

Araştırma Makalesi | Research Article

Investigating the Associations of Mindfulness and Well-being with Driver Behaviors

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Abstract

There is a growing need for studies on the role of positive psychology concepts on driver behavior. The present study aimed to investigate the associations between mindfulness and well-being with risky driver behaviors (i.e. errors, lapses, aggressive violations, ordinary violations) as well as positive driver behavior. A total of 249 licensed drivers between the ages of 19-70 participated in the study (53.4 % women). The data were collected by using the Demographic Information Form, the Toronto Mindfulness Scale, the Driver Behavior Questionnaire, and the Flourishing Scale. Hierarchical Regression Analyses were carried out to examine the relationships between the variables. Results showed that well-being and mindfulness were positively related to positive driver behaviors. Additionally, mindfulness was negatively related to errors, aggressive violations, and ordinary violations in traffic settings. The present study is one of the first examples to examine the influence of positive psychology constructs on positive and negative driver behaviors. The findings indicate the importance of the positive constructs in traffic setting. Interventions focuses on mindfulness and well-being can increase positive driver behaviors and reduce aberrant driver behaviors in order to increase road safety.

Keywords: mindfulness, well-being, driver behaviors, positive driver behaviors

Bilinçli Farkındalık ve İyilik Halinin Sürücü Davranışlarıyla İlişkisinin İncelenmesi

Öz

Pozitif psikoloji kavramlarının sürücü davranışları üzerindeki rolüne ilişkin çalışmalara gittikçe artan bir ihtiyaç duyulmaktadır. Bu çalışma, bilinçli farkındalık ve iyilik hali ile riskli sürücü davranışları (hatalar, ihmaller, saldırgan ihlaller ve sıradan ihlaller) ve pozitif sürücü davranışları arasındaki ilişkileri araştırmayı amaçlamıştır. Araştırmaya 19-70 yaşları arasında toplam 249 ehliyetli sürücü katılmıştır (%53,4 kadın). Veriler, Demografik Bilgi Formu, Toronto Bilgece Farkındalık Ölçeği, Sürücü Davranışları Anketi ve İyilik Hali Ölçeği kullanılarak toplanmıştır. Değişkenler arasındaki ilişkileri incelemek için Hiyerarşik Regresyon Analizleri yapılmıştır. Sonuçlar, iyilik hali ve bilinçli farkındalığın pozitif sürücü davranışlarıyla pozitif yönde ilişkili olduğunu göstermiştir. Ek olarak, bilinçli farkındalık, trafik ortamlarındaki hatalar, agresif ihlaller ve sıradan ihlallerle negatif yönde ilişkili olarak bulunmuştur. Bu çalışma, pozitif psikoloji kavramlarının pozitif ve negatif sürücü davranışları üzerindeki rolünü inceleyen ilk örneklerden biridir. Bulgular, bu pozitif kavramların trafik ortamında önemini göstermektedir. Buna göre bilinçli farkındalık ve iyilik haline odaklanan müdahaleler, yol güvenliğini artırmak için olumlu sürücü davranışlarını artırabilir ve riskli sürücü davranışlarını azaltabilir.

Anahtar Kelimeler: bilinçli farkındalık, iyilik hali, sürücü davranışları, pozitif sürücü davranışlar

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Investigating the Associations of Mindfulness and Well-being with Driver Behaviors

The World Health Organization's (WHO, 2018) data indicates that 1.35 million deaths have occurred as a result of traffic accidents all over the world. Also, the Turkish Statistical Institute (TurkSTAT, 2019) reported that 1,168,144 traffic accidents were recorded in 2019 and these resulted in 5483 deaths and 283,034 injuries. The causes of road traffic accidents involve three main categories - environment, vehicle/equipment, and the human factor, among which the human factor is the main or the auxiliary cause in almost 90 % of fatal traffic accidents (Lewin, 1982; Rumar, 1982). Therefore, attempts to understand and predict the human factor in the driving context have the potential to contribute to addressing this serious public health issue. The current study aims to examine mindfulness and well-being as antecedents of positive and aberrant driver behaviors. To the authors' knowledge, this study constitutes one of the first attempts in the literature to investigate the associations of mindfulness with aberrant driver behaviors operationalized by Reason, Manstead, Stradling, Baxter, and Campbell (1990) as human error framework. Most studies examining mindfulness in the driving context have been carried out in Western countries and cultures (e.g., Bird, 2018; Murakami et al., 2015). In addition, the current study is the first attempt in the literature to examine the associations between mindfulness and positive driver behaviors.

