Original Article

Relationship between *Mizaj* (Temperament) and Professional Driving Behavior: A Survey among Bus Drivers

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Abstract

Background: The increasing frequency of traffic accidents within public transportation systems leads to economic and public health challenges. It is essential to investigate predictive factors for high-risk driving behaviors, encompassing physical, psychological, personality, and health-related aspects.
Objectives: The present study examines the correlation between a driver's "*Mizaj*" (temperament) and their driving behavior, as well as the associated risk of accidents. Additionally, the study evaluates the link between smoking habits and drivers' behavior.
Methods: In this cross-sectional study conducted in Tehran, Iran, a total of 253 bus drivers participated. They were evaluated using a temperament questionnaire, the Manchester Driving Behavior Questionnaire, data on smoking habits, driving experience, and the number of accidents over the past three years. Correlations among temperament, smoking habits, driving behavior factors, and accident frequencies were determined by Pearson's correlation coefficients.
Results: Among the study participants, 97 reported one or more traffic accidents while driving. Statistically significant associations were found between road accidents and factors such as driving experience, smoking, type of temperament, and driving behavior. It is noteworthy that drivers with a hot temperament had a higher incidence of accidents compared to those with cold or moderate temperaments (P-value < 0.05). Moreover, smokers reported significantly more accidents (P-value < 0.01) and higher scores for violations and errors in driving behavior (P-value < 0.01). In addition, drivers with a first-grade driver's license and more than 15 years of experience reported a significantly lower number of accidents (P-value < 0.05).
Conclusion: The results of the present research indicate a clear association between temperament and driving behavior. Bus drivers with a hot temperament were more prone to accidents, violations, and driving errors compared to those with cold or moderate temperaments. Furthermore, drivers with a dry temperament faced a higher risk of accidents than those with a wet temperament.

Keywords: Driving behavior, Smoking, Temperament, Traffic crash

1. Background

In 2021, the Iranian Legal Medicine Organization reported a staggering 16,778 fatalities and 317,120 injuries resulting from traffic accidents, among which urban accidents accounted for one-third of the total (1). Many of these accidents can be attributed to human errors (2), highlighting the importance of investigating individual differences in driving behavior (3). Therefore, it becomes crucial to examine the role of human factors in reducing traffic-related fatalities. Recent research has demonstrated that various factors, including health status, demographic variables, and driving behavior characteristics, can significantly impact the safety of all road users. In this way, pedestrians (4), motorcyclists (5), and occupants of passenger vehicles (6), as well as drivers of taxis, trucks, and buses (7) can be affected by these factors. However, it is noteworthy that professional drivers, particularly public bus drivers, encounter a unique array of stressors, such as health issues, heavy traffic, air pollution, and demanding shift schedules. These stressors may adversely affect their performance and contribute to accidents or undesirable driving behaviors (8).

According to recent studies, bus drivers experience more severe injuries and enduring impairments compared to other occupational groups (9-11). The overall condition of the roads, vehicles, and most notably, the drivers themselves, collectively contribute to the potential risks associated with passenger transport. Bus accidents pose a substantial health concern for bus drivers, underscoring the importance of conducting epidemiological surveys to prevent such incidents (12). The bus network represents one of the largest public transportation systems in Tehran, Iran (13), making traffic accidents involving intra-city buses significant due to the substantial number of passengers relying on this system. Between April 2015 and June 2017, approximately 600 accidents were recorded on just two routes of the Bus Rapid Transit (BRT) system in Tehran (3).

Moreover, research on traffic crashes, particularly concerning bus drivers, suggests the involvement of

specific factors. However, some studies indicate that healthy drivers working under suitable job conditions, as opposed to those facing extreme workloads, are less susceptible to road accidents (14). The health and behavior outcomes of professional driving, which is considered a high-risk activity, can impact other groups of road users as well (15, 16) and elevate the likelihood of severe injuries and lasting disabilities (17). Numerous factors, including health status and human errors, play pivotal roles in accidents (18). However, human factors continue to account for a significant portion of road accidents (19). Human errors can be influenced by internal or external factors, such as illness, poor mental and physical conditions, and other health issues (17).

In order to address these concerns, it is essential to prioritize accident prevention. A valuable approach involves the identification of predictive factors for driver behavior and accident risk. Numerous studies have been conducted to analyze the physical and psychological traits, as well as personality characteristics of drivers, with a specific focus on the health-related factors influencing their driving behaviors (20, 21).

