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Mindfulness and Mental Health in the Flight Deck: A Study of Airline Pilots

Kokpit Ortamında Farkındalık ve Mental Sağlık: Hava Yolu Pilotları Üzerine Bir Araştırma

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Abstract   Mindfulness has been extensively associated with improved cognitive and emotional regulation, both of which are critical to maintaining aviation safety. This research article aims to examine the relationship between mindfulness, psychological well-being, and mental health among commercial airline pilots. To the best of the authors' knowledge, there has been no prior study examining mindfulness, psychological well-being, and mental health among airline pilots in Türkiye. As a cross-sectional study, a self-administered questionnaire was used to collect the data from airline pilots. A total of 99 airline pilots participated in the study, completing standardized measures including the Depression Anxiety Stress Scales (DASS-21), the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R), and the Flourishing Scale. The response rate was %19.8. Through empirical analysis, the study investigates the correlations between mindfulness, well-being, and mental health outcomes. The results demonstrate significant negative associations between mindfulness and mental health challenges (depression, anxiety, and stress), as well as a strong positive correlation between mindfulness and psychological well-being. These findings underscore the potential value of integrating mindfulness-based practices and well-being interventions into aviation safety and mental health programs for flight crew members. The findings reported in this study may contribute to enhancing aviation safety practices.

Öz   Farkındalık, bilişsel ve duygusal düzenleme becerilerinin geliştirilmesiyle geniş ölçüde ilişkilendirilmiş olup, bu beceriler havacılık emniyetinin sürdürülmesinde kritik bir rol oynamaktadır. Bu araştırma makalesi, ticari havayolu pilotları arasında farkındalık, psikolojik iyi oluş ve ruh sağlığı arasındaki ilişkiyi incelemeyi amaçlamaktadır. Yazarların bilgisi dâhilinde, Türkiye'de havayolu pilotları arasında farkındalık, psikolojik iyi oluş ve ruh sağlığını inceleyen daha önce yapılmış bir çalışma bulunmamaktadır. Bu kesitsel araştırmada, havayolu pilotlarından veri toplamak amacıyla öz-bildirim esasına dayanan bir anket yöntemi kullanılmıştır. Çalışmaya toplam 99 pilot katılmış ve Depresyon Anksiyete Stres Ölçeği (DASS-21), Bilişsel ve Duygusal Farkındalık Ölçeği–Gözden Geçirilmiş (CAMS-R) ile Psikolojik iyi oluş Ölçeği'ni doldurmuştur. Yanıt oranı %19,8 olarak gerçekleşmiştir. Ampirik analiz yoluyla, farkındalık ile iyi oluş ve mental sağlık çıktıları arasındaki ilişkiler araştırılmıştır. Sonuçlar, farkındalık ile mental sağlık sorunları (depresyon, anksiyete ve stres) arasında anlamlı düzeyde olumsuz korelasyon, farkındalık ile psikolojik iyi oluş arasında ise güçlü bir olumlu korelasyon olduğunu göstermektedir. Bulgular, pilotlar için havacılık emniyeti ve mental sağlık programlarına farkındalık temelli uygulamaların ve iyi oluş müdahalelerinin entegre edilmesinin potansiyel değerini ortaya koymaktadır. Bu çalışmada sunulan bulgular, havacılık emniyeti uygulamalarının geliştirilmesine katkı sağlayabilir.

Keywords   mindfulness · mental state · psychological well-being · airline pilots · flight safety

Anahtar Kelimeler   farkındalık · mental durum · psikolojik iyi oluş · havayolu pilotları · uçuş emniyeti

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Mindfulness and Mental Health in the Flight Deck: A Study of Airline Pilots

Mindfulness refers to a cognitive state marked by sustained, non-judgmental awareness of present-moment experiences, characterized by openness and the absence of habitual or automatic responses (Fornette et al., 2012). The concept was first introduced into a scientific framework by Jon Kabat-Zinn, who operationalized mindfulness through structured interventions such as the Mindfulness-Based Stress Reduction (MBSR) program (Kabat-Zinn, 2003) (Kabat-Zinn, 2005). The concept of 'mindfulness' originates from the Pali term *sati*, which conveys notions of awareness, focused attention, and memory. As the language of the earliest Buddhist texts, Pali was used to preserve the teachings of the Buddha (Siegel et al., 2009).