Driver behavior is defined as the typical behavior that a driver exhibits while driving (Oppenheim & Shinar, 2011) and is also referred to as "driving style" (Elander, West, & French, 1993). It reflects the preferences of individuals about how to drive and it is associated with involvements in road traffic crashes (Elander et al., 1993). It includes several variables such as speed selection and tendencies to make traffic rule violations (Evans, 1996). The Driver Behavior Questionnaire (DBQ) by Reason and colleagues (1990) is a widely accepted and commonly used scale to measure driver behaviors. The original scale is based on Reason's (1990) human error classification and aims to measure negative driver behaviors in three categories; errors, lapses, and violations. Based on this classification, intentional and unintentional aberrant driver behaviors should be differentiated since these are enacted as the output of different processes. Intentional aberrant driver behaviors are violations and are mostly related to attitudes and motivational processes (Elander et al., 1993). Violations are further classified as aggressive and ordinary violations; the former involving an interpersonal aggression component while the latter does not. On the other hand, unintentional aberrant driver behaviors are mostly related to cognitive processes and further divided into errors and lapses. Errors are defined as unintentional behaviors displayed while driving and might have serious consequences, whereas lapses take place due to memory and attentional deficits that would not lead to consequences as serious as that of errors. Reason and colleagues (1990) have stated that errors, violations, and lapses are significantly correlated with each other.

Özkan and Lajunen (2005) developed the Positive Driver Behavior Scale as an additional subscale to the DBQ. They defined positive driver behaviors as the behaviors displayed in the driving context for the benefit of the traffic environment and other road users. These include being kind, giving in the right of way, and helping others that share the immediate traffic environment. These behaviors do not necessarily take into account the formal traffic rules and regulations or safety principles. Özkan and Lajunen (2005) give the example of a driver crossing the barrier line to avoid a puddle that may splash water on pedestrians, which, in the worst-case scenario, might lead to a small accident. These types of behaviors with good intentions are enacted during everyday driving and should be considered in studies attempting to delineate the important construct of driver behavior. Therefore, in the present study, positive driver behaviors were examined as the criterion variable of interest, along with negative driver behaviors.

1.1. Mindfulness, Well-being, and Driving

The concept of mindfulness is derived from the Buddhist tradition and involves the wholeness of mind and body, and the conscious awareness of the person by attending to an internal or external stimulus such as breathing, body posture, surrounding voices, thoughts, and emotions at a given moment (Hill & Updegraff, 2012; Kabat-Zinn, 2003; Panek, Bayer, Dal Cin, & Campbell, 2015). Mindfulness is defined as “sustained nonreactive attention to one’s ongoing mental contents and processes (physical sensations, perceptions, affective states, thoughts, and imagery)” (Samuelson, Carmody, Kabat-Zinn, & Bratt, 2007, p.255), and formal training in mindfulness meditation is traditionally used to cultivate it (Samuelson et al., 2007). Mindfulness is related to one’s capacity for attention and attentional performance (Moore & Malinowski, 2009) along with psychological well-being (Carmody & Baer, 2008), and emotion regulation, specifically in terms of handling difficult emotions (e.g., anxiety, frustration, worries), emotional reactions (e.g., hostility, aggressiveness) (Baer, 2011) as well as managing negative thoughts (e.g., rumination), judgments, negative schemas towards internal and external stimulus in daily activities (Borders, Earleywine, & Jajodia, 2010; Hill & Updegraff, 2012; Peters et al., 2015).

Mindfulness affects our daily lives and one of these contexts is driving (Valero-Mora et al., 2015). Mindfulness has the potential to play a critical role in driving behavior because of the differences in drivers’ levels of mindfulness skills as a result of differences between individuals concerning attentional capacity and conscious awareness of internal and external distractions (Murphy & Matvienko-Sikar, 2019; Nilsson 2020). Drivers’ mindfulness levels are negatively correlated with aberrant driving behaviors, such as lapses and errors while driving (Koppel et al., 2018), and engagement of distracting activities such as mobile phone use, social media access, eating, drinking, and other external distractions (Qu, Ge, Zhang, Zhao, & Zhang, 2015; Young et al., 2019). One of the most dangerous and common distractions while driving is texting and drivers’ levels of mindfulness are negatively associated with texting while driving (Bird, 2018; Feldman, Greeson, Renna, & Robbins-Monteith, 2011; Moore & Brown, 2019; Salazar & Khandelwal, 2021) and low-level mindful drivers use texting as a means of emotion-regulation or self-regulation while driving (Feldman et al., 2011; Moore & Brown, 2019).