From the perspective of Persian Medicine (PM), "*Mizaj*" (temperament) determines individuals' physical and emotional characteristics, as well as their physiological functions (22, 23). According to this concept, each person possesses a unique temperament that is distinguished and categorized based on physical, physiological, and psychological traits (22, 24). Temperament, a fundamental concept in PM (25), arises from the interplay of four elements (fire, air, water, and earth) within the human body, and it plays a pivotal role in preventive, therapeutic, and lifestyle recommendations within traditional medicine (26). As introduced in Avicenna's Canon of Medicine, these temperaments are characterized as hot, cold, dry, wet, or combinations thereof (hot-dry, hot-wet, cold-dry, and cold-wet). In addition, there is a neutral temperament that lacks any of these traits (24, 27). Consequently, individuals can be classified into nine groups based on these two-dimensional spectrums of varying degrees of warmth and moisture within PM.

Temperament profoundly influences an individual's personality and behavioral traits. Moreover, some studies have unveiled a potential correlation between temperament type and personality characteristics. Therefore, it is conceivable that there is a link between individuals' driving behavior and their respective temperaments – an idea that has not been previously explored in published studies.

Furthermore, smoking represents a significant health concern and may contribute to a 50% higher crash rate and 46% more violations compared to other drivers (28, 29). Some studies on the relationships between cigarette smoking and traffic accidents from 1967 to 2013 indicated a crude relative risk of approximately 1.5 among smokers (30), which may reflect a greater tendency towards risk-taking behavior among smokers.

2. Objectives

The present study aimed to investigate the relationship between temperament and road accidents, as well as professional driving behavior among bus drivers. In addition, the association between smoking and the two parameters mentioned above was explored. The data was collected using a questionnaire assessing drivers' health status, driving behavior, and accident history.

3. Methods

This cross-sectional study was conducted among bus drivers employed by the Tehran and Suburbs Bus Company (TSBC) in Tehran, Iran, from February 2014 to May 2014. Given the substantial statistical population of 5,000 bus drivers, the sample size was determined by assuming a precision level of 0.1 and a confidence level of 95%; this calculation resulted in a required sample size of 213 individuals. Consequently, in accordance with the required sample size, all 253 bus drivers of TSBC employed in the 7th district of Tehran were selected asparticipants in the present research.

To assess drivers' experience levels, we examined the duration they held a valid driving license. In addition, participants were queried about their demographic characteristics and smoking habits. Information on the number of accidents per driver from 2010 to 2013 was obtained from the TSBC database. Notably, the accident rates among drivers were adjusted according to the ratio of accidents in the past three years to the mean number of working hours per day.

The "Mojahedi's Ten-Item *Mizaj* Questionnaire" (MMQ) was employed to assess the temperament types of bus drivers. This concise self-report temperament questionnaire can distinguish between hotness, coldness, dryness, and wetness. Mojahedi et al. assessed the questionnaire's overall validity and reported a Cronbach's alpha of 0.84 (26). In the present study, the drivers' temperaments were categorized as hot, cold, moderate, dry, wet, or moderate.

In addition to the temperament questionnaire, a 25-item version of the Manchester Driving Behavior Questionnaire (MDBQ) was used in this work. The MDBQ evaluates self-reported behavior among bus drivers, including violations and errors. Violations during driving signify instances where drivers disobey traffic rules, while errors primarily denote driving skill mistakes that result in faults.

Participants were asked to rate their experiences with each described event on a 6-point scale, ranging from 1 (never) to 6 (always). Subsequently, the scales were adjusted so that higher scores on each item would indicate a more favorable driver condition. The Cronbach's alpha coefficients were calculated to assess the questionnaire's reliability and validity. The values of Cronbach's alpha coefficients were 0.73, 0.64, and 0.83 for errors, violations, and the entire questionnaire, respectively.

The data gathered from the questionnaires were analyzed using SPSS software (version 21). In addition, the correlation analysis method was employed to identify the connection between drivers' behavior and temperament. The relationships among smoking habits, temperament, the MDBQ factors, and the number of crashes were examined by calculating Pearson's correlation coefficients. In all instances, drivers were requested to voluntarily complete the questionnaire during their breaks, with the assurance of anonymity and confidentiality.

