondents perform the test. More score obtained by respondents, it indicates that they did more errors during driving. LSV and RORI index calculated twice that is for the first hour and next 1 hour (after energy drink given).

4.2.6.1 LSV Index for the First and Second Hour

Table 4.6 showed the LSV score for the first hour driving (before energy drink given) and second hour driving (after energy drink given). For the first reading, mean (\pm SD) score recorded is 3132.82 (657.452). Score range is about 1975.80 (minimum) and 6083.80 (maximum). Meanwhile, for second LSV score, Mean (\pm SD) is 2845.91 (407.17). Range of score was between 1897.53 (minimum) and 3942.23 (maximum).

Table 4.5: LSV score for first and second test

Variables	Mean \pm SD	Range
LSV ^a	3132.82 \pm 657.452	1975.80 – 6083.80
LSV ^b	2845.91 \pm 407.170	1897.53 – 3942.23

N=40

a=Large Speed Variation (before energy drink given)

b=Large Speed Variation (after energy drink given)

4.2.6.2 RORI score for the first and second hour

Table 4.6 below was about the RORI score for the first hour driving (before energy drinks given) and second hour driving (after energy drinks given). For the first reading, mean score recorded is 403.65 and standard deviation is 217.46. Score range was about 163.60(minimum) and 853.61(maximum). Meanwhile, for second RORI score, mean score is 369.07 and standard deviation is 210.51. Range of score was between 92.70 (minimum) and 947.21 (maximum)

Table 4.6: RORI score for first and second test

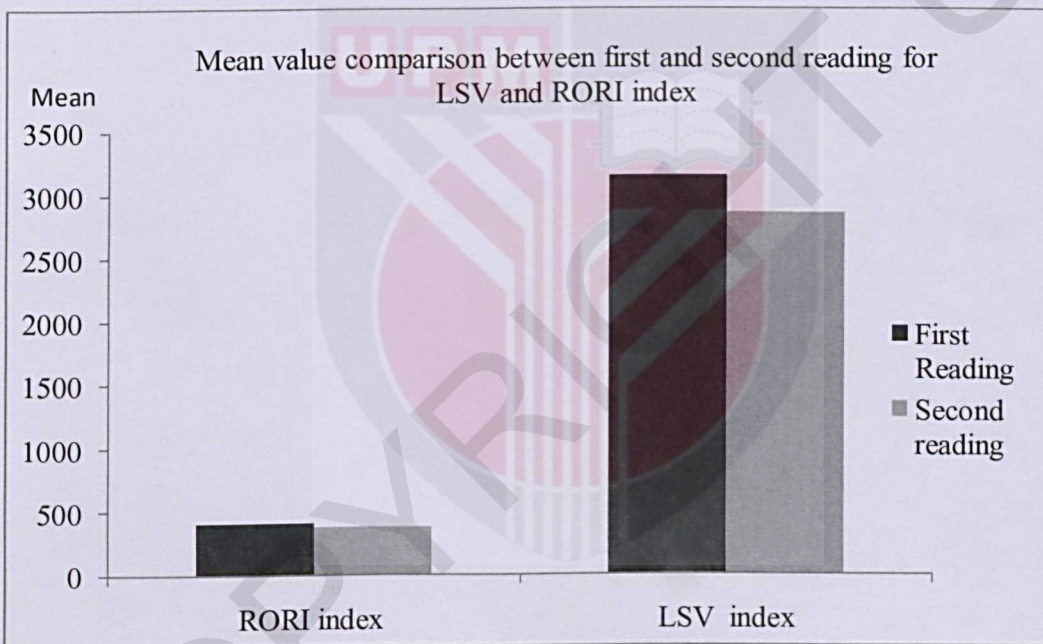
Variables	Mean \pm SD	Range
RORI ^a	403.65 \pm 217.46	163.60 – 853.61
RORI ^b	369.07 \pm 210.51	92.70 – 947.21

N=40

a=Running Off the Road Index a (before energy drink given)

b=Running Off the roads index b (after energy drink given)

Besides that, Figure 4.4 showed the mean comparisons between first reading and second reading (after treatment given). Based on that figure, first reading score is higher compared to second reading score for both indices measurement. For RORI index, the mean for first reading is 403.68 and second reading is 369.07. Meanwhile, LSV first score index is 3132.8 and second LSV score index is 2845.9.