Studies indicated that mindfulness interventions decrease drivers’ intense and frequent anger in traffic settings; and as a result of this, improves safety and performance while driving (Borders et al., 2010; Heppner et al., 2008; Koppel et al. 2018; Wright, Day, & Howells, 2009; Valero-Mora et al., 2015). Correlational studies also indicated a positive relationship between mindfulness and positive and safe driving behaviors, which are mediated through self-control, happiness, emotion regulation, and psychological well-being (Bird, 2018; Bowen & Smith, 2019). In other words, mindfulness is positively associated with these variables, which in turn positively affects safe driving. Although the mechanisms through which mindfulness affects driving-related outcomes may not be clear or there might be a number of such mechanisms, still one can say that mindfulness seems to have positive influences on safe driving by reducing risky driving behaviors. In the present study, the associations between mindfulness, negative and positive driver behaviors are examined. In light of the previous findings presented above, a positive relationship between mindfulness and positive driver behaviors, and a negative relationship between mindfulness and negative driver behaviors (i.e., aggressive violations, ordinary violations, errors, lapses) are generally expected. Aggressive and ordinary violations are risky behaviors enacted intentionally and therefore it would be reasonable to expect that drivers with high levels of mindfulness would display these kinds of behaviors less frequently. Besides, errors and lapses are unintentional negative behaviors that have attentional and cognitive antecedents, and therefore mindfulness should be negatively associated with them due to its very own quality of having enhanced attention and awareness.

Studies showed that the state of awareness brought by mindfulness is related to well-being (Foster & Chow, 2020). In detail, studies showed that mindfulness has an important role in well-being by promoting self-endorsed behavioral regulation, and preventing automatic thoughts, habits, and unhealthy behavioral patterns (Ryan & Deci, 2000). Several approaches in psychology support the link between mindfulness and well-being. Based on self-determination theory (Deci & Ryan, 1980), mindfulness may have a role in well-being through self-regulated activity. In other words, the awareness triggered by mindfulness can help regulate behaviors related to one's basic needs (Hodgins & Knee, 2002; Ryan & Deci, 2000). Baumeister, Heatherton, and Tice (1994) highlighted the importance of conscious attention and they suggested that it is positively related to the cognitive, emotional and behavioral aspects of well-being.

The definition of well-being includes the ability of control difficult events and negative emotions occur in daily life (Huppert, 2009) and mindful state of mind provides people to see unpleasant experiences with greater awareness of thoughts and feelings and has negative impact on perceived stress (Huynh & Torquati, 2019). A high level of happiness and life satisfaction related to one's well-being can protect drivers from risky situations in traffic setting (Isler & Newland, 2017). Thus, in the present study well-being was considered as another potential antecedent of driver behaviors.

Well-being is defined as the experience of health, happiness, and prosperity (Davis, 2019). Some social scientists have defined well-being as an assessment of individuals' lives in positive terms and have also referred to it as life satisfaction (Diener, 1984). Well-being can also be defined as the ability to control difficult events and negative emotions that occur in daily life (Huppert, 2009). It is also defined by the lack of psychological dysfunction and not suffering from psychological symptoms such as depression or anxiety (Ryff & Singer, 1996). On the other hand; Lomas, Medina, Ivtzan, Rupperecht, and Eiroa-Orosa (2018) noted that in some areas of psychology, people have argued that well-being is not only associated with the absence of symptoms such as anxiety, depression but also with life satisfaction (Diener et al., 1985) or "flourishing," (Keyes, 2002) which refers to living within the ideal range of human functioning (Fredrickson & Losada, 2005). Many factors can affect one's well-being, such as self-esteem (Padhy, Rana, & Mishra, 2011), personality traits like extraversion, neuroticism (Gale et al., 2013), sensation-seeking (Ravert et al., 2013), and being resilient to stress (Caspi et al., 2003). Anger is one of the major issues associated with well-being (Painuly, Sharan, & Mattoo, 2005). In relation to this, well-being is essential for understanding the underlying reasons why drivers drive aggressively (Deffenbacher, Stephens, & Sullman, 2016). According to Gulliver and Begg's (2007) study, higher levels of well-being and aggression can predict an individual's driving speed, where this could reach more than 120 km/h on an open road. Examining data from 37 countries, Kirkcaldy and Furnham (2000) found that well-being has a significant negative correlation with the occurrence of accidents, as well as deaths incurred through driving accidents. Additionally, environmental conditions such as noise can cause stress on drivers and this is associated with their well-being, which in turn is associated with driver behavior (Babisch, Fromme, Beyer, & Ising, 2001; Brink, 2011). Furthermore, road conditions (Parsons, Tassinary, Ulrich, Hebl, & Grossman-Alexander, 1998) and traffic systems, such as noise, (Gee & Takeuchi, 2004) have also been associated with the driver's level of stress and well-being (Silla & Gamero, 2018). Some studies have shown that mindfulness had reduced stress (Specia, Carlson, Goddey, & Angen, 2000) which is one of the factors associated with well-being. Mindfulness can also improve driving in terms of a self-regulation exercise (Shapiro, Carlson, Astin, & Freedman, 2006). At this point, well-being and mindfulness can be evaluated as critical factors that influence driver behavior. Therefore, in the current study, it is expected that well-being would relate positively to positive driver behaviors and negatively to aberrant driver

