original article

# Effect of state anxiety on driver behavior with regard to self-reported in Iranian drivers

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## ABSTRACT

**Aims:** The aims of this study was determination of driver behavior in car accident and analyzing the relationship between state anxieties (SA) with subscale of driving behavior.
**Materials and Methods:** The self-reporting of the drivers was determined by using Manchester driving behavior questionnaire (DBQ) and Spielberger state-trait anxiety inventory in 168 drivers who had a crash while driving.
**Results:** Independent *t* tests showed that violations (ordinary and aggressive) are the most common behavior in drivers, Pearson's correlation revealed that SA had a significant direct positive relationship with lapses ($P < 0.01$) and error subscales ($P < 0.05$), also Pearson's correlation showed that age had a negative significant relationship with factors of DBQ.
**Conclusion:** It can be concluded from the results (according to the relationship between SA with error and lapses factor) that SA is destructive and affects the memory performance and mental process in the drivers and causes absent mindedness and imperfect memory function and process in these people during driving.

**Key words:** Driving behaviors, drivers having crash, state anxiety

## INTRODUCTION

It is estimated that two million people die in road accidents annually in the world[1] and the number of injured people in driving accidents has been estimated to be more than 15 million.[2] Unfortunately, Iran is no different in this regard but in comparison to other countries it is notable in improving the process of prevention of accidents. The improving process of accident index is slow or negative in the other countries from 1990 to 1993. For example, this level was 2.2% for North Korea, 16% in England, 18% in France, 7% in Denmark, 2% in Pakistan, and 1.2% in India, but it is 55% in Iran.[3]

It is reported that developing countries were prone to 85% road accident, mortality resulting in losing 90% of life time due to drivers' disabilities and injuries in 1998.[4] It is estimated that human factor was the only reason for driving accidents in 90-95% of the cases.[5]

Additionally, the traffic accidents are more due to inappropriate and deficient function of people, in comparison to technical imperfection in vehicles. It is a rational agreement that errors are classified into two different classes: The first class includes deviations due to attention deficiency and memory and

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information processing dysfunctions, which lead to slips and errors; and the second class includes errors due to selection of an inappropriate function to obtain his purpose without any information about these false functions. The intentional disregard for the safety of other people and ignorance of the driving legislation, are considered as a harmful behavior.[6] In the older drivers, the high score of errors and lapses is a predictor factor to the mentioned reactive accidents; however, this relationship is strong between lapses and inactive accidents.[7]

However in errors, the cognitive dimension and information process have more important roles, and the people with cognition deficiencies are more susceptible to make the different errors in driving.[8] It should be noted that the motivational, social, and cultural parameters play more important roles in driving violations.[9]

In this study the assessment of general driving behavior was obtained using the Driver Behavior Questionnaire (DBQ).[6] DBQ is an important tool having extensive applications for analyzing the driving behavior.[10] DBQ was compiled in 1990 in Manchester University by Reason *et al*.[11]

Despite small differences existing between the theoretic structure of the four constructive subscales of driving behaviors used in different countries, the accuracy and verification of the general structures of four subscales have been examined and approved in various studies.[12,13]

Three classes of behaviors within the DBQ were originally identified: Errors, lapses, and violations. Lapses were defined as absent-minded behaviors, which usually do not pose any threat to road users. Violations were defined as deliberate departures from behaviors believed to represent safe driving practices. Errors were defined as failures of observation that may be hazardous to others. Errors also included planned actions that fail to accomplish their intended outcomes.[6]

According to reported definitions of mental disease and diagnostic prescriptions (DSM-IV-TRm American Psychiatric Association,[14] There are different anxiety disorders, which show potential effects on peoples' driving (e.g., General Anxiety and Stress Disorder Association, Washington, DC, 2000).