N=40

Figure 4.4: Comparison of means value for first and second reading LSV and RORI index

4.2.6.3 Comparison between RORI first score reading and RORI second score reading

Table 4.7 showed the comparison between RORI first reading and RORI second reading. Dependant paired sample t-test were used to compare between these 2 variables to see either treatment (energy drink) is effective or non-effective. Value of p was set for 0.05. As a result, Mean (\pm SD) value for RORI score was 35.594 (248.46). Value of t recorded was 0.881 and p value is 0.384. Since p value is 0.384 and it is more than 0.05, the comparison of both reading is not significantly increase. Thus, energy was not helpful too much in increasing RORI score among respondents.

Table 4.7: Comparison of first RORI index score and second RORI index score among respondent

Variables	Mean \pm SD	t value	p value
RORI ^a and RORI ^b	34.594 \pm 248.46	0.881	0.384

N=40

*Paired sample t-test, significant at $p \leq 0.05$

*RORI=Running Off the Road Index

4.2.6.4 Comparison between LSV first score reading and LSV second score reading

Table 4.8 showed the comparison between LSV first reading and LSV second reading. Similarly with RORI index, dependant paired sample t-test were used to compare between these 2 variables to see either treatment (energy drink) is effective or non-effective. Value of p was set for 0.05. As a result, Mean (\pm SD) value for LSV score is 286.91 (796.66). As the test ran, value of t recorded was 0.881 and p value is 2.278. Since p value is 0.028 and it is less than 0.05, the comparison of both reading is significant. Thus, energy was helpful in increasing LSV scores among respondents.

Table 4.8: Comparison of first LSV index score and second LSV index score among respondent

Variables	Mean \pm SD	t value	p value
LSV ^a and LSV ^b	286.91 \pm 796.66	2.278	0.028

N=40

*Paired sample t-test, significant at $p \leq 0.05$

4.3 Summary

There are three parameters including drowsiness level, RORI index and LSV index which are used to test the hypotheses. These parameters have been used to indicate either energy drinks is effective enough to reduce drowsiness and improve driving performance during prolong driving. For the drowsiness measurement, energy drinks is found to help in reducing fatigue among respondents. However, Energy drink is not too helpful in improving driving performance which was measured through LSV (Large speed variation) score and RORI (Running off the Road Index) measurement.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Socio-Demographic Data

Socio-demographic data is important in order to investigate the background of respondents to qualify them to be participating in the study. All data were obtained through the questionnaire form. As this is an experimental study design, only few respondents were required. Thus, there were 40 respondents involved in this study.

All respondents are studying in University Putra Malaysia to represent young adult in Malaysia. Based on the data, Respondents age range was determined to be between 19 and 25 years old with mean age is 23 (Douglas et al., 2005). In addition, a study conducted in Canada found that most young adult drivers who involved in road accident within mean age 23 (Douglas, 2005). Other question analyzed is level

of education which are consists of Matriculation, STPM, Diploma and *Asasi*. Most of them were graduated from Matriculation (82.5 %), followed by Diploma (12.5%), STPM (2.5%) and *Asasi* (2.5%).

5.2 Respondent's Requirement

To choose the respondent's qualification, some of the parameters were measured. It were includes body mass index (BMI) and Epworth Sleepiness Questionnaire. Measurement of BMI and ESS questionnaire was referred from study done by Monique et al., 2011. After screened 55 volunteered respondents, only 40 of them were qualified enough to participate in this study.

5.3 Driving Experience among Respondents

Experience in driving was studied to ensure that selected respondents can easily adapt with driving situation. More long they have driving experience, it is indicating the faster they can adapt with the simulator.

5.4 Energy Drink and Drowsiness

There are three measurement were taken during the assessment of drowsiness. Before the test conducted, each of the respondents was required to fill the first IOWA questionnaire. First score is important as a baseline to compare with next scores after perform test. After 1 hour drive using driving simulator, respondents then asked to fill second IOWA questionnaire in order to evaluate if they develop drowsy. After completely perform second hour test, respondents are required to fill final IOWA questionnaire form to be compared with previous IOWA score. The distributions of IOWA score are present through scattered graph where it can show the distribution of respondents' score for IOWA.

Based on the Figure 4.2.4.1 (phase I: Before perform test), the distribution scores is between 14 and 34. After one hour driving, the drowsiness among respondents were developed where the distributions of scores is between 23 and 56 as shown in Figure 4.2.4.2 (phase II: After 1 hour test). After given energy drink, drowsiness among respondents was reduced. As shown in Figure 4.2.4.3 (phase III: After energy drink given).

