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Research Article

Effects of Environmental Session Conditions on Acute Mood Profiles in Freediving Athletes

Serbest Dalış Sporcularında Çevresel Oturum Koşullarının Akut Duygu Durumu Profilleri Üzerindeki Etkileri

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Abstract: The aim of this study was to examine the acute effects of different environmental session conditions (control, water, and land) on the mood profiles of freediving athletes. A total of 25 athletes (16 males, 9 females) with a mean age of 20.04 (SD = 2.47), mean height of 169.8 cm (SD = 8.80), and mean body weight of 64.5 kg (SD = 11.35) participated in the study. The Brunel Mood Scale (BRUMS) was administered to the participants in three different sessions (control, water, and land). In the present study, four mood items were assessed: Energetic, Confused, Anxious, and Worried. Differences among the three session conditions were analysed using the non-parametric Friedman test, followed by Bonferroni-corrected Conover post-hoc comparisons, with Kendall's W as the effect-size estimate. Environmental session conditions significantly affected all four mood items. Energetic scores were significantly lower in the land condition than in both the control and water conditions [$\chi^2(2) = 10.69$; $p = 0.005$], with the highest level observed in the water condition. The negative mood items were highest in the control condition: confused and anxious scores were significantly lower in the land condition than in the control condition, and worry scores were significantly lower in the water and land conditions than in the control condition. The effect sizes ranged from small to medium (Kendall's W = 0.16–0.24). Sex comparisons (Mann–Whitney U) revealed two significant differences, both in the control condition: male athletes scored higher on the energetic item and female athletes scored higher on the worry item, with no significant differences in the water or land conditions or in the other items. These findings suggest that different training environments may produce divergent psychological effects on the mood states of freediving athletes. The results are considered to provide important contributions to the field of sport psychology in the areas of mood regulation, the psychological effects of training environments, and performance optimization.

Keywords: Freediving, mood states, brunel mood scale (BRUMS), training environment, acute psychological response.

Özet: *Bu çalışmanın amacı, serbest dalış sporcularının farklı ortamlarda (kontrol, su ve kara oturumları) sırasında uygulanan statik apne (nefes tutma) antrenmanının duygu durumu değişimlerini incelemektir. Araştırmaya yaş ortalaması 20,04 (SS = 2,47), boy ortalaması 169,8 cm (SS = 8,80) ve ağırlık ortalaması 64,5 kg (SS = 11,35) olan toplam 25 sporcu (16 erkek, 9 kadın) dâhil edilmiştir. Brunel Ruh Hali Ölçeği uygulanarak dört duygu durumu maddesi (Enerjik, Aklı karışık, Kaygılı, Tedirgin) üç oturumda değerlendirilmiştir. Üç oturum koşulu arasındaki farklar parametrik olmayan Friedman testiyle, anlamlı çıkan değişkenlerde Bonferroni düzeltmeli Conover post-hoc karşılaştırmalarıyla incelenmiş; etki büyüklüğü Kendall W katsayısıyla hesaplanmıştır. Çevresel oturum koşulları dört maddenin tamamını anlamlı biçimde etkilemiştir. Enerjik puanları kara oturumunda hem kontrol hem de su oturumlarına kıyasla anlamlı düzeyde düşük bulunmuş [$\chi^2(2) = 10,69$; $p = 0,005$], en yüksek değer su oturumunda gözlenmiştir. Olumsuz duygu maddeleri en yüksek kontrol oturumunda saptanmış; aklı karışıklık ve kaygı puanları kara oturumunda kontrole göre anlamlı düzeyde düşük, tedirginlik puanları ise su ve kara oturumlarında kontrole göre anlamlı düzeyde düşük çıkmıştır. Etki büyüklükleri küçük–orta düzeydedir (Kendall W = 0,16–0,24). Cinsiyet karşılaştırmalarında (Mann–Whitney U) yalnızca kontrol oturumunda iki anlamlı fark bulunmuştur: erkek sporcuların enerjik puanları, kadın sporcuların ise tedirginlik puanları daha yüksek çıkmıştır; su ve kara oturumlarında ve diğer maddelerde anlamlı fark görülmemiştir. Bu bulgular, serbest dalış sporcularında farklı antrenman ortamlarının duygu durumu üzerinde farklılaşan psikolojik etkiler yaratabileceğini göstermektedir. Elde edilen sonuçların, spor psikolojisi alanında duygu durum düzenlenmesi, antrenman ortamlarının psikolojik etkileri ve performans optimizasyonu konularında önemli katkılar sağlayacağı düşünülmektedir.*