The females had more critical conditions than males among these people.[15] In fact, the anxiety is known as a way associated to driving, for example, in a study it is found that when a practical drivers' license test was taken simultaneously with theoretical drivers' license test, the people had more anxiety than those taking the tests separately.[16]

In a study on 1000 Australian people, there was no evidence of relationship between anxiety and high-risk driving behavior[17] but in a study by Amit Shahar on 110 drivers, there was a direct positive relationship between driving behavior and state and trait anxiety level.[18] In a previous study[19] it was reported that fear and anxiety in driving can have a positive effect, which results in more safe travelling and driving, but in this study the focus is on general anxiety and the related signs, but not on fear and anxiety in travelling. However, it is noted that theoretically high-level anxiety can be an effective factor in increase of high-risk driving behaviors.[20]

## MATERIALS AND METHODS

### Participants

The participants consisted of 26 females and 142 males with the mean age of 29 ± 6.7 in the range of 19-48 years. The standardized DBQ for Iranian drivers was distributed in Isfahan traffic police section responsible for vehicle crash crimes verification and completed by accident drivers with financial loss waiting for their accident case investigation. All of these people had driving licenses and committed a crime in driving accidents and were referred to traffic police to draw accident layout. All of them participated in this study voluntarily. It is a significant point that all of these drivers had financial loss but there was no mortality and injuries due to these accidents.

### Applied instruments: Driving behavior questionnaire

The applied instrument in this study is the most common questionnaires in driving behavior or Manchester driving DBQ, which consisted of four behavioral parameters with two main groups: ordinary and aggressive violence and the second group, which consisted of lapses and error). For example, the permanence of these parameters in Gras *et al*.'s study based on alpha Cronbach percentage in DBQ included lapses and error and unintentional and intentional ignorance measured as 82%, 46%, 59%, 81%, respectively. In Oraizi and Haghaigh's study (2009), Manchester driving questionnaires were translated and examined to obtain permanence and intersimilarity coefficients in different parameters in 293 drivers. These coefficients include lapses: 0.77, errors: 0.81, aggressive violence: 0.86, and ordinary violence: 0.65.[21]

This questionnaire consisted of 50 different questions, which were classified into four categories and the answers to the questions were graded into Likert scale from 0 to 5, which shows (0 = never, 1= hardly, 2 = occationally, 3 = mostly, 4 = frequently 5= always).[21] The highest score of the four parameters determines the most prevalent driving behavior. These questions were different in two dimensions, first in behavior type and the second in the risk and danger level of behavior to the people. Also, based on risk level of these behaviors there are three behavior types.

a. The behaviors without any risk for other drivers and causing feeling of discomfort to other people (low risk probability).
b. The behaviors with risk for other people (mild risk probability).

c. The behaviors with certain risk for other people (high-risk probability).

### Spielberg trait-state questionnaire

The other instrument used in this study was Spielberg trait-state questionnaire, which consisted of 40 questions; 20 questions in trait anxiety and 20 questions in state anxiety.[22] This questionnaire constructed in Likert form with scores in 1 equal to never to 4 equal to always. It was used in a study by Panahishahri in 1993 in Iran with high similarity of internal correlation coefficient.

The reported mean of reliability coefficients in different classes in state anxiety was 92% and in trait anxiety it was 90%.[23]

### Statistical analysis

The applied statistical tests in this study to discuss conclusions were included: Independent *t* test, one-way analysis of variance (ANOVA), Pearson's correlation test.

## RESULTS

### Descriptive statistics

The mean scores and standard deviation for evaluation of state anxiety was 35.35 (SD = 15.67). Independent *t* test in Table 1 shows that mean scores for two subscale of violation (ordinary and aggressive) had a higher score than subscale of lapses and errors among the total drivers (men and women), and the mean score of errors subscale in men was significantly higher than women but other subscale of DBQ the mean scores between the genders was not significant.

### Relationship between DBQ and SA with age, daily work hours, and driving experience

The mean scores and standard deviation for driving experience (year) and daily work hours were 7.53 (SD=5.36) and 8.41 (SD=2.31). Table 2 shows correlation between subscale of DBQ and SA with age, driving experience, and daily work hours. Pearson's correlation revealed that between subscale of DBQ and SA scores there was a significant positive relationship with all of the DBQ subscales and this point is notable that errors and lapses had higher relationship with SA than violation subscale.

Also Pearson's correlation shows that age had a significant negative relationship with three subscales of DBQ (lapses, aggression, and ordinary violation) but errors subscale had a weaker correlation($r = -.081$), which was not significant. Driving experience had negative relationship with all of the DBQ subscales but this point is notable that driving experience had a significant negative relationship with aggressive violation. Daily work hours had a positive relationship with all subscales of DBQ but this point is notable that daily work hours had a significant direct positive relationship with aggression violation subscale. Also relationship between daily work hours and SA was positive but not significant among drivers having crash [Table 2].