To see the significance of these three results, repeated ANOVA measurements was used. Based on the result, value of F recorded was 32.720. Meanwhile, p value was 0.0005 which is less than 0.05 and the result is significance. From the result, it is shows that energy drinks are helpful to reduce drowsiness during driving. As a result, result was significant between energy drink intake and the reducing of drowsiness development. The result was fulfilling the hypothesis set before the test has been conducted.

A study from Peter (1999) found that the drowsiness will develop after driving and it will lead to sleepiness. One of the factors that contribute to drowsiness during driving is quality of sleep (Peters, 1999). However, a study is found that taking caffeinated drinks such as energy drinks is helpful in reducing drowsiness during driving (Brice, 2001).

Long duration of driving is a significant cause of fatigue-related crash on motorways or major roadways. The drowsiness caused by driving for extended periods acutely impairs driver alertness and performance and can compromise transportation safety (Ting et al., 2008). Drowsiness also affected by sleep, subjective, physiological sleepiness, and cardiovascular disease (Torbjorn, 2009).

The combination of ingredients in the energy drink is stimulating people to do some activities and reduce drowsiness. Energy drinks contain bio-active ingredients that may likely stimulate brain and other vital organs of their consumers (Yunusa, 2011). The measurements of mental drowsiness found that drowsiness will develop after more than one hour driving (Chunlin, 2011).

Based on this study also, respondents informed that their drowsy feel was eliminated for about 10 minutes after energy drink taken. Similarly with findings by Monique et al., (2011), energy drink was helpful in reducing drowsiness during prolong driving. Moreover, this result is supported by a study of energy drink consumption among college students in 2007. According to the survey, frequency of students that used energy drinks to stay up in the night for study is high (Brenda et al., 2007).

5.5 Energy Drink and Driving Performance

Driving performance was measured through Running off Road Index (RORI) and LSV index (LSV). RORI and LSV score was measured twice which were first (after one hour drive) and second (after second hour drive). Based on the result, the result was not significance for RORI first score and RORI second score. However, the first LSV score and second LSV score was significant.

Energy drink was found to not totally increase or improve RORI score among drivers after second hour driving. This might be due to some factors such as bore or different types of roads used. RORI score result indicate that respondents unable to maintain the good control of the car. Thus, the RORI score was increase and lead to road crash among some respondents. The result is supported by the study done by Mohammad Nizam (2006). Road crash generally caused by traffic itself such as, combination of traffic composition, improper intersection design, provision of street lightning, high traffic volume, provision of pedestrian crossing and signal light (Mohammad Nizam, 2006). According to a study, vehicles speed also contributes to road crash especially when drivers drive more than speeds limit authorized (Mohammad Nizam, 2006).

However, all respondents were more alert and able to control their vehicle speeds especially after energy drink given. The fact was showed through the LSV index scores among respondents were reduced after second phase of driving. LSV result from this study was similarly with findings done by Monique (2011). Energy drink was found to increase driving performance among respondents (Monique et al., 2011). In addition, a study on energy drink on simple choice reaction time by Chase Carnden also reported the same result (Carnden et al., 2008).

Since the result of RORI scores and LSV scores was not parallel, thus the result was not indicating the improvement of driving performance. As a result, data for this finding was contradicted with the previous study where energy drink was not found to totally improve the driving performance among respondents. From the result, LSV score had shown the significance difference while the result is not significant for RORI index. Sze Seen Kee (2010) study found that LSV and RORI index score is affected by the types of roads.

However, the road conditions and environmental factors are not considered in this study because the study is about the driving performance during prolong driving. In conclusion, driving performance can be equally studied in real and simulated environments but reaction time and self-evaluation of sleepiness are more affected in a simulated environment.

Real driving and driving simulators are comparable for measuring line crossings but the effects are of higher amplitude in the simulated condition. Driving simulator may need to be calibrated against real driving in various conditions (Philip,2005).

5.6 Study Limitations

One of the limitations in this study is the simulator is not represent the actual driving situation. During the real driving situation, respondents will face many related confounders like environment and various types of drivers. Environment factor such as weather, road condition and traffic condition will effect mainly on driving performance. In addition, there are some confounders to be considered if the test conducted in real driving situation. Confounders like vibration and temperature effects are absence in driving simulations machine.

This study also not measure respondent's nutritional diet intake. According to study, daily diet intakes by respondents also effect the development of drowsiness among drivers. Besides that, time also is a limitation. One respondent per day is also the limitation. 40 days were required to complete all the test with time given is limited.

5.7 Conclusion

Based on the finding from this study, energy drink is not significantly improves driving performance. This was due to different result of RORI scores and LSV scores among respondents. RORI score was recorded non-significant result while LSV scores showed significant result. The differences between both result was due to some factors such as the absence of actual environmental in driving simulator compare to real driving conditions.