Anahtar Kelimeler: *Serbest dalış, duygu durumu, brunel ruh hali ölçeği (BRUMS), antrenman ortamı, akut psikolojik yanıt.*

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INTRODUCTION

The investigation of the relationship between exercise and mood states has long been an important research area in the literature of exercise and sport psychology (Faul & LaBar, 2023; Znazen et al., 2022). Mood states play a determining role in cognitive processes, influencing higher-order mental functions such as decision-making, problem-solving, attention, and creativity, and they are considered a critical component in the manifestation of athletic performance. Previous studies have shown that regular physical activity supports not only physical fitness but also psychological well-being; in particular, aerobic exercise has been demonstrated to reduce depressive symptoms, improve cognitive functioning, and enhance attentional processes (Altmann et al., 2016; Martinsen, 1994).

Freediving is a unique sport characterized by extreme physiological demands and high environmental stressors. In this discipline, athletes are exposed to considerable hydrostatic pressure and hypoxic conditions during breath-hold periods that may extend up to 10–12 minutes and during dives that exceed 200 m in depth. Significant increases in lung gas volume, the potential occurrence of pulmonary edema, alveolar hemorrhage, arrhythmia, and bradycardia render freediving a high-risk sport (Lindholm & Lundgren, 2009; Lemaitre et al., 2009). The reduction of oxygen levels (hypoxia) and the increase of carbon dioxide levels (hypercapnia) during apnea may exert effects on the central nervous system, leading to transient slowing of cognitive functions. In addition, euphoria-like changes in mood states following dives have also been reported in association with hypercapnia. Increased peripheral vasoconstriction and decreased heart rate (bradycardia) during diving are among the fundamental components of freediving-specific physiological adaptations (Lindholm & Lundgren, 2009; Lemaitre et al., 2010; Tetzlaff et al., 2021).

Beyond these physiological responses, the inherent life-threatening risks of freediving (blackout, pressure-related injuries, and cardiac rhythm disturbances) may generate elevated levels of awareness, anxiety, and stress in athletes (Blogg et al., 2023; Oktay, 2024). In this context, freediving performance appears to be closely related not only to physical aspects but also to cognitive and affective processes. The literature indicates that acute diving adaptations may produce changes in energy, vigor, and concentration levels in freediving athletes (Vincenzi, 2019; Patrician et al., 2021; Hagen, 2018). These findings highlight that monitoring athletes' mood states during training and competitions performed under extreme conditions is critically important for both performance and safety.

The Brunel Mood Scale (BRUMS), frequently used in mood assessment, is a practical measurement tool that provides valid and reliable results in exercise and sport contexts (Lan et al., 2012; Zhang et al., 2014). BRUMS evaluates fundamental mood dimensions such as anger, confusion, depression, fatigue, tension, and vigor/energy, allowing the monitoring of mood changes during training and competition processes (Quartiroli et al., 2017; Jeffries et al., 2022; Vlachopoulos et al., 2023). Previous studies have demonstrated that BRUMS subscale scores are associated with athletic performance indicators, and that changes in vigor/energy and tension subscales in particular are related to perceived exertion, recovery requirements, and self-efficacy perceptions (Lew et al., 2023; Terry et al., 2021).