behaviors. Although they are strongly related, the investigated concepts refer to different constructs. Thus, it is believed that they should be evaluated separately. Lastly, as an exploratory analysis, the mediating role of well-being in the relationship between mindfulness and driver behaviors was tested.

2. Method

2.1. Participants

A total of 249 individuals (53.4 % women) with valid and official driver's licenses have participated in the study. The age of the participants ranged between 19 and 70 with a mean of 38.56 ($SD = 13.49$). Participants indicated having driven 380,356 km on average ($SD = 1,802,819$) after obtaining their driver's licenses.

2.2. Instruments

2.2.1. Demographic Information Form.

The participants were asked to report their age, gender, and total mileage in this section.

2.2.2. Toronto Mindfulness Scale.

This 13-item scale was developed by Lau et al. (2006) and the adaptation study of the scale to the Turkish language was carried out by Şahin and Yeniçeri (2015). Although the original scale was developed to measure state mindfulness, the Turkish version of the questionnaire followed the same approach with Davis, Lau, and Cairns (2009) which suggests that the questionnaire can be used to measure dispositional aspects of Mindfulness with minor semantic changes of items (see Şahin & Yeniçeri, 2015). The scale consists of two subscales, namely “decentering” and “curiosity”. The Decentering subscale is composed of seven items and measures the extent to which individuals can achieve a shift from personally identifying with their thoughts and feelings to an experience where these can be identified in a broader field of awareness (Ireland, Day, & Clough, 2018). Curiosity subscale includes six items and measures the degree of presence of an attitude involving a willingness to learn more about one's own experiences (Ireland et al., 2018). The internal consistency reliability coefficients (*Cronbach's Alpha*) in the present study are .55 and .78 for the decentering and curiosity subscales respectively. The items required responding on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) and higher scores indicated higher levels of decentering and curiosity dimensions of the mindfulness construct.

2.2.3. Driver Behavior Questionnaire.

The 28-item scale was developed by Reason et al. (1990) and adapted to the Turkish language by Sümer, Lajunen, and Özkan (2002), and Sümer and Özkan (2002). The scale measures the frequency of aberrant driver behaviors in four different categories, which are errors, lapses, ordinary violations, and aggressive violations. Later on, Özkan and Lajunen (2005) developed the 14-item Positive Driver Behavior Scale as an addition to DBQ. This latest scale consisted of 42 items that required responding on a six-point frequency scale (1= never; 6= always) and higher scores indicated a higher frequency of the given behavior. In the present study, The Cronbach's Alpha coefficients for the 8-item errors subscale was found to be .61; for the 8-item lapses subscale was .68; for the 9-item ordinary violations subscale was .69; for the 3-item aggressive violations subscale was .68; and that for the positive behaviors subscale was .65. In addition, the Cronbach's alpha coefficient for the whole scale was found to be .74.

2.2.4. Flourishing Scale.

The 8-item self-report measure of general well-being was developed by Diener et al. (2009) and translated to the Turkish language by Fidan and Usta (2013). The questionnaire has a single factor structure. The items required responding on a seven-point Likert scale (1= strongly disagree; 7= strongly agree) and higher scores indicated higher levels of well-being reported by the participants. The scale yielded a *Cronbach's Alpha* coefficient of .88 in the current study.

2.3. Procedure

After obtaining the approval of the ethical committee of Baskent University (Ankara, Turkey, Approval number: 17162298.600-371), the online questionnaire package was distributed by using the convenience sampling approach. The online survey started with an informed consent form and there was a debriefing section at the end. Participants who were active drivers and drove their own vehicle at least 1000 km per year filled out the questionnaire. Data were collected using QUALTRICS online software over a 4-week period.