However, energy drink was helpful in reducing drowsiness during prolongs driving which is more than one hours of driving. Based on the evaluation through IOWA questionnaire, it was found that the level of drowsiness among respondents were drops after the consumption of energy drink. The result was similarly with some findings where previous researchers confirm that energy drink was helpful in reducing as well as eliminated drowsiness. In addition, this study was limited to healthy person only. Unhealthy person such as diabetic patients or caffeine allergic person was not involved.

5.8 Recommendation

Based on the result, it is recommended for the healthy adult drivers to consume energy drink during prolong driving. The consumption of energy drink was proven to reduce drowsiness for healthy male adult respondent. Further research need to develop to test the effectiveness of energy drink in reducing drowsiness and increase driving performance. Future research must be considered some factors such as nutritional intake, actual health status and types roads.

As drowsiness is one of major factors for road accident crash in Malaysia, It also is possible to suggest the consumption of energy drinks in order to reduce drowsiness during prolong driving among normal and healthy drivers. However, it is not compulsory to take energy drinks because contains in energy drinks may affect other sensitive people. Some people may develop allergic reactions and may affect fetus health for pregnant women. Thus, to reduce drowsiness during driving, it is suggested for drivers to take enough rest, enough sleep time and simple exercise before begin the journey. If drowsiness is develop during driving, it is highly recommended for people to stop for while to take rest. Traffic related regulations also need to be strictly implemented to reduce the road accident rate in Malaysia.

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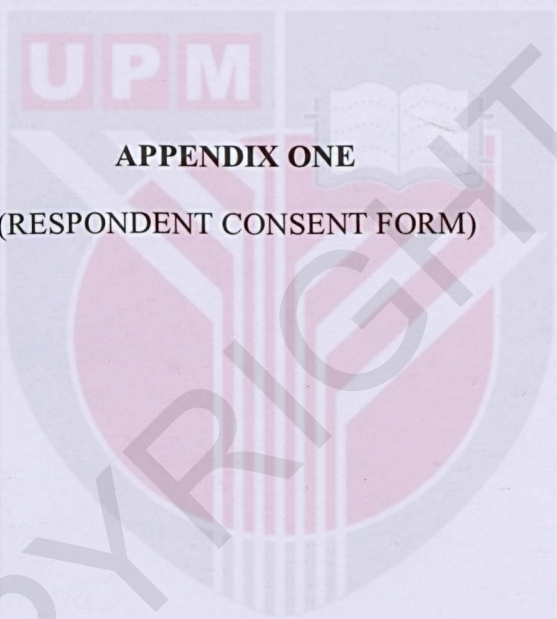
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APPENDIX ONE

(RESPONDENT CONSENT FORM)



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1. TAJUK KAJIAN:

**EFFECTS OF A SELECTED ENERGY DRINK IN INFLUENCING DROWSINESS
AND DRIVING PERFORMANCE AMONG YOUNG ADULT CAR DRIVERS BY
USING DRIVING SIMULATOR**

2. PENGENALAN:

Kemengantukan sewaktu memandu boleh disebabkan oleh beberapa factor seperti rasa mengantuk yang berlebihan sewaktu sedang memandu, keletihan, dan beberapa factor sampingan seperti kekenyangan. Menurut kajian yang dijalankan oleh "*American academy of sleep medicine*", seramai 80 000 pemandu mengalami rasa mengantuk setiap tahun. Tambahan lagi, kemengantukan sewaktu memandu menyumbang pada kadar kecuaian dalam kalangan pemandu di Malaysia (MIROS). Oleh yang demikian, penyelidikan ini dibuat untuk menilai samada "energy drink" berupaya untuk membantu mengatasi masalah keletihan yang menyebabkan mengantuk sewaktu pemanduan. Ujikaji dijalankan menggunakan simulasi pemanduan "driving simulator".

3. APAKAH YANG AKAN DILAKUKAN:

Setiap responden dikehendaki untuk menjalani **pemanduan selama 2 jam menggunakan simulasi pemanduan iaitu sesi pertama dan sesi kedua**. Untuk sesi pertama, pemandu diminta untuk memandu selama sejam. Selepas itu, 15 minit masa rehat diberikan dan "energy drink" akan diberikan kepada responden. Responden diminta untuk menghabiskan "energy drink" dalam tempoh tersebut Berdasarkan pada rujukan-rujukan dari kajian sebelumnya, responden dinasihatkan untuk **tidak mengambil sebarang makanan 3 jam sebelum eksperimen dijalankan**.