In aviation, mindfulness refers to a mental state in which pilots and crew members maintain continuous, non-judgmental awareness of their present environment, thoughts, and actions (Darses et al., 2023). It involves intentional attention to operational tasks without distraction or automatic reactivity, thereby enhancing situational awareness, decision-making, and emotional regulation under pressure (Li et al., 2020). A growing body of research has demonstrated that mindfulness fosters improved cognitive and emotional regulation, both of which are foundational to the execution of effective and reliable decision-making processes in high-stakes environments such as aviation, medicine, nuclear power industry, and oil and gas industry (Çeken & Tuncal, 2025; Dahl & Kongsvik, 2018; Özer & Küçük, 2024; Zhang et al., 2013).

Mental health of airline pilots is an urgent global public health challenge (Cahill et al., 2021; Bilal Kilic, 2022; Ozturk, 2020, 2020). Mental disorders may elevate the risk of accidents and incidents by impairing pilot performance (Pasha & Stokes, 2018; Vuorio et al., 2017). (Bilal Kilic & Tabak, 2022) investigated 108 ab-initio pilots and found that 44.2% of them reported feeling very stressed, 24% of the ab-initio pilots had anxiety on varying levels, and 44.2% of the ab-initio pilots were depressed. (Li et al., 2020) addressed a critical gap in the literature by presenting a detailed analysis of the mental health status of commercial airline pilots. (Bilal Kilic, 2022) conducted a study examining the mental health status of airline pilots, contributing further insight into the psychological demands of the profession. Notably, 63.2% of the participating pilots reported symptoms consistent with depression, 57.2 experienced anxiety, and 76.6% were stressed.

Research on mental health has predominantly concentrated on negative outcomes such as depression, anxiety, and stress (Dehoff et al., 2018; B. Kilic & Ucler, 2019). However, the examination of positive constructs, including well-being (psychological flourishing), is equally essential (Chang et al., 2024). Well-being can be defined as a transient psychological state characterized by the experience of positive emotions within the workplace context (Salas-Vallina et al., 2018). Several studies have demonstrated that mindfulness is positively correlated with well-being, indicating its potential role in promoting mental health across various professional domains. (Chen et al., 2025; Li et al., 2020).

Mounting evidence suggests a potential link between pilot mental health issues and aviation safety outcomes (Kilic, B, 2021) Several accidents have drawn attention to the psychological state of flight crew members (Bilal Kilic, 2019, 2024; Bilal Kilic & Gumus, 2020). Understanding the interaction between psychological well-being, stressors, and mindfulness is therefore crucial for proactive safety management.

Previous studies have examined the relationship between mindfulness and well-being, the association between well-being and work-related stressors, and the link between mindfulness and mental health among airline pilots (Cahill et al., 2021; Chang et al., 2024; Özer & Küçük, 2024). However, to the best of the author's knowledge, no study to date has simultaneously explored the interrelationship between mindfulness, well-being, and mental health within this population. Based on these considerations, we propose the following research hypothesis.

H1. Mindfulness is negatively related to Depression, Anxiety, and Stress levels in airline pilots.

H2. Well-being is negatively related to Depression, Anxiety, and Stress levels in airline pilots.

H3: Mindfulness is positively related to the well-being in airline pilots.

H4: Mindfulness and psychological well-being (PWB) negatively predict depression.