### Different mean scores between three levels of SA

Finally, the sample was split on the basis of anxiety scores into three anxiety groups of low-, medium-, and high-SA (LSA, MSA, and HSA). The mean SA scores for the LSA (n = 64), MSA (n = 94), and HSA (n = 10) groups were 19.74 (SD = 8.03), 38.01 (SD = 7.79), and 40.77 (SD = 3.20), respectively. ANOVAs for each of the dependent variables, DBQ, errors, lapses, ordinary violations, and aggressive violations had a significant difference (*P* value < 0001).

It can be inferred from Table 3. that with increasing anxiety from LSA to HSA all of the DBQ subscales have increased, and only lapses were significant.

**Table 1: Variation of Mean score and SD, DBQ, and SA as function of sex**

| DBQ and state anxiety | Male | | Female | | Total | | *P* value |
|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | |
| Aggressive violation | 20.54 | 12.69 | 15.97 | 13.44 | 19.83 | 12.88 | 0.097 |
| Ordinary violation | 23.23 | 15.95 | 17.69 | 15.04 | 22.38 | 15.90 | 0.102 |
| lapse | 17.36 | 8.23 | 15.55 | 7.68 | 17.08 | 8.15 | 0.321 |
| Errors | 14.02 | 9.84 | 9.82 | 6.16 | 13.37 | 9.47 | 0.038* |
| State anxiety | 37.59 | 16.37 | 42.51 | 21.36 | 38.35 | 17.25 | 0.183 |

DBQ: Driving behavior questionnaire, SD: Standard deviation, SA: State anxiety, *$P < 0.05$

**Table 2: Pearson's correlation between subscale of DBQ and TA with age, driving experience, and daily work hours**

| DBQ and SA | State anxiety | Age | Daily work hours | Driving experience |
|---|---|---|---|---|
| Aggressive | 0.119 | −0.274** | 0.142* | −0.197** |
| Ordinary | 0.074 | −0.159* | 0.053 | −0.104 |
| Lapses | 0.219** | −0.155* | 0.070 | −0.086 |
| Error | 0.131* | −0.081 | 0.027 | −0.083 |
| State anxiety | — | −0.028 | 0.104 | — |

DBQ: Driving behavior questionnaire, SA: State anxiety, *$P < 0.05$,**$P < 0.01$

**Table 3: Means by the LSA, MSA, and HSA groups on the dependent variables, for the 3× (LTA, MTA, and HTA) ANOVA**

| DBQ | LSA | | MSA | | HSA | | *F* |
|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | |
| Aggressive violation | 17.95 | 11.07 | 20.60 | 13.54 | 24.61 | 12.95 | 1.54 |
| Ordinary violation | 21.25 | 15.17 | 22.53 | 14.52 | 28.00 | 27.07 | 0.789 |
| Lapses | 14.91 | 6.51 | 18.20 | 8.99 | 20.61 | 6.37 | 4.48** |
| Errors | 11.94 | 7.53 | 14.32 | 10.26 | 15.77 | 12.45 | 1.02 |

ANOVA: Analysis of variance, DBQ: Driving behavior questionnaire, SA: State anxiety, LSA, MSA, HSA, *$P < 0.05$,**$P < 0.01$, LSA: Low-state anxiety, MSA: Moderate state anxiety, HAS: High state anxiety, ANOVA: Analysis of variance

## DISCUSSION

The main objective of the present study was to find answers to the following questions: 1. Which of the DBQ factor or factors is most common in drivers having crash without the effect of SA? And which of the DBQ factor or factors is most common in drivers who have crash with affect of SA?

Behavior of drivers is quite complicated during driving and no researching analysis could cover all its complications. Nevertheless, because questionnaires such as DBQ are issued according to a strong theory, it is at present one of the most useful tools in assessing driving behavior.[24]

The important point obtained according to the studies about driving behavior and its establishing principles is that no similar and absolute driving behaviors could be observed among the drivers in different countries of the world and that could be due to different dependent principle factors, which include the existing social and cultural differences among the people in different parts of the world.[6,9]

Hence, one of the main goals of this study is analyzing and determining the shares of subscale, of which DBQ has been compiled. The results of this study show that ordinary and aggressive violations, lapses, and finally error play a major role in driving behavior of the Iranian drivers having had crash similar to those in northern European and Scandinavian countries, especially Finland,[8] and considering the meta analysis by[24] violations were predictors of accidents more among young drivers than older drivers.