Freediving involves numerous environmental and task-specific stressors such as breath-hold duration, dive depth, water temperature, equipment use, and training environment (water or land). Hydrostatic pressure and water-specific sensory feedback may influence the perception of effort underwater and the interpretation of bodily sensations, thereby potentially producing differences in mood profiles (Becker, 2009; Colodro Plaza et al., 2014; Tang et al., 2022). Comparing BRUMS profiles displayed by the same athlete in different training environments (water vs. land) may contribute to a better understanding of the psychological effects of the training context and to optimizing the load–recovery balance. Owing to its short administration time and high sensitivity, BRUMS has been reported in previous studies to reliably detect acute mood changes between different session conditions (Vlachopoulos et al., 2023; Brandt et al., 2016).

Studies investigating the effects of acute diving exercises on mood states are limited in the existing literature. These studies have reported decreases in anxiety and tension and increases in vigor and psychological well-being during the acute period following a dive (Tang et al., 2022; Marlinge et al., 2019; Santiago Perez et al., 2023). More recent research has emphasized that activities performed in blue spaces (water-based natural environments) hold a unique potential in mood regulation and stress management (White et al., 2010; Gascon et al., 2017; Völker & Kistemann, 2015). However, the majority of these studies have focused on deep-water diving, and no study in the literature has examined the acute effects on mood states of diving training performed at minimal depth (≈2 m).

The importance of this study can be considered from several perspectives. First, the systematic investigation of the acute emotional effects of environmental context in an extreme and psychologically demanding sport such as freediving may yield important practical implications for both athlete health and performance safety. Second, comparing water- and land-based training environments through BRUMS contributes to strengthening the evidence base for training planning and recovery strategies. Third, it constitutes a unique example of the integration of current literature on blue spaces into sport psychology.

Building on this gap, the aim of the present study was to examine the acute effects on mood profiles of a single-session freediving training performed at minimal depth, under different session conditions (control, water, and land). A minimal depth of approximately 2 m was deliberately chosen because it can be implemented safely and consistently in a standard indoor swimming pool, which makes the protocol readily accessible for routine training use and suitable for athletes at an early or intermediate stage of adaptation, without requiring open-water or deep-diving conditions. Within this scope, the hypotheses of the study were as follows:

H1: Different session conditions (control, water, and land) will produce significant differences in the positive mood item (Energetic).

H2: Different session conditions will produce significant differences in the negative mood items (Confused, Anxious, and Worried).

As an exploratory aim, sex differences (female vs. male) in the mood items across the three conditions were also examined.

METHODS

Research Model: This study was conducted using a repeated-measures, experimental research design aimed at examining the acute effects of different environmental session conditions (control, water, and land) on mood profiles in freediving athletes. All participants were assessed under three different conditions, and the mood responses of the same individuals across different environments were analyzed comparatively.

Purpose of the Research: The main purpose of this study was to examine the acute effects on mood profiles of a single-session freediving training performed at minimal depth, under control, water, and land conditions, by means of the Brunel Mood Scale (BRUMS). As a secondary, exploratory aim, sex differences (female vs. male) in the mood items were also examined.

Research Group: Twenty-five healthy freediving athletes (16 males, 9 females) participated voluntarily in the present study. The mean age of the participants was 20.04 ± 2.47 years, the mean height was 169.8 ± 8.80 cm, and the mean body weight was 64.5 ± 11.35 kg. All participants were active competitive athletes participating in national and international freediving competitions. All athletes specialized in the apnea discipline, with a mean static breath-hold performance of 05:03 ± 00:47 minutes.

Before taking part, every athlete received a detailed explanation of the procedures and provided written, voluntary informed consent. The required sample size was estimated a priori with G*Power 3.1 (Faul et al., 2007) under a repeated-measures, within-subjects analysis-of-variance framework, matching the present design (control, water, and land). With the effect size fixed at f = 0.50 (a medium effect), power at 95%, and the alpha level at 5%, the procedure returned a minimum of 18 participants (Cohen, 1988); 25 athletes were ultimately recruited to offset possible attrition and to strengthen analytical power. Ethical approval for the protocol was granted by the Non-Interventional Clinical Research Ethics Committee of the

Trakya University Faculty of Medicine (Decision No: TUTF-GOBAEK 2026/182).