4. Results

A total of 253 bus drivers participated in the survey. After reviewing the questionnaires, 11 were excluded due to incomplete or inaccurate responses. Ultimately, data from 242 subjects were included in the analysis. All drivers were male and married, ranging from 31 to 52 years old, with a mean age of 41.38 (SD=9.5). On average, they had 13.4 years of driving experience (ranging from 4 to 24 years). Most participants had held first-grade driving licenses, enabling them to operate heavy vehicles such as buses on both urban and rural roads. Others possessed second-grade licenses, allowing them to drive city buses with special certifications (Table 1).

Table 1. Characteristics of the participants

Variable		Number	Percentage
Age	31-35	27	11.1
	36-40	88	36.4
	41-45	78	32.2
	46-50	45	18.6
	>50	4	1.7
Type of driving license	First grade	153	63.2
	Second grade	89	36.8
Driving experience (year)	4-8	10	4.1
	8-12	72	29.8
	12-16	128	52.9
	16-20	23	9.5
	20-24	9	3.7
Driving duration (hours per day)	8	203	83.9
	11	39	16.1

The mean and standard deviation (SD) of the data for the DBQ questions were calculated (Table 2).

The results obtained from the MDBQ revealed that the most frequent errors made by bus drivers include habitually taking the wrong route instead of the main (mean=1.39), failing to notice motorcycles or bicycles when making right turns (mean=1.37), and not spotting pedestrians while transitioning from the main road to a secondary road (mean=1.32). Furthermore, this survey revealed that the most violations committed by bus drivers include exceeding the speed limit due to inattention to the bus speedometer (mean=1.64), signaling their presence to the car in front by honking or continuously flashing lights (mean=1.61), and entering intersections with insufficient clearance, thereby compelling other vehicles to stop (mean=1.28).

Table 2. Means and standard deviations of MDBQ items

Statistical Variable	Errors	Violations
Mean	10.72	15.89
SD	4.285	7.11
Variance	18.359	50.34
Range	22	40
Min	3	3
Max	25	43

According to the survey results, hot-temperament drivers had a higher mean number of crashes compared to those experienced by cold-temperament drivers, and both groups experienced more crashes than moderate-temperament drivers (Table 3). Figure 1 illustrates that cold-temperament and hot-temperament drivers had 40.8% and 84.3% more crashes, respectively, compared to those experienced by moderate-temperament bus drivers.

The results regarding the connection between

temperament type and the mean score of errors and violations indicate that individuals with a hot temperament tend to violate rules more frequently than others (Figure 2).

Moreover, the survey revealed that hot-temperament drivers had a higher mean number of violations compared to cold-temperament drivers.

Both groups exhibited more violations and errors than the overall mean for all drivers. Moreover, drivers with a moderate- temperament committed fewer violations and errors in comparison with their counterparts (Table 4).

Examining the correlation between smoking and the number of accidents revealed that smokers

Table 3. Frequency of road crashes experienced by bus drivers, separated by three temperament types

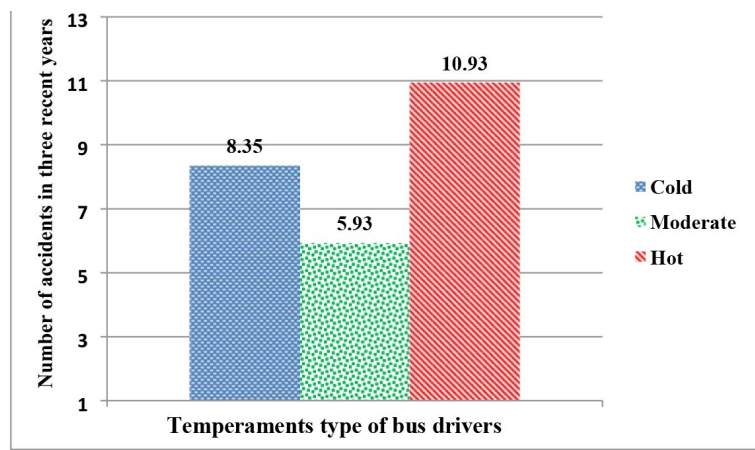| Type of temperament	Mean	Number	SD
Cold	8.35	62	5.823
Moderate	5.93	108	3.354
Hot	10.93	72	7.107
Total	8.04	242	5.743