Materials and Methods

Study design

The survey, adapted from previously published work by (Diener et al., 2009; Feldman et al., 2007; Bilal Kilic, 2022) , was distributed online to 500 airline pilots employed by carriers across Türkiye. A total of 99 airline pilots completed the survey. A purposive sampling method, as a form of non-probability sampling, was employed to recruit participants who possessed characteristics relevant to the theoretical concerns of the study. Participants were given a period of three months to complete the survey in order to allow adequate time for participation and thoughtful responses. The sample size was evaluated in terms of its suitability for statistical analysis. Tabachnick and Fidell (Tabachnick & Fidell, 2013) provide a formula to determine the minimum required sample size. According to this formula, the sample size should exceed *50+8m*, where *m* represents the number of independent variables. Since six independent variables were included in the hierarchical regression analysis, the sample size was considered adequate. The instrument consisted of four sections: (i) demographic questions, (ii) the Depression Anxiety Stress Scale (DASS-21) (21 items), (iii) the Cognitive and Affective Mindfulness Scale–Revised (CAMS-R) (10 items), and (iv) the Flourishing Scale (8 items). The overall response rate was 33%. Regarding age distribution, 17.2% of participants (N = 17) were between 21 and 30 years old, 45.5% (N = 45) were between 31 and 40, and 15.1% (N = 22) were over 50 years old. The majority of respondents (70.7%, N = 70) were married. In terms of rank, 43.4% (N = 43) were first officers and 56.6% (N=56) were captains. With respect to aircraft type, nearly three-quarters of participants (75.8%, N=75) operated short-haul aircraft (e.g., Boeing 737, Airbus A320), while 24.2% (N = 24) flew long-haul aircraft (e.g., Boeing 777, 787, 747; Airbus A330, A340, A350). Ethical approval for the study was granted by the Özyeğin University Human Research Ethics Board (2025/03/03).

Statistical analysis

Data for this study were collected through an online survey. To assess the internal consistency of the 45 items included in the questionnaire, Cronbach's alpha reliability analysis was conducted (George & Mallery, 2019). The analysis was carried out using IBM SPSS Statistics version 25.0. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were calculated to summarize the data. A p-value of less than 0.05 was considered statistically significant ($\alpha = 0.05$). Hierarchical multiple regression was conducted to examine the predictive ability of two psychological measures (CAMS-R and Psychological Well-Being (PWB) on levels of depression, while controlling for status, age, experience, and aircraft type. Preliminary analyses confirmed that the assumptions of normality, linearity, multicollinearity, and homoscedasticity were not violated. The descriptive statistics of the participants are shown in Table 1.

Table 1

The Frequencies of Demographic Variables

Variables	Categories	Frequencies	Percent
	21-30	17	17.2
Age	31-40	45	45.5
	41-50	22	22.2

Variables	Categories	Frequencies	Percent
Marital status	51 and above	15	15.1
	Married	70	70.7
	Unmarried	29	29.3
Status as pilot	First Officer	43	43.4
	Commander	56	56.6
Aircraft type	Short-haul (e.g. Boeing 737 and Airbus320)	75	75.8
	Long-haul (e.g. Boeing 777, 787, 747, and Airbus 330, 340, 350)	24	24.2
Experience as a commercial airline pilot	Less than 5	32	32,3
	6-10 years	17	17,2
	11-15 years	25	25,2
	16-20 years	7	7,1
	21 and above	18	18,2

Result and Discussion

This study explores the relationship between mindfulness, psychological well-being, and mental health among commercial airline pilots. A total of 99 pilots participated in the survey, completing standardized measures including the Depression Anxiety Stress Scales (DASS-21), the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R), and the Flourishing Scale. Correlational analysis revealed significant negative associations between mindfulness and mental health challenges (depression, anxiety, and stress), and a strong positive correlation between mindfulness and psychological well-being. Hierarchical regression analysis demonstrated that while demographic and operational variables (e.g., age, experience, aircraft type, and pilot rank) explained a small portion of variance in mental health, the inclusion of mindfulness and psychological well-being significantly improved the model. Specifically, psychological well-being and mindfulness were significant negative predictors of poor mental health, accounting for 41% of the total variance.

As shown in Table 2, descriptive analyses revealed that the mean depression score among airline pilots was 3.57 (SD = 3.01), anxiety was 2.40 (SD = 2.90), and stress was 4.83 (SD = 3.92) as measured by the DASS-21. The mean score on the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R) was 30.60 (SD = 4.39), while the Flourishing Scale, reflecting psychological well-being (PWB), yielded a mean of 45.29 (SD = 6.56).