Data Collection: The study consisted of three separate sessions conducted at least 48 hours apart. In the first session (control condition), participants' demographic and anthropometric measurements were taken and information was provided on the application protocols. The second session (water condition) was performed in an indoor swimming pool at 2 m depth, 26.5 °C water temperature, and 60% relative humidity. Athletes wore a 1 cm thick specialized diving suit, a nose clip, and a face mask throughout the training. The third session (land condition) consisted of the application of the same protocol in a dry, out-of-water environment. The structural details of both training sessions are presented in Table 1, and the static apnea (breath-hold) set structure is presented in Table 2. All participants were ensured to attend the sessions having had at least 7 hours of sleep; they were also asked to complete their main meals at least 2 hours before each session and to abstain from caffeine, alcohol, or any substances that could affect mood.

Apnea Training Protocol: The water and land conditions each consisted of a single, structured acute apnea training session built on the progressive-intensity ("O_2 table") approach used in elite freediving training (Lemaitre et al., 2009; Lemaitre et al., 2010; Patrician et al., 2021). Both sessions followed an identical five-phase sequence — warm-up, passive preparation, a main static-apnea phase comprising six progressive sets (50–80% of each athlete's maximum breath-hold time, applied with a 1:1.5 work-to-recovery ratio), a transition phase, and a cool-down — and differed only in the application environment (water vs. dry land). The control session involved no exercise and was limited to anthropometric measurement and protocol familiarisation. The Brunel Mood Scale (BRUMS) was administered immediately before and after every session. Because this study was designed to capture the acute effects of each session, the between-condition comparisons reported in the Results (Table 3) are based on the BRUMS scores collected immediately after completion of each session's protocol; the pre-session assessment served only to confirm a comparable baseline mood state across conditions. The overall experimental flow, the within-session phase structure, and the mood-measurement time points are summarised in Figure 1, while the phase-by-phase and set-by-set parameters are detailed in Tables 1 and 2.

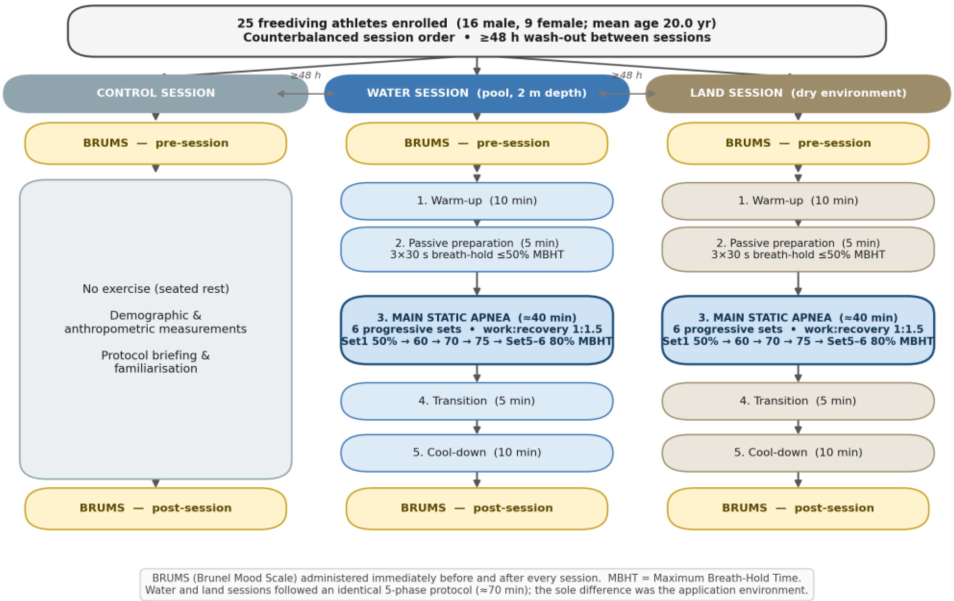

Figure 1. Flow of the experimental procedure and apnea training protocol. Twenty-five athletes completed three counterbalanced sessions (control, water, and land) at least 48 hours apart. For the water and land sessions, the identical five-phase structure and the six progressive static-apnea sets (50–80% MBHT) are shown; the Brunel Mood Scale (BRUMS) was administered immediately before and after each session.