3. Results

3.1. Correlations between the Study Variables

Firstly, the correlations between the demographic variables and the study variables were examined. Age yielded a significant positive correlation with decentering, a significant negative correlation with lapses, ordinary violations and aggressive violations. Gender (being male, since gender was coded as 1 = female, 2 = male) was significantly negatively related to well-being and lapses. Finally, total mileage did not show any significant relationships with the study variables.

Second, the correlations between mindfulness dimensions and well-being were examined and only the curiosity dimension of mindfulness yielded a significant and positive correlation with well-being.

Third, the associations between the mindfulness dimensions and driver behaviors were examined. While decentering was not correlated with any of the driver behavior dimensions significantly, curiosity was significantly negatively correlated with errors, ordinary violations, aggressive violations, and also demonstrated a significant positive correlation with positive driver behaviors.

Finally, the correlations between well-being and driver behaviors were observed. Well-being was found to have a significant negative association with errors, and a significant negative association with positive driver behaviors. Correlation coefficients were presented in Table 1.

3.2. Hierarchical Regression Analyses

A series of hierarchical multiple regression analyses were conducted to examine the associations between decentering and curiosity dimensions of mindfulness with each driver behavior factor by controlling the effects of age, gender, and total mileage in the association. Therefore, in all these analyses, age, gender, and total mileage variables were entered in the first step, and decentering and curiosity variables were entered in the second step of the analysis in order to control for possible confounding effects of these demographic variables in the associations. Due to the strong link between mindfulness and well-being, the analyses were conducted separately to avoid a multicollinearity problem in the investigated variables. The results have been presented in Table 2.

Table 1. Correlations between the Study Variables

	1	2	3	4	5	6	7	8	9	10	11
1 Errors	1.00										
2 Lapses	.60**	1.00									
3 Ordinary Violations	.49**	.50**	1.00								
4 Aggressive Violations	.20**	.22**	.46**	1.00							
5 Positive Driver Behaviors	-.16*	-.12	-.13*	.01	1.00						
6 Decentering	-.04	-.04	-.09	-.03	.05	1.00					
7 Curiosity	-.19**	-.08	-.14*	-.16*	.23**	.41**	1.00				
8 Well-being	-.17**	-.04	-.06	-.01	.13*	.10	.24**	1.00			
9 Age	-.08	-.19**	-.25**	-.28**	.08	.15*	.04	.00	1.00		
10 Gender	.03	-.15*	.08	.02	.03	-.06	-.09	-.15*	.29**	1.00	
11 Total Mileage	.04	-.07	.07	-.07	.09	.11	.12	.04	.19**	.53**	1.00

Note: * Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed). Gender variable was coded as 1= women, 2=men. The correlations between gender and continuous variables of the study show in this Table are Spearman's rho coefficients.

In the analysis with errors as the outcome variable, the demographic variables entered in the first step did not explain a significant portion of the variance in the errors ($R^2 = .012$, *ns*), while the model in the second step that included decentering and curiosity explained a significant amount of variance ($R^2_{change} = .040$, $p = .010$). In this step, curiosity yielded a significant negative association with errors ($\beta = -.221$, $p = .003$) while decentering was not significantly associated with the errors.

In the second analysis, with lapses as the outcome variable, the amount of variance explained by the demographic variables entered in the first step was found to be significant ($R^2 = .053$, $p = .008$), whereas that of the mindfulness dimensions entered in the second step was not ($R^2_{change} = .007$, *ns*). Consequently, mindfulness dimensions were not significantly associated with lapses.

Third, the analysis was carried out by using ordinary violations as the outcome variable. Again, variables in the first step explained a significant amount of variance in ordinary violations ($R^2 = .097$, $p < .001$), whereas variables in the second step did not ($R^2_{change} = .017$, *ns*). However, curiosity yielded a marginally significant negative association with ordinary violations ($\beta = -.136$, $p = .054$).

The fourth analysis was conducted by using aggressive violations as the outcome variable. In this analysis, the variance in aggressive violations that have been explained by the variables entered in both the first step ($R^2 = .090$, $p < .001$) and in the second step ($R^2_{change} = .026$, $p = .044$) were significant. Among the mindfulness dimensions, curiosity was significantly negatively related to aggressive violations ($\beta = -.174$, $p = .014$).

Finally, while the demographic variables in the first step did not explain a significant amount of variance in positive driver behaviors ($R^2 = .013$, *ns*), in the analysis with positive driver behaviors as the outcome variable, mindfulness dimensions that were entered in the second step did ($R^2_{change} = .052$, $p = .003$). Again, only the curiosity dimension yielded a significant and positive association with positive driver behaviors ($\beta = .249$, $p = .001$).