Figure 1. Frequency of road crashes experienced by bus drivers, separated by three temperament types
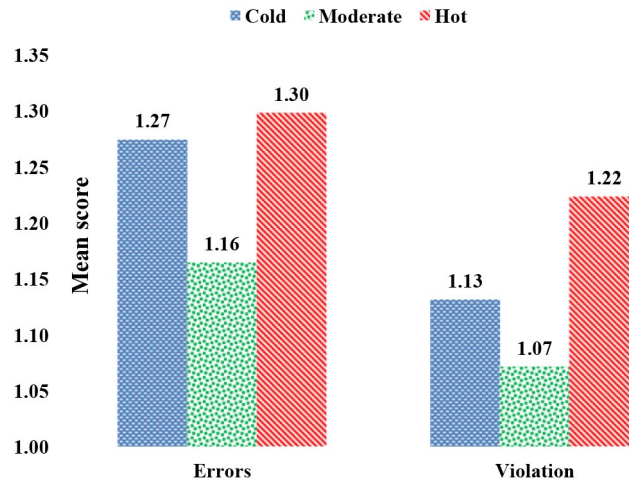

Figure 2. Mean errors and violations (based on MDBQ) committed by bus drivers with different temperament types

experienced a higher frequency of crashes compared to non-smokers (Table 5). Table 6 illustrates that drivers with a more extended history of smoking exhibited a greater incidence of accidents. Furthermore, drivers who had smoked for over ten years had 41.52% more accidents than those experienced by their non-smoking counterparts.

The connection between smoking habits and driving behaviors, as presented in Table 7, reveals that drivers who smoke committed 14.5% more violations and 9.5% more errors while driving compared to those of non-smokers. Furthermore, Table 8 illustrates that drivers with a more extended history of smoking exhibited higher violation scores.

In addition, those who had smoked for over ten years had a 41.52% higher rate of accidents compared to those experienced by their non-smoking counterparts.

In summary, the results of Pearson's correlation coefficient analysis revealed that drivers with a hot temperament reported a higher incidence of accidents compared to those with cold and moderate temperaments (P-value < 0.05). Furthermore, a statistically significant relationship was observed between the dryness-wetness of temperament and the risk of accidents. Individuals with a wet temperament had a lower risk of accidents than those with a dry temperament (P-value < 0.05). In addition,

Table 4. Driving behavior among drivers with different temperament types

Type of temperament	Mean of Errors	Mean of Violations
Cold	1.274	1.131
Moderate	1.164	1.071
Hot	1.298	1.223
Total	1.232	1.132

Table 5. Association between smoking and road crashes

Smoking	Number of crashes	Number of drivers	SD
Yes	9.63	51	6.390
No	7.61	191	5.498
Total	8.04	242	5.743

Table 6. Association between smoking duration and road crashes

Duration (Years)	Number of crashes	Number of drivers	SD
Not Smoking	7.61	191	5.498
<5	8.00	13	3.536
5-10	9.38	16	5.377
>10	10.77	22	8.147
Total	8.04	242	5.743

Table 7. Association between smoking and driving behavior

Smoking	Mean Errors	Mean of Violations	Number
Yes	1.322	1.258	51
No	1.207	1.098	191
Total	1.232	1.132	242

Table 8. Association between smoking duration and driving behavior

Duration (Years)	Mean of Errors	Mean of Violations	Number
Not Smoking	1.208	1.098	191
< 5	1.367	1.177	13
5 – 10	1.354	1.197	16
> 10	1.273	1.350	22
Total	1.232	1.132	242

among the drivers, smokers reported significantly more accidents (P-value < 0.01) and higher scores in terms of violations and errors in their driving behavior (P-value < 0.01). Regarding driving experience, drivers with first-grade licenses and more than 15 years of driving experience reported a significantly lower mean number of accidents (P-value < 0.05).

5. Discussion

The present work aimed to investigate the effect of drivers' temperament and smoking habits on their crashes and driving behavior. According to the findings, smokers exhibited significantly higher scores in violations and errors while driving. Moreover, drivers with over ten years of smoking experience had a 41.52% higher incidence of crashes compared to non-smoking counterparts. These results are consistent with the literature; in a similar study, Mousavi Bazzaz et al. (2015) identified smoking as a significant risk factor for accidents among drivers in Mashhad, another densely populated city in Iran (31).