The other point to be considered in the study is the higher mean scores of each basis in driving behavior in men as compared with women that indicate that women are prone to less aberrant behaviors than men, which shows that women considerably act safer than men and admit less risks according to a previous finding.[25]

The second aim of the study is analyzing the effects and relationship rates of SA in emergence of any of the driving behaviors subscale (DBQ).

The correlation showed that SA had a significant direct effect on all of the DBQ subscales, especially on errors and lapses and these result show that anxiety has a negative and destructive psychological effect on driving behavior; especially (errors due to lack of attention and mental concentration and lapses due to lack of attentiveness) and its reason is the destructive effect of anxiety on appropriate mental and psychological functions in drivers that subsequently causes disorders in decisions made and effects proper mental processing of drivers for proper and correct performance that would be expected by cognitive interference theory.[12] The linear effects are consistent with studies that have found general adverse effects of anxiety on performance effectiveness[27] and processing efficiency theory;[28] this suggests that worries occupy the processing capacity of working memory, resulting in information-processing overload at the expense of the task to be performed as well as adverse effects of anxiety on driving performance in particular.[19,17]

The results of the study is verification of the matter that by increasing the SA level from the low level toward the medium and high levels, the mean scores of the four constructive basis for behavior have been ascending, which indicates the negative effect of high levels in emergence of aberrant behaviors of the drivers.[19] It can be inferred that the drivers with higher levels of anxiety are more susceptible to aberrant behavior leading to accidents than the drivers with lower levels of anxiety.[19] In addition to the mentioned relationships, the positive and significant correlation could be seen between TA and violations, especially the obtained aggressive violations.

Regarding the positive relationships between SA and ordinary and aggressive violation, it can be concluded that the increment in ordinary violations as a function of SA may well reflect the same mechanism that was used to explain the differences with regard to errors and lapses. Specifically, although highly-anxious individuals do not intend to violate traffic laws, they do so more frequently than low-anxious individuals do due to inattention, which results from cognitive overload. Also one might expect that anxious individuals would be more afraid of being involved in car accidents, of violating laws in general and of law enforcement officers in particular.[27,28] It can generally be stated that aggressive violations involve the nonpersonal part of the aggressive behavior of drivers, which is due to inattention to driving regulations and the short time available for developing behavioral culture in observing the regulations.[9] It can be assumed that the rate of anxiety might be a reflection of high level of aggression in drivers taking risks.[29]

The Pearson correlation revealed that age had a significant negative effect on all DBQ subscale except error that was not significant similar to the meta-analysis of the relationship between the DBQ factors and age, and exposure which revealed that violations, and to a lesser extent errors, reduced with age.[24] The rate of dangerous behaviors reduced with regards to constructive bases of driving behavior and with respect to the following priorities: Aggressive violation, ordinary violation, error and finally lapses, and it can be inferred that with increased age and driving experience,[30] the drivers emotional driving is reduced and older drivers would gain better knowledge and drive safer with more awareness of consequences of dangerous driving that could cause accidents. It was reported in a study that women and the elderly people have less inclination to violations during driving than young people. On the other hand, women and the elderly people are more susceptible to making errors than young people and also, men are more inclined to infringements.+ Safer driving in older drivers as compared to the younger ones indicates the need for increasing the level of traffic culture in these people.[24,31]

Finally, according to significant results the present study can conclude that numerous cognitive factors such as trait anxiety and state anxiety singly and in combination with each other have a destructive effect on driver behavior and when these two cognitive factors combine with each other they have stronger inappropriate effect on driver behavior.

## CONCLUSION

Since driving behavior requires continual analysis from the obtained information regarding vehicles (speed, moving direction, acceleration, determining the moving route, reaction time for braking, and so on) and the environment (traffic, road conditions, climatic conditions, area lighting, viewing distance, predicting the other drivers' behaviors, and so on), anxiety as a destructive factor has been found to make all the above functions deficient, such that in some cases it has led to accidents. In a more prevalent state, it has led to many "near miss" incidents. Because the rates of accidents and mortalities due to driving is higher than the expected average, any intervention for evaluation, and determining worried drivers for reducing the emergence of the errors leading to accidents is justifiable and could be undertaken.

Therefore paying more attention to the affecting psychological factors (ie, trait anxiety and state anxiety) in supplementary studies in future is essential.

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