Then, another series of hierarchical regression analyses were carried out to investigate the relationship between well-being and each of the driver behavior dimensions, after controlling for the effects of age, gender, and total mileage. Again, in all these analyses, age, gender, and total mileage variables were entered in the first step, and well-being was entered in the second step. Well-being showed a significant negative association with errors ($\beta = -.164, p = .016$) and a significant positive association with positive driver behaviors ($\beta = .135, p = .047$) after controlling for age, gender and mileage. The remaining analyses (with lapses, ordinary violations, and aggressive violations as the outcome variable) did not yield a significant association.

Finally, the mediating role of well-being in the relationship between mindfulness and driver behaviors was examined via mediated regression analysis. The results did not yield any significant indirect effect in any of the analyses carried out when using errors, lapses, ordinary violations, aggressive violations, and positive driver behaviors as the outcome variables.

4. Discussion

Although there is a body of research conducted on aberrant behaviors in traffic settings, studies on the role of positive constructs are relatively rare. The present study is one of the first examples to examine the influence of positive psychology constructs on driver behaviors. Moreover, the small number of studies that have been conducted in this area (e.g. Kita & Luria, 2020; Murphy & Matvienko-Sikar, 2019; Nilsson 2020) investigate only the effect of positive constructs on aberrant driver behaviors, but not on positive driver behaviors.

In the current study, hierarchical regression analyses were conducted to examine the associations between mindfulness and well-being with positive and negative driver behaviors, after the related demographic variables were controlled. In the first set of analyses, the associations of mindfulness and well-being with errors were examined. As a result, a significant negative relationship was found between curiosity dimension of mindfulness and errors. Accordingly, a higher curiosity level of the drivers is related to a lower level of errors. This finding is consistent with that of Koppel and colleagues (2018), who studied the relationship between self-reported aberrant driving behaviors and mindfulness. Both studies found that as drivers' mindfulness (curiosity dimension) levels increase, their tendency to make errors decreases. A possible explanation for this might be that errors could have destructive and negative cognitive as well as attentional antecedents. To this extent, mindfulness might be negatively related to errors because it helps increase attentional capacity (Jensen, Vangkilde, Frokjaer, & Hasselbalch, 2012) and the attention switching performance of individuals (Chambers, Lo, & Allen, 2008). Therefore, drivers with a high level of curiosity might have fewer tendencies to make errors in the traffic setting by increasing the cognitive flexibility of drivers' actions.

In addition, a negative relationship between well-being and errors was found. Kirkcaldy and Furnham (2000) pointed out that drivers' well-being is negatively related with the occurrence of accidents. Consistently, Isler and Newland (2017) stated that well-being, alongside life satisfaction, is positively related to safe driving practices in young adults. Thus, present findings are consistent with the expectations.

In the second set of hierarchical regression analyses with lapses as the dependent variable, no significant relationship was found between mindfulness and lapses, as well as well-being and lapses. As stated above, lapses include inattention and forgetfulness failures (Parker, Reason, Manstead, & Stradling, 1995). Accordingly, it can be interpreted that mindfulness and well-being does not primarily affect attention and memory in terms of driver behaviors. Still, the non-significant associations of both constructs with lapses leave a question mark for future

Table 2. Findings of the Separate Hierarchical Regression Analyses

DV:	Errors				Lapses				Ordinary Violations				Aggressive Violations				Positive Driver Behaviors				
	R ²	ΔR^2	β	p	R ²	ΔR^2	β	p	R ²	ΔR^2	β	p	R ²	ΔR^2	β	p	R ²	ΔR^2	β	p	
Step 1:	.012	.012		.458	.053	.053		.008	.097	.097		.000	.090	.090		.000	.013	.013		.409	
Age			-.101	.155			-.153	.028				-.312	.000			-.305	.000			.062	.380
Gender			.053	.454			-.124	.072				.146	.031			.111	.100			.008	.906
Total km			.054	.434			-.024	.717				.109	.099			-.030	.651			.082	.234
Step 2:	.052	.040		.010	.060	.007		.431	.114	.017		.124	.116	.026		.044	.065	.052		.003	
Decentering			.064	.388			.017	.818				.010	.888			.102	.152			-.068	.351
Curiosity			-.221	.003			-.092	.207				-.136	.054			-.174	.014			.249	.001
Step 1:	.012	.012		.458	.053	.053		.008	.097	.097		.000	.090	.090		.000	.013	.013		.409	
Age			-.101	.155			-.153	.028				-.312	.000			-.305	.000			.062	.380
Gender			.053	.454			-.124	.072				.146	.031			.111	.100			.008	.906
Total km			.054	.434			-.024	.717				.109	.099			-.030	.651			.082	.234
Step 2:	.026			.016	.057	.004		.335	.099	.002		.500	.090	.000		.888	.031	.018		.047	
Well-being			-.164	.016			-.064	.335				-.044	.500			.009	.888			.135	.047