Table 1. Phase-based details of the training protocol (Water and Land Sessions)

Phase	Duration	Water Session	Land Session	Intensity
1. Warm-up	10 min	4×50 m easy swim + 5 min diaphragmatic breathing	5 min dynamic stretching + 5 min diaphragmatic breathing	Low (RPE 2–3)
2. Passive Preparation	5 min	3×30 sec breath-hold at surface (≤50% MBHT)	3×30 sec seated breath-hold (≤50% MBHT)	Low (RPE 3)
3. Main Static Apnea	40 min	6 sets of progressive-intensity static apnea (at pool surface)	6 sets of progressive-intensity static apnea (in dry environment)	Moderate–High (RPE 5–7)
4. Transition	5 min	Diaphragmatic breathing + slow swim (≤25 m)	Diaphragmatic breathing + slow walk	Low (RPE 2)
5. Cool-down	10 min	Low-tempo free swim	Slow walk + breathing regulation	Low (RPE 2)

Note: *MBHT: Maximum Breath-Hold Time; RPE: Borg 0–10 Rating of Perceived Exertion. Both sessions lasted approximately 70 minutes; the only difference was the application environment (water vs. land). The same number of sets and intensity steps were applied for all athletes. The protocol is based on the progressive-intensity ("O_2 table") approach used in elite freediving training literature (Lemaitre et al., 2009; Lemaitre et al., 2010; Patrician et al., 2021).*

Table 2. Progressive structure of static apnea sets (Main Working Phase)

Set	Target Duration (% MBHT)	Example Duration (5:03 MBHT)	Active Recovery	Repeat Ratio
1	50% MBHT	≈ 2:30 min	3:45 min diaphragmatic breathing	1:1.5
2	60% MBHT	≈ 3:00 min	4:30 min diaphragmatic breathing	1:1.5
3	70% MBHT	≈ 3:30 min	5:15 min diaphragmatic breathing	1:1.5
4	75% MBHT	≈ 3:45 min	5:35 min diaphragmatic breathing	1:1.5
5	80% MBHT	≈ 4:00 min	6:00 min diaphragmatic breathing	1:1.5
6	80% MBHT	≈ 4:00 min	6:00 min diaphragmatic breathing	1:1.5

Note: *Set intensity was progressively increased; no athlete exceeded 80% of MBHT. Active recovery durations were set at 1.5 times the apnea duration (1:1.5 ratio). This ratio falls within the 1:1.5–1:2 range commonly recommended in elite freediving literature (Lemaitre et al., 2009; Lemaitre et al., 2010), keeping cumulative fatigue limited while ensuring adequate recovery. Example durations were calculated based on the mean MBHT value of the study group (05:03 ± 00:47 min). Durations were individually adjusted for each athlete according to their personal MBHT values. The total main working duration is approximately 40 minutes (6 × 6.5 min ≈ 39 min).*

Mood states were measured with the Brunel Mood Scale (BRUMS), which participants completed at each of the three sessions (control, water, and land). The instrument was originally developed by Terry et al. (1999, 2003) and was adapted into Turkish, with its validity and reliability established, by Çakıroğlu (2016). Each adjective is rated on a five-point scale ranging from 0 (Not at all) to 4 (Extremely), with higher scores reflecting a stronger presence of the corresponding mood. Four items were examined in the present analysis — Energetic, Confused, Anxious, and Worried — each scored from 0 to 4. These four items were selected, out of the 24-item, six-subscale BRUMS, because they most directly capture the risk-perception and readiness dimensions relevant to freediving — energy reflecting performance readiness, and confusion, anxiety, and worry reflecting hazard-related apprehension — and because their brevity made them practical to administer immediately before and after each session without disrupting the training protocol. For the Turkish form among adult athletes, the reported Cronbach's alpha internal-consistency coefficient is 0.86 (Çakıroğlu, 2016).

Analysis of Data: Data were processed in IBM SPSS Statistics (v25.0; IBM Corp., Armonk, NY, USA). Because the Shapiro–Wilk test (Shapiro & Wilk, 1965) showed that the BRUMS item scores departed from a normal distribution ($p < 0.05$), non-parametric procedures were adopted throughout. Within-subject differences across the three session conditions (control, water, and land) were tested with the Friedman two-way analysis of variance by ranks (Gibbons & Chakraborti, 2011). Where the Friedman result was significant, the sessions were contrasted pairwise through the Conover procedure, with a Bonferroni adjustment applied to contain the Type I error inflation that accompanies multiple comparisons. Sex-based contrasts for each item, within each condition, relied on the Mann–Whitney U test (female n = 9; male n = 16).

Effect sizes accompanying the Friedman test were expressed as Kendall's W, the coefficient appropriate for this design, with values of 0.10–0.29, 0.30–0.49, and ≥0.50 taken to indicate small, medium, and large effects, respectively. Across all tests, an alpha of 0.05 served as the threshold for statistical significance.

RESULTS

The descriptive statistics of the BRUMS item scores obtained from 25 freediving athletes participating in the study under different session conditions (control, water, and land) are presented in Table 3. As the data did not satisfy the normality assumption (Shapiro–Wilk; $p < 0.05$), all analyses were performed using non-parametric methods. The findings are presented in order of the study hypotheses.

Friedman analysis revealed a statistically significant difference among the control, water, and land conditions for the Energetic item [$\chi^2(2) = 10.69$; $p = 0.005$; Kendall's W = 0.214]. Bonferroni-corrected Conover post-hoc comparisons showed that energetic scores in the land condition were significantly lower than those in both the control ($p = 0.032$) and water ($p = 0.004$) conditions, whereas the control and water conditions did not differ significantly. The highest mean was obtained in the water condition (M = 2.84 ± 1.18) and the lowest in the land condition (M = 1.52 ± 1.42).

For the Confused item, the Friedman test indicated a significant difference among the session conditions [$\chi^2(2) = 12.20$; $p = 0.002$; Kendall's W = 0.244]. Post-hoc comparisons showed that confused scores in the land condition were significantly lower than those in both the control ($p = 0.002$) and water ($p = 0.011$) conditions. The highest mean was observed in the control condition (M = 1.08 ± 1.00) and the lowest in the land condition (M = 0.36 ± 0.70).

For the Anxious item, a significant difference was found among the session conditions [$\chi^2(2) = 7.73$; $p = 0.021$; Kendall's W = 0.155]. Post-hoc comparisons showed that anxiety scores in the control condition were significantly higher than those in the land condition ($p = 0.019$). Mean values were M = 0.92 ± 1.04 (control), M = 0.40 ± 0.58 (water), and M = 0.32 ± 0.56 (land).

For the Worried item, the Friedman test revealed a significant difference among the session conditions [$\chi^2(2) = 9.74$; $p = 0.008$; Kendall's W = 0.195]. Post-hoc comparisons showed that worry scores in the control condition were significantly higher than those in both the water ($p = 0.008$) and land ($p = 0.034$) conditions. The lowest mean was obtained in the water condition (M = 0.04 ± 0.20) and the highest in the control condition (M = 0.44 ± 0.71).

Sex differences were examined using the Mann–Whitney U test (female n = 9; male n = 16). Two statistically significant sex differences emerged, both in the control condition. For the Energetic item, male athletes scored higher than female athletes (U = 24.5; $p = 0.006$; female M = 1.67 ± 1.22; male M = 3.19 ± 0.91), whereas for the Worried item, female athletes scored higher than male athletes (U = 103.0; $p = 0.036$; female M = 0.89 ± 0.93; male M = 0.19 ± 0.40). No significant sex differences emerged in the water or land conditions, nor for the Confused or Anxious items in any condition (all $p > 0.05$).

Table 3. Means and standard deviations of brums ıtem scores according to session conditions

Condition	Energetic (M ± SD; Mdn [IQR])	Confused (M ± SD; Mdn [IQR])	Anxious (M ± SD; Mdn [IQR])	Worried (M ± SD; Mdn [IQR])
Control	2.64 ± 1.25 Mdn (IQR) = 3.00 (2.00–4.00)	1.08 ± 1.00 Mdn (IQR) = 1.00 (0.00–2.00)	0.92 ± 1.04 Mdn (IQR) = 1.00 (0.00–1.00)	0.44 ± 0.71 Mdn (IQR) = 0.00 (0.00–1.00)
Water	2.84 ± 1.18 Mdn (IQR) = 3.00 (3.00–4.00)	0.80 ± 0.82 Mdn (IQR) = 1.00 (0.00–1.00)	0.40 ± 0.58 Mdn (IQR) = 0.00 (0.00–1.00)	0.04 ± 0.20 Mdn (IQR) = 0.00 (0.00–0.00)
Land	1.52 ± 1.42 Mdn (IQR) = 1.00 (0.00–3.00)	0.36 ± 0.70 Mdn (IQR) = 0.00 (0.00–1.00)	0.32 ± 0.56 Mdn (IQR) = 0.00 (0.00–1.00)	0.16 ± 0.55 Mdn (IQR) = 0.00 (0.00–0.00)

Note: *The table presents the means and standard deviations for each BRUMS item across control, water, and land conditions. All values were calculated based on a Likert-type (0–4) rating. Given the non-normal distribution of the data, the median and interquartile range (IQR = Q3 – Q1, 25th–75th percentile) are also reported for each cell.*

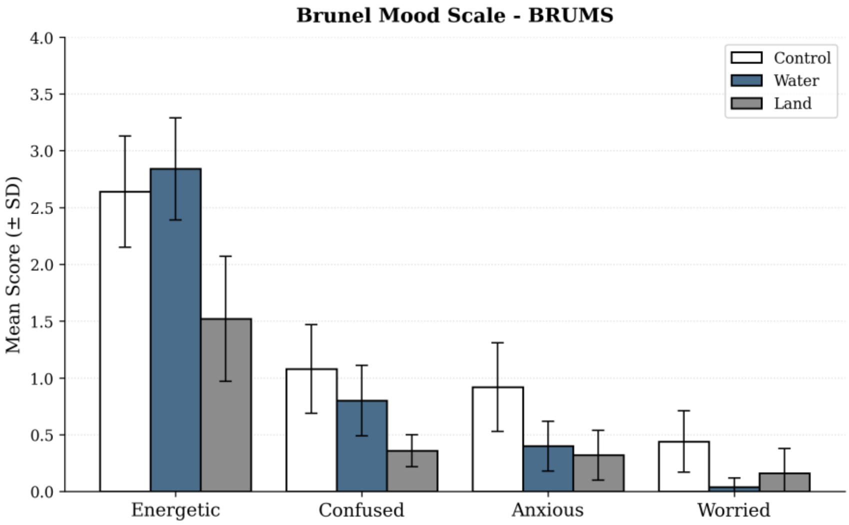

Figure 2. Mean (± standard deviation) scores of Brunel Mood Scale (BRUMS) items in the control, water, and land sessions. Energetic, Confused, Anxious, and Worried items are presented comparatively across different session conditions.

The distribution of BRUMS item mean scores across different session conditions is presented in Figure 2. The figure displays mean values and standard deviation bars for each item across the control, water, and land conditions.

DISCUSSION AND CONCLUSION

The aim of this study was to examine the acute effects of different environmental session conditions (control, water, and land) on the mood profiles of freediving athletes by means of the Brunel Mood Scale (BRUMS). The findings demonstrate that environmental context plays a significant and distinguishing role in short-term mood. When the three conditions are compared, the water environment appears to provide a profile that supports positive mood states while suppressing negative ones.

One of the main findings of the study is that energetic scores were significