

EFFECT OF GENDER DIFFERENCE ON BRAKE REACTION TIME

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ABSTRACT

BACKGROUND OF THE STUDY

Reaction time is the time taken to respond to a stimulus or change in the environment. It is a method to assess the time taken from the perception of a stimulus followed by mental processing for a motor response. Reaction time in various day to day activities as in driving a car is very important. Brake reaction time (BRT) is the time taken for the driver to respond to visualize an object and to press the brake pedal. It is affected by many features like age, gender, neuromuscular disorders.

OBJECTIVE OF THE STUDY

Study has been undertaken to compare the BRT in male and female drivers and to analyze the effect of sex difference on Brake reaction time.

MATERIALS & METHODS

Male and female subjects between the age group of 25 – 35 years with driving license were included.

Study is conducted in a stationary car. An in-house built; braking timer is fixed to the electric circuit of the braking system in the car. This device is wirelessly connected to the reaction time software installed in the laptop. The subject is instructed to press the brake pedal when the light changed from red to green in the laptop screen. 5 readings are taken and the mean BRT is recorded.

STATISTICAL ANALYSIS & RESULTS

Statistical analysis done with unpaired student t test indicates that the BRT was more in the females than the males and was statistically significant (p value - 0007).

CONCLUSION

Gender difference has a significant effect on BRT and reaction time in female is longer than for the males.

KEYWORDS

Female drivers, Brake reaction time, Perception reaction time, Brake response time.

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INTRODUCTION: Reaction time (RT) is the time taken for an individual to respond to a change in the environment. Reaction time is an indicator of the speed of a person to implement a task following a mental processing. It includes components like sensory perception time, central processing time and the motor response time. It gives us an idea about the time taken for mental processing, involving cognition, from the time of presentation of stimulus to the motor response.¹

RT has great practical applications and when affected has great consequences in day to day activities as in driving a vehicle. While driving, the response to a distracting stimulus has to be very quick in order to prevent accidents.

The Brake reaction time (BRT) for a driver can give us an idea about how fast he/she can respond to an on-road stimulus while driving.

Brake reaction time is the time taken from visualization of an object on the road to the application of brake.² It includes the following components the visual perception time, mental processing time, leg movement time and the device response time.^{3,4} BRT is affected by various factors like age, gender, mental fatigue, alcohol intake, sleep deprivation etc. It is also affected by the features of the distracting stimuli, like the size of the object, colour of the object, amount of illumination in the background etc.¹ Here in this study we want to assess the effect of gender on BRT. Many studies have been undertaken to assess the differences in RT among males and females and most of the studies have concluded that the RT in males was faster than for females. They have used tests to find the simple reaction time for audio-visual stimuli⁵ and tests for choice reaction time.¹

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There has been no study done among the Indian population to find the effect of gender on BRT. So this study has been undertaken to assess the Brake reaction time among the male and female drivers.

MATERIALS AND METHODS: This study was conducted in & around the Veerapandi village in Salem district, Tamilnadu. 35 Male and 25 female drivers were selected between the age groups of 25-35 years. All the subjects were ensured to have a driving license. Subjects with illnesses likely to disable them from driving like muscular disorders or neurological illnesses were excluded from the study. Subjects with visual impairment were also excluded.

About Instrument:

- The entire study was conducted in a stationary car.
- An in-house built, vehicle braking timer is fixed to the electric circuit of the braking system in the car. This device is wirelessly connected to the reaction time software installed in the laptop computer.

METHODOLOGY: The driver is seated in the driver's seat of the car with his/her right leg on the accelerator pedal. Laptop is placed in front of the driver. The software displays a change in the colour of spot light from red to green on activation by the examiner. The subject is instructed to move his foot from the accelerator pedal and to press the brake pedal each time the stoplight changed from red to green. The test allowed for five RT trials to be taken consecutively over the course of approximately one minute with random rest intervals as determined by the test. The test then automatically calculates mean RT in seconds, which constituted each subject's BRT. These recordings were preceded by two to five practice sequences for the subject to get familiar with the test.

The software recorded the time at which the participant releases the accelerator pedal and when the brake pedal began to be depressed fully for each of the sequences. The times were relative to the traffic light changing from red to green.

STATISTICAL ANALYSIS AND RESULTS: SPSS software, version 17 was used to analyze the data. Mean, Standard deviation and 95% CI was calculated for all the parametric variables. The statistical inference was derived by using unpaired student t test.

Table 1 shows that the BRT was more in females when compared to the male drivers and the value was found to be statistically significant (p value-0007).

DISCUSSION: The results from our study show that the BRT in males are shorter than that for the females. The study was conducted among the drivers including 25 females and 35 male drivers, the age group was also kept in a narrow range to prevent the influence of age on BRT.

Our study agrees with most of the RT studies where they have proven that the females' reaction to a stimulus is slower. In simple reaction time studies where the subjects

were presented with audio and visual stimuli it was identified that the males responded faster for the visual stimuli than for the auditory stimuli. Here in our study the stimulus presented for the braking response was a change in the colour of light and hence it could be that there was a faster reaction by the male drivers.⁶

BRT is split into its components, Perception reaction time – Time taken from the point of visualization of stimuli to the movement of foot from the accelerator pedal to brake pedal and Brake response time – From the time the foot completely presses on the brake pedal.⁷ In their study Warshawsky et al have identified that females had a longer Brake response time and the perception reaction time was unaffected by gender difference.

The female disadvantage of RT has been attributed to the presence of more muscle fibres in the males which allows them to give a quicker response.¹ Jain et al have identified that the motor response time is similar in females and males but the motor response or the muscle contraction is stronger in the males which could be the reason for their shorter RT.⁸ Adam et al have attributed the longer RT in females to the difference in neural processing speed and have identified males to exhibit more neural activity when they have to respond to an external stimuli and the difference in neural processing is an inherent difference between the genders.⁹

Nerve conduction velocity studies done in males and females prove that the nerve conduction velocity is 4% faster males.¹⁰ Also the effect of female hormones in various phases of menstrual cycle tends to cause water and salt retention which causes delay in axonal conduction. It is also suggested that the water and sodium retaining effect can alter the availability and release of neurotransmitter release at the synapse. This effect of sex steroids on the neurotransmitter availability and impulse transmission affects the sensory motor association with the processing speed in the central nervous system.¹¹

Along with the above physiological reasons for longer RT in females some psychological thinking patterns of females could have also prolonged their BRT. Studies including gender differences in accidents have proven that female drivers differ from male drivers in decision-making strategies. They tend to avoid high-demand, high-stress conditions by self-regulation and therefore they are at greater risk when faced with sudden high-risk situations on road.¹²

Though there is a female disadvantage over the males in the RT, studies done among the athletes have proven that with regular exercises and practice/training the reaction times difference in males and females can be decreased.¹³

CONCLUSION: In conclusion the main finding of the study is that the BRT in males are shorter than that for the females. Males respond quicker to unexpected stimuli in the experimental condition. There are various reasons presented here for the longer reaction time in females. But the BRT may be different in the real road conditions. For any gender reaction times can be improved by regular practice and training.

LIMITATIONS OF THE STUDY: We have not been able to individualize the components of BRT as Perception reaction time and Brake response time and to time them separately. If we had been able to separate the BRT to its components we could have been able to identify which component was affected gender-wise.

Statistical variables	Male	Female
Mean	0.640	0.863
SD	0.148	0.160
95%CI	0.49 – 0.771	0.703 – 1.023
P value (T test)	<.0007	

Table 1: Mean±SD of BRT in male and female drivers

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