Oleh yang demikian, responden diminta untuk **menjalani eksperimen pada pukul 8 pagi bagi mengelakkan pengambilan apa-apa makanan yang lain**. Hal ini penting bagi memastikan kesan penggunaan “energy drink” dapat dinilai dengan lebih jelas. Selain itu, responden juga dikehendaki untuk tidur **dengan secukupnya sekurang-kurangnya 6 jam pada waktu malam** sebelum memulakan eksperimen. Sekiranya didapati responden tidak mendapat tidur yang mencukupi, maka responden tersebut dikecualikan dari menjalani eksperimen pada hari tersebut.

Sebelum eksperimen dijalankan, responden akan dimaklumkan terlebih dahulu mengenai prosedur yang akan dijalankan. Perkara yang paling penting ialah, responden akan diberitahu mengenai jenis “energy drink” yang akan diberikan sebagai “treatment” dalam eksperimen. Untuk kajian ini, “Red Bull” dipilih sebagai treatment kerana telah digunakan dalam beberapa kajian sebelumnya. Responden berhak menarik diri dari menyertai eksperimen jika responden mempunyai “alergi” sekiranya meminum minuman ini.

Responden seterusnya akan dimaklumkan mengenai pengukuran “Body Mass Index” BMI sebagai prasyarat sebelum menyertai eksperimen. Pengukuran BMI merangkumi dua bahagian penting iaitu ukuran tinggi dan ukuran berat.

Adalah dimaklumkan juga, responden akan diberikan borang kaji soal selidik dan ianya dinyatakan seperti berikut:

- i) Borang kaji selidik ESS (Epworth Sleepiness Scale)
 - Diberikan beberapa hari sebelum responden dipanggil untuk menjalankan kajian. Selain itu beberapa soalan mengenai masalah kesihatan yang dihadapi juga akan disertakan

- ii) Skala keletihan IOWA (IOWA fatigue scale)
 - Diberikan sewaktu kajian dijalankan

4. SIAPAKAH YANG TERLIBAT DALAM KAJIAN INI

Menurut definisi yang dinyatakan oleh UNICEF, muda diklasifikasikan sebagai mereka yang berumur antara 19 hingga 24 tahun. Oleh kerana itu, hanya responden yang berumur tidak kurang 19 tahun dan tidak lebih 24 tahun yang layak untuk menjalani eksperimen ini.

Dalam eksperimen ini juga, beberapa kriteria responden akan disenaraikan bagi mengelakkan berlaku "bias" ketika keputusan eksperimen dianalisa. Ciri-ciri untuk "Inclusive criteria" termasuklah :

- a) Responden hendaklah terdiri dari mereka yang sukarela
- b) Responden yang mempunyai tahap kesihatan yang baik iaitu bebas dari sebarang penyakit kronik seperti diabetes, masalah jantung dan sebagainya. Responden dikehendaki memaklumkan pada penyelidik jika mempunyai sebarang masalah kesihatan. Jika mempunyai masalah kesihatan, responden perlu menunjukkan surat pengesahan doctor bagi mengesahkan responden selamat untuk menjalankan eksperimen
- c) Umur responden mestilah dalam lingkungan usia 19 hingga 25 tahun. Hal ini berdasarkan definisi "youth" dari organisasi antarabangsa seperti WHO.
- d) Mempunyai "Body Mass Index (BMI)" yang sihat antara 19-24.9
- e) Responden mempunyai tidur yang mencukupi dan tiada masalah tidur. Hal ini dinilai melalui skor dalam skor ESS lebih dari 10

Selain itu, Beberapa "Exclusive criteria" juga disertakan bagi pemilihan responden. Ciri-ciri tersebut antaranya ialah:

- a) Responden yang merupakan pengguna minuman beralkohol
- b) Responden yang merokok

- c) Responden yang kerap mengambil minuman yang mengandungi kafein iaitu lebih dari 3 gelas/cawan sehari
- d) Responden yang mempunyai masalah tidur iaitu mereka yang mencatatkan skor ESS kurang dari 10

5. FAEDAH YANG DIPEROLEHI DARI DAPATAN KAJIAN INI

i) Kepada responden

Responden diharap akan lebih memahami mengenai risiko kesan keletihan dan kemengantukan sewaktu pemanduan yang lama. Selain itu, responden juga mungkin mempertimbangkan untuk menggunakan “energy drink” sebagai salah satu alternatif untuk mengurangkan rasa mengantuk sewaktu menjalankan pemanduan di masa akan datang.

ii) Kepada penyelidik

Memandangkan masih sedikit kajian mengenai kesan “energy drink” pada kajian ini diharapkan menjadi sebagai satu rujukan untuk kajian yang akan datang.

6. ADAKAH TERDAPAT SEBARANG RISIKO?

Berdasarkan beberapa kajian yang telah dijalankan, didapati bahawa tiada sebarang kesan yang memudaratkan terhadap penggunaan “energy drink”. Namun demikian, sesetengah bahan yang digunakan dalam “energy drink” didapati memberikan kesan jika digunakan secara berlebihan. Untuk kajian ini, hanya 125ml digunakan untuk tujuan eksperimen.

7. ADAKAH TERDAPAT KEMUNGKINAN RESPONDEN MENARIK DIRI DARI KAJIAN

Bagi eksperimen ini, responden diberikan kebebasan untuk menarik diri daripada kajian.

8. ADAKAH MAKLUMAT KAJIAN DAN IDENTITI PENYELIDIK ADALAH SULIT?

Segala maklumat kajian akan didedahkan kecuali identiti responden yang terlibat. Setiap responden hanya dikenali dengan nombor responden. Segala keputusan kajian akan dimaklumkan kepada responden.

9. SIAPAKAH YANG BOLEH DIHUBUNGI SEKIRANYA PENYELIDIK MEMPUNYAI SEBARANG PERSOALAN MENGENAI KAJIAN INI

Name : **Dr. Kulanthayan K.C. Mani**

Position : Senior Lecturer (Supervisor)

Phone : (O) +6 03-8947 2398
(M) +6 013-382 2000

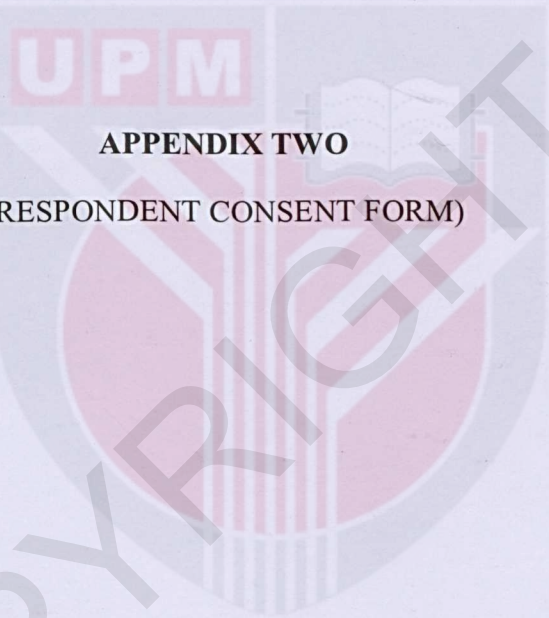
E-mail : kulan@medic.upm.edu.my

Name : **Dr. Barakatunnisak Mohd Yusao**

Position : Lecturer (Co-Supervisor)

Phone : (M) +6019-336 5686

E-mail : bnisak@medic.upm.edu.my



APPENDIX TWO

(RESPONDENT CONSENT FORM)



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BORANG PERSETUJUAN RESPONDEN

TAJUK KAJIAN : "EFFECT OF SELECTED ENERGY DRINK ON DROWSINESS AND DRIVING PERFORMANCES AMONG YOUNG ADULT CAR DRIVERS

PENYELIDIK : MOHD SHAZWAN BIN SAMJAN

Saya.....No.K/P.....

bersetuju/ tidak bersetuju * untuk menyertai kajian bertajuk seperti di atas.

Saya telah membaca dan memahami isi kandungan kajian berdasarkan apa yang telah dinyatakan di dalam 'PENERANGAN KEPADA PESERTA' yang telah dilampirkan bersama surat kebenaran ini dan penerangan tambahan daripada penyelidik.

Saya juga faham bahawa segala maklumat yang diberikan dan segala keputusan yang saya perolehi adalah sulit dan hanya akan digunakan untuk tujuan penyelidikan dan rujukan penyelidik. Saya juga faham bahawa maklumat ini boleh digunakan untuk penerbitan tetapi setiap individu tidak akan dinyatakan identitinya.

Saya faham bahawa saya mempunyai hak untuk menarik diri dan juga mempunyai hak untuk menarik semula keizinan pada bila-bila masa sekiranya perlu apabila merasa tidak selesa pada mana-mana ujian atau aktiviti yang dijalankan oleh penyelidik semasa kajian dijalankan dan tiada sebarang tindakan boleh dikenakan ke atas saya atas tindakan tersebut.