According to PM, people with a hot temperament tend to have warm bodies, larger chests and joints, and prominent blood vessels. They are typically characterized as energetic, active, social, and prone to quicker anger. In contrast, individuals with a cold temperament often have cold skin, are less active,

tend to oversleep, and display more weakness and fear. Furthermore, those with a dry temperament tend to be thinner, while individuals with a wet temperament typically have larger bodies (32).

The present study revealed that bus drivers with a hot temperament were more prone to committing violations and experienced a higher average number of crashes. The findings indicate that drivers with a hot temperament commit more violations compared to those with moderate or cold temperaments. Conversely, this research examined various variables, including the frequency of accidents, errors, and violations, which were lower among drivers with moderate temperaments than those with hot and cold temperaments. Traditional medicine sources emphasize that individuals with a moderate temperament exhibit superior physical, physiological, and psychological performance (33). Therefore, these findings align with the principles of traditional medicine.

It is essential to recognize that investigations into the correlation between individuals' personality traits, behavioral characteristics, and temperament reveal variations, and in some cases, conflicting findings may emerge. The results of the present investigation are in line with the literature; they are discussed in the following section in detail.

In a study conducted by Parvizi et al. (2017), the relationship between personality type and temperament was explored, revealing that neuroticism was associated with a hot temperament (34). Other studies have also highlighted the correlation between neuroticism and risky driving behaviors (35, 36). Moreover, Safari et al. observed that extroversion was more common among individuals with a hot temperament than those with a cold one (37). Similarly, O'Hern et al. proposed a positive association between extroversion and negative driving behavior in their survey of Australian cyclists (38).

Furthermore, Idreesi et al. (39) discovered that individuals with a hot temperament exhibit greater pain sensitivity compared to those with a cold temperament. This finding holds significant importance, especially given the prevalence of painful conditions such as neck and backaches among drivers, which can profoundly impact their driving performance and behavior (40). Consequently, it is conceivable that drivers with a hot temperament, as opposed to those with a cold temperament, may be more susceptible to negative driving behaviors due to their high sensitivity to pain.

According to PM textbooks, personalities are believed to be influenced by both the brain and the heart, and the temperament of the brain can significantly affect behavior and personality. An interesting study conducted by Khaki et al. revealed a connection between violent crimes and individuals exhibiting a hot-dry temperament of the brain *(41)*.

The PM defines a person as healthy when their temperament is in a state of balance, while most diseases are attributed to an imbalance in temperament (23). In essence, temperament serves as a guide to maintaining one's health. For instance, individuals with a cold temperament tend to exhibit less physical activity than those with a hot temperament, which can impact activities such as driving (22, 24, 42). Therefore, it is hypothesized that individuals with a hot temperament who experience an imbalance resulting in increased heat may face a higher risk of accidents. Therefore, in order to prevent drivers from deviating from a balanced temperament, it is advisable to adhere to the healthy lifestyle recommendations provided by PM.

The results of the present study regarding the relationship between the driver's temperament and the risk of accidents, errors, and violations while driving can be considered in predicting drivers' behavior. Moreover, if these findings are confirmed with subsequent rigorous studies, temperament may emerge as an important factor in driver recruitment and the evaluation of their performance. Finally, considering the importance of driver training and psychological interventions in preventing accidents, drivers' temperament seems influential in determining the priority of these interventions for drivers with different temperaments.

The novelty of this research can be highlighted as a strength, particularly using a database to determine the frequency of accidents among bus drivers. However, it should be noted that this study was conducted exclusively in Tehran, Iran, which presents certain limitations. Future research should explore the relationship between various human factors, including attitude and personality, and health outcomes. Moreover, expanding the sample size and diversifying the sampling locations will enhance the reliability of the results of future works.

6. Conclusion

The present investigation demonstrated a clear relationship between temperament and driving behavior among bus drivers. Specifically, bus drivers with hot temperaments exhibited a higher frequency of crash accidents, violations, and driving errors compared to those with cold or moderate temperaments. Furthermore, drivers with a dry temperament reported an increased risk of accidents compared to their wet-temperament counterparts. Therefore, it can be inferred that the temperament type may predict bus drivers' driving behavior. Nevertheless, further research employing rigorous methodology seems to be necessary. In addition, it was observed that smoking was associated with a higher incidence of crashes, violations, and errors among bus drivers.

Acknowledgments

Footnotes

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