Note. Gender was coded as 1=female, 2=male. All of the analyses were conducted separately for each DV (dimensions of driver behaviors). In the five analyses presented in the top section of the table, decentering and curiosity were entered in the second step, while in the remaining five analyses presented in the bottom section of the table, well-being was entered in the second step.

studies. In addition, the insignificant correlations may be due to the nature and the measurement of lapses. As it was stated above, lapses are related to inattention and forgetfulness failures (Parker et al., 1995). Thus, the nature of lapses may not allow recognizing and reporting such errors.

With regard to the relationship between mindfulness and ordinary violations, the curiosity dimension of mindfulness yielded a significant negative relationship with ordinary violations. As previously mentioned, while the aggressive violation includes the interpersonal aggression component, ordinary violations do not (Cheng, Liu, & Tilliani, 2015; Elander et al., 1993). Ordinary violations in traffic settings can be characterized as exceeding the speed limit, overtaking vehicles, driving very close to the vehicle ahead (Özkan, Lajunen, & Summala, 2006) or crossing red lights (Rowe, Roman, McKenna, Barker, & Poulter, 2015). Reason and his colleagues (1990) emphasized that drivers who rate themselves as “skillful drivers” tend to show more ordinary violations in traffic settings. These drivers evaluate a skillful driver as someone “who can bend the rules” and they tend to show riskier behaviors in traffic settings. In addition, Young et al. (2019) stated that aggression and anger in the traffic setting are related to drivers’ evaluation of the driving situation and other drivers’ behaviors. They found that a mindful state of consciousness is related to a lower level of anger and violations in traffic settings because there is a focus on the present moment without reactions or judgments rather than drivers focusing on negative past experiences or schemas that the person may have. Therefore, it can be evaluated that a drivers’ higher mindful state can provide a lower level of anger and fewer behaviors that include ordinary violations in terms of focusing on the present moment rather than focusing on schemas and past experiences related to “skillful driver” schemas.

In the next analysis with aggressive violations as the dependent variable, it was found that there is a significant negative relationship between curiosity dimension of mindfulness and aggressive violations. This finding is parallel with Koppel and colleagues’ study (2018) on drivers’ levels of mindfulness, where a significant relationship between curiosity and acts of violations in the traffic setting was found. This result may be explained by utilities of mindfulness in the curiosity dimension because negative and destructive feelings arise from our automatic, distorted, unrealistic, pop-up style thoughts and continuous ruminations; while the mindful state of mind counteracts the automatic, intriguing thoughts and their effect on impulsive behaviors (Bargh & Chartrand, 1999) since it helps being consciously aware of thoughts and sensitively observing them as they are by purely accepting them (Killingsworth & Gilbert, 2010). To this extent, drivers who have a high level of curiosity have a lower tendency to act with aggressive violations in the traffic setting.

On the other hand, well-being was not significantly related to ordinary and aggressive violations. Well-being has several components such as the physical, emotional, psychological, or social (National Centers for Disease Control and Prevention, 2018). The non-significant relationship in the present study may be related to the single factor scale that was used in the present study. In future studies, it can be suggested to measure well-being with a multidimensional scale to investigate its relationship with driver behaviors.

Lastly, a significant positive relationship was found between curiosity dimension of mindfulness and positive driver behaviors. This finding is consistent with the finding where curiosity has been seen as a protective factor against risky behaviors, errors, violations, anxiety, and negative thoughts while driving (Murphy, & Matvienko-Sikar, 2019). Increased mindfulness levels can contribute to increased levels of safe driving (Bird, 2018; Koppel et al., 2019). Considering the definition of curiosity as being open to experiences (Lau et al., 2006) and focusing on experiences at the moment (Bishop et al., 2004; Kabat-Zinn, 2003), drivers

may also regulate themselves when they are curiously approaching and are noticing their experiences in traffic. Mindfulness is similar to driving in terms of self-regulation (Shapiro, Carlson, Astin, & Freedman, 2006). which is one of its important functions (Khoury et al., 2017). In this way, drivers may quickly detect and regulate negative situations while driving. Therefore, drivers with high curiosity levels may exhibit positive driver behaviors by managing negative situations at a given moment.

There is also a significant positive relationship between well-being and positive driver behaviors. This finding is consistent with expectations, as well as the findings in the relevant literature suggesting that well-being is associated with positive driver behaviors, such as paying attention to the rules, regulating hostile behaviors, and making few violations (Bowen & Smith, 2019). Also, well-being plays an important role in regulating individuals' negative emotions and difficult situations (Huppert, 2009). Based on this, drivers with high levels of well-being may regulate the stressful environment in traffic and, by this way, not reflect on their own negative emotions. The link between well-being and positive driver behaviors can be mediated by the presence of the psychological symptoms (Ryff & Singer, 1996), resilience to stress (Satici, 2016), and anger (Painuly et al., 2005). Present findings support the idea suggested by Özkan (2006), that positive driver behaviors have a different psychological background than aberrant driver behaviors.

No significant relationships between the decentering dimension of mindfulness and driver behaviors were found. A possible explanation for this might be that the decentering subscale focuses purely on observing, watching, and being aware of feelings and thoughts without over-identifying and personal identification (Ireland et al., 2018). However, the curiosity subscale includes attending to and catching thoughts, feelings, and sensations with curiosity and openness in the course of action (Ireland et al., 2018). Driver behaviors possibly require a high level of cognitive processes and abilities, such as paying enough attention, perceiving and being aware of the stimulus such as rules, vehicles, pedestrians, signals, and actions with coordination and accommodation (Miller, Taylor-Piliae, & Insel, 2016). It also requires attending to thoughts and feelings and their regulations, and actively being aware of negative thoughts and feelings to release impulsive and destructive tendencies and violations (Bird, 2018). In that case, decentering and curiosity components might work interactively; however, the curiosity component fairly outweighs decentering in traffic settings. Besides, the driver might need to be open and curious enough to act on safe and positive driver behaviors and this also might explain the reasons why no significant relationship between the decentering dimension of mindfulness and positive driver behaviors has been found.

The present study has some theoretical and practical implications. First of all, this study is one of the first attempts in the literature to examine the role of mindfulness and well-being in predicting driver behaviors. To the best of the authors' knowledge, the present study is also the first one to investigate the role of mindfulness and well-being on positive driver behaviors. Thus, it can be stated that present study has a significant contribution to the related literature. Considering present findings, curiosity, but not decentering, dimension of mindfulness was found as a significant predictor of driver behaviors. Additionally, well-being is found to be associated with a decrease in errors and an increase in positive driver behaviors. Although well-being does not contribute to explaining violations, improving positive driver behaviors can be a way to improve road safety. Thus, interventions that focus on the aforementioned positive psychology constructs can be considered as characteristics to work on within the field. In light of this, there are examples of mindfulness interventions on driver performance (Kass et al., 2011) and distracted driving (Feldman et al., 2011).

There are some limitations to the study. Initially, self-report measures were used. Although self-report measures frequently used and statistically proven to be fairly valid instruments in the literature, it always has the possibility of tending social desirable responding (Sullman & Taylor, 2010). Second, the Cronbach's alpha internal consistency value for the decentering subscale is relatively low. Although the alpha value is a function of the number of items in a scale and the aforementioned subscale revealed a similar alpha value in other studies as well (Yu, Rodriguez, Deng, Xiao, & Liu, 2021). This point should be considered while generalizing the present findings. In the present study, since the data was obtained cross-sectionally and there was no manipulation of the independent variables, no cause and effect relationship might be derived with regard to the associations of mindfulness and well-being with driver behaviors. As discussed above, the relationship between mindfulness and driving behaviors might be mediated by various factors, such as attentional abilities (Chambers et al., 2008; Jensen et al., 2012), working memory performance (Jensen, et al., 2012), problem-solving strategies (Mrazek, Franklin, Phillips, Baird, & Schooler, 2013) and emotional capacity (Brown & Ryan, 2003; Brown, Ryan, & Creswell, 2007). Drivers' physical and psychological sensibility to traffic-related external factors such as noise, road conditions, and the traffic system could have been included to reach more comprehensive findings. Driver-related factors such as physical well-being, personality characteristics, and quality of life could also be considered in future studies on this association.

Ethics Committee Approval Statement

Ethics committee approval of the present study was obtained from Başkent University (Ankara, Turkey, Approval number: 17162298.600-371).

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