Tandatangan
 (Responden)

Tandatangan.....
 (Saksi)

Tarikh :

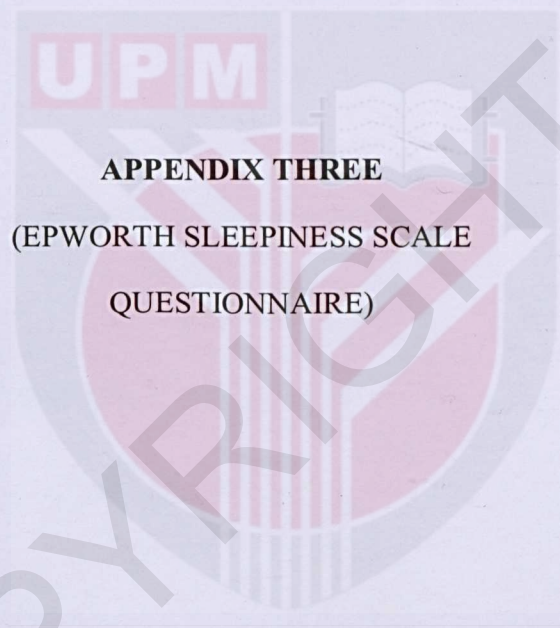
Nama.....

No. K/P :

Saya mengesahkan bahawa saya telah menjelaskan kepada responden sifat dan tujuan penyelidikan klinikal yang tersebut di atas.

Tarikh

Tandatangan
 (Penyelidik)



APPENDIX THREE
(EPWORTH SLEEPINESS SCALE
QUESTIONNAIRE)

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QUESTIONNAIRE FORM

RESPONDENT'S ID

The purpose of this questionnaire is to study the qualification of each respondents either they are qualify enough to be participate in this study. All respondents are compulsory to fill this questionnaire before perform another test.

PART A: RESPONDENT'S BACKGROUND

Please write all the information

Age :

Race :

Marital status :

PART B : SLEEP HISTORY

a. How many caffeinated drinks do you have daily? _____

a. What time is the last caffeinated drink of the day? _____

b. Do you exercise regularly? Yes No

c. Have you ever used diet pills? Yes No

d. Have you ever used stimulant drugs before? Yes No

e. Do you currently smoke cigarettes? Yes No

f. Have you ever smoked cigarettes? Yes No

If yes, i) How many packs per day? _____

ii) How many years did you smoke? _____

iii) Have you quit smoking yet? Yes No

PART C : FAMILY HISTORY

Please provide any medical problems and sleep issues for the following

Mother : _____
Father : _____
Siblings : _____
Children : _____

Allergies: Please list any medication allergies or drug reactions you have or have had

Drug: _____ Reaction: _____

Drug: _____ Reaction: _____

Medications:

Please list any medication you are currently taking with the dose and how often they are taken. Include over-the-counter sleeping pills such as Melatonin and include as well any herbal remedies and vitamins/supplements. If you have provided a list to the front desk you may skip this question.

1.

2.

3.

4.

PART D: SLEEP QUESTIONS

Please respond to what extent a statement (item) has been applicable to you during the past 4 weeks. Score each item on a 4-point-scale:

1 (not at all) 2 (somewhat) 3 (rather much) 4 (very much)

SECTION 1					
NO	Question	Point scale			
		1	2	3	4
1	I am told that I snore				
2	I sweat during the night				
3	I am told that I hold my breath when sleeping				
4	I am told that I wake up gasping for air				
5	I wake up with a dry mouth				
6	I wake up during the night while coughing or being short of breath				
7	I wake up with a sour taste in my mouth				
8	I wake up with a headache				
SECTION 2					
9	I have difficulty in falling asleep				
10	Thoughts go through my head and keep me awake				
11	I worry and find it hard to relax				
12	After waking up during the night, I fall asleep slowly				
13	I wake up early and cannot get back to sleep				
14	I sleep lightly				
15	I sleep too little				
SECTION 3					
16	I see dreamlike images when falling asleep or waking up				
17	I sometimes fall asleep on a social occasion				
18	I have sleep attacks during the day				
19	With intense emotions, my muscles sometimes collapse during the day				
20	I sometimes cannot move when falling asleep or waking up.				
SECTION 4					
21	I am told that I kick my legs when I sleep				
22	I have cramps or pain in my legs during the night.				
23	I feel little shocks in my legs during the night				
24	I cannot keep my legs at rest when falling asleep				
SECTION 5					
25	I would rather go to bed at a different time				
26	I go to bed at very different times (more than 2 hr difference).				
27	I do shift work				

SECTION 6

28	I sometimes walk when I am sleeping	1	2	3	4
29	I sometimes wake up in a different place than where I fell asleep				
30	I sometimes find evidence of having performed an action during the night I do not remember				

SECTION 7

31	I have frightening dreams (if not, go to Item 37)				
32	I wake up from these dreams				
33	I remember the content of these dreams				
34	I can orientate quickly after these dreams				
35	I have physical symptoms during or after these dreams (eg; sweating, heart palpitations, shortness of breath)				

SECTION 8

36	It is too light in my bedroom during the night				
37	It is too noisy in my bedroom during the night.				
38	I drink alcoholic beverages during the evening				
39	I smoke during the evening				
40	I use other substances during the evening(e.g., sleep or other medication).				
41	I feel sad				
42	I have no pleasure or interest in daily occupations				

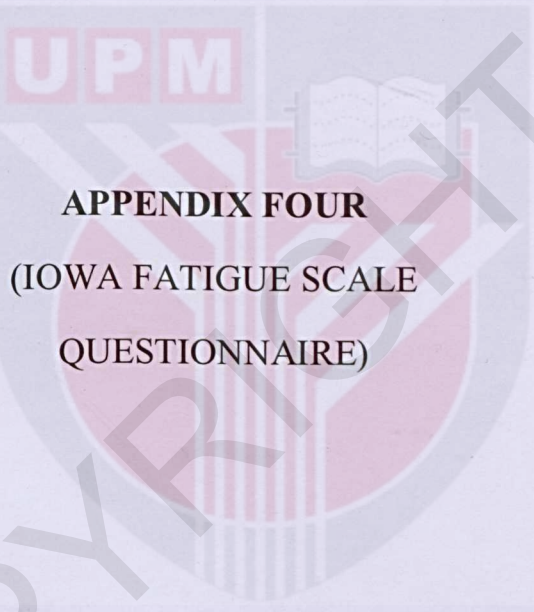
SECTION 9

43	I feel tired at getting up				
44	I feel sleepy during the day and struggle to remain alert				
45	I would like to have more energy during the day				
46	I am told that I am easily irritated				
47	I have difficulty in concentrating at work or school				
48	I worry whether I sleep enough				
49	Generally, I sleep badly.				

Total Score :

Respondents qualification : Approve

Reject



APPENDIX FOUR
(IOWA FATIGUE SCALE
QUESTIONNAIRE)

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BORANG KAJI SOAL SELIDIK

ID RESPONDEN

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Borang Kaji Selidik ini ialah bertujuan untuk mengkaji keletihan (drowsiness) semasa pemanduan jarak jauh dalam kalangan pemandu yang berusia antara 19 hingga 23 tahun menggunakan simulator pemanduan (driving simulator)

BAHAGIAN A: Latar Belakang

Isikan jawapan di dalam ruang yang sediakan dan Tandakan (X) pada jawapan yang berkenaan

- 1) Umur :tahun
- 2) Bangsa :
- 3) Taraf Perkahwinan :
- 4) Tahap Perkahwinan :

BAHAGIAN B: Pengalaman Memandu

- 1) Tarikh mula mendapat lesen memandu :
- 2) Berapa lamakah tempoh terpanjang anda memandu sejak hari pertama anda mendapat lesen memandu?
- 3) Pernahkah anda berasa letih setelah memandu melebihi 1 jam
Ya tidak
Jika ya, sila nyatakan kenapa:
- 4) Apakah yang biasanya anda lakukan jika berasa letih ketika memandu:
 - Minum Minuman berkafen (caffeinated drink)
 - Berhenti dan berehat seketika
 - Tetap meneruskan pemanduan
 - Lain-lain: Sila nyatakan:

BAHAGIAN C: IOWA FATIGUE SCALE

Please circle the number of the response that **best** indicates how you have felt after performed the test

		Not at all	A little	Moderately	Quite a bit	Extremely
1	I feel worn out	1	2	3	4	5
2	I feel energetic	1	2	3	4	5
3	I feel slowdown in my thinking	1	2	3	4	5
4	I do quite a lot within a day	1	2	3	4	5
5	I have trouble concentrating	1	2	3	4	5
6	I feel drowsy	1	2	3	4	5
7	Physically I feel in good shape	1	2	3	4	5
8	I have low output	1	2	3	4	5
9	I have trouble with my memory	1	2	3	4	5
10	I feel rested	1	2	3	4	5
11	I can Concentrate well	1	2	3	4	5

Fill by researcher

Total score :

.....

.....