Table 2
Descriptive Analysis

	n	Min.	Max.	x̄	s
DASS-21					
Depression	99	0	14	3.57	3.01
Anxiety	99	0	14	2.40	2.90
Stress	99	0	17	4.83	3.92
The Flourishing Scale					
Psychological Well-Being	99	25	56	45.29	6.56
Cognitive and Affective Mindfulness Scale (CAMS-R)					
Cognitive and Affective Mindfulness	99	16	40	30.60	4.39

As shown in Table 3, pearson's correlation coefficients indicated significant relationships among the key variables. Mindfulness (CAMS-R) showed significant negative correlations with depression (r = -.55, p < 0.01), Anxiety (r = -.39, p < 0.01), and Stress (r = -.44, p < 0.01). Psychological Well-Being (PWB) was also negatively correlated with depression (r = −.60, p < 0.01), Anxiety (r = -.39, p < 0.01), and Stress (r = -.55, p< 0.01). Additionally, mindfulness was positively correlated with psychological well-being (r = .65, p< 0.01), supporting the hypothesized interrelationship between these constructs. Internal consistency for all scales was strong (α > 0.75), confirming the reliability of the instruments. Two participant responses were removed due to outlier detection via Mahalanobis distance.

Table 3
Correlation Analysis

Pearson Correlation	Depression	Anxiety	Stress	CAMS-R	PWB
Depression	1**(.75)**				
Anxiety	.65**	1**(.78)**			
Stress	.74**	.76**	1**(.86)**		
CAMS-R	-.55**	-.39**	-.44	1**(.81)**	
PWB	-.60**	-.39**	-.55**	.65**	1**(.89)**

Note. **Correlation is significant at the 0.01 level (2-tailed). Internal consistency reliability estimates (i.e., alpha values) for the scales are presented in bold at the diagonal.

A hierarchical multiple regression analysis was conducted to predict depression scores. As presented in Table 4, Step 1 revealed that demographic variables (age, pilot status, aircraft type, and experience) accounted for 5% of the variance in depression. In Step 2, the addition of mindfulness (CAMS-R) and psychological well-being (PWB) significantly improved the model, increasing the explained variance to 41%, F(11, 87) = 7.06, p < .001.Both mindfulness (β = -.27, p < .05) and psychological well-being (β = -.44, p < .001) emerged as significant predictors. The PWB scale had a stronger predictive value for depression compared to mindfulness, suggesting that psychological well-being may play a more central role in mitigating depressive symptoms.

Table 4
Results of Hierarchical Regression Analysis for Depression

Variables	Step 1				Step 2			
	B	SE B	β	t	B	SE B	β	t
Status	−1.27	1.40	-.21	-.91	.22	1.14	.04	.19
Aircraft Type	-.42	1.26	-.06	-.33	.70	1.01	.10	.70
Age								
1). 31-40	-.48	.92	-.08	-.52	-.82	.73	-.14	−1.12
2). 41-50	1.46	1.31	.20	1.11	1.08	1.04	.15	1.03
3). 51 and above	2.00	2.29	.24	.88	2.37	1.81	.28	1.31
Experience								
1). Less than 5	−2.55	1.51	-.40	−1.69	-.03	1.26	-.00	-.02
2). 6-10	−2.70	1.17	-.34	−2.30*	-.38	.98	-.05	-.38
3). 16-20	−2.51	1.72	-.22	−1.46	−2.27	1.37	-.19	−1.66
4). 21 and above	−2.87	2.07	-.37	−1.39	−2.55	1.64	-.33	−1.56
Mindfulness					-.18	.07	-.27	−2.52*
PWB					-.20	.05	-.44	−4.05***

Variables	Step 1	Step 2
R	.37 .05 1.55	.69 .41 27.65***
R^2		
F for change in R^2		

This study provides empirical evidence supporting the critical role of mindfulness and psychological well-being in airline pilots' mental health. Consistent with prior research, results demonstrated that higher levels of mindfulness are associated with lower levels of depression, anxiety, and stress (Li et al., 2020). These findings affirm Hypothesis 1, which posited a negative relationship between mindfulness and mental health challenges (depression, anxiety, and stress) in airline pilots. The positive correlation between mindfulness and psychological well-being also confirms Hypothesis 3 and 4. Pilots reporting greater present-moment awareness and emotional regulation also indicated stronger engagement with life, sense of purpose, and social connectedness factors aligned with flourishing.

Furthermore, the study supports Hypothesis 2, which proposed a negative relationship between well-being and mental health difficulties (depression, anxiety, and stress). Pilots who demonstrated higher flourishing reported significantly lower symptoms of depression, anxiety, and stress, a pattern that reflects the buffering effect of psychological well-being in high-demand occupations like aviation (Chang et al., 2024).

The significant inverse correlations between mindfulness and depression (r = -.55), and between well-being and depression (r = -.60), are particularly noteworthy in the context of aviation, where early detection and prevention of depressive symptoms are critical for flight safety and performance. These associations also affirm the conceptual overlap and mutual reinforcement of mindfulness and flourishing, as constructs that support mental health. These findings highlight the potential benefits of incorporating mindfulness-based practices and well-being interventions in aviation safety and mental health programs for flight crew members.

Conclusion

The main goal of this study was to examine the associations between mindfulness, mental health challenges (depression, anxiety, and stress), and overall well-being. To the best of the authors' knowledge, no prior research has specifically investigated the relationship between mindfulness, psychological well-being, and mental health among commercial airline pilots. One of the most significant findings of the current study is higher levels of mindfulness were significantly associated with lower symptoms of depression, anxiety, and stress, while psychological well-being emerged as a strong protective factor against mental health challenges, while greater psychological well-being was also strongly linked to reduced mental health difficulties. These findings highlight the importance of integrating mindfulness-based practices and well-being interventions into aviation training and organizational health programs. By fostering present-moment awareness, emotional regulation, and flourishing, airlines may not only support pilot well-being but also strengthen situational awareness and decision-making in high-stakes environments.

Despite these contributions, the study is not without limitations. The reliance on self-reported measures and the cross-sectional design may limit causal interpretations and generalizability. Future studies employing longitudinal and intervention-based approaches with larger and more diverse samples would further clarify the mechanisms linking mindfulness, well-being, and mental health.

Finally, this research demonstrates that both mindfulness and psychological well-being are central to maintaining mental health in the flight deck. Addressing these factors proactively through structured well-

being strategies may reinforce aviation's safety culture and ensure that pilots remain mentally fit to meet the profession's demanding challenges.

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Appendix | Ek

SURVEY

Demographics

1. Gender
2. Age
3. Marital Status
4. Which position do you hold?
5. How long have you been flying? (Total flight experience)
6. What type of aircraft do you fly? (Current Type Rating)

Section 1- DASS-21 Scale

1. I found it hard to wind down during the past week
2. I was aware of dryness of my mouth during the past week
3. I couldn't seem to experience any positive feeling at all during the past week
4. I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion) during the past week
5. I found it difficult to work up the initiative to do things during the past week
6. I tended to over-react to situations during the past week
7. I experienced trembling (e.g., in the hands) during the past week
8. I felt that I was using a lot of nervous energy during the past week
9. I was worried about situations in which I might panic and make a fool of myself during the past week
10. I felt that I had nothing to look forward to during the past week
11. I found myself getting agitated during the past week
12. I found it difficult to relax during the past week
13. I felt down-hearted and blue during the past week
14. I was intolerant of anything that kept me from getting on with what I was doing during the past week
15. I felt I was close to panic during the past week
16. I was unable to become enthusiastic about anything during the past week
17. I felt I wasn't worth much as a person during the past week
18. I felt that I was rather touchy during the past week
19. I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat) during the past week
20. I felt scared without any good reason during the past week
21. I felt that life was meaningless during the past week

Section 2- Cognitive and Affective Mindfulness Scale- Revised (CAMS-R)

1. It is easy for me to concentrate on what I am doing.
2. I can tolerate emotional pain.
3. I can accept things I cannot change.
4. I can usually describe how I feel at the moment in considerable detail.
5. I am easily distracted.
6. It's easy for me to keep track of my thoughts and feelings.
7. I try to notice my thoughts without judging them.
8. I am able to accept the thoughts and feelings I have.

9. I am able to focus on the present moment.
10. I am able to pay close attention to one thing for a long period of time.

Section 3- The Flourishing Scale

1. I lead a purposeful and meaningful life.
2. My social relationships are supportive and rewarding.
3. I am engaged and interested in my daily activities
4. I actively contribute to the happiness and well-being of others
5. I am competent and capable in the activities that are important to me
6. I am a good person and live a good life
7. I am optimistic about my future
8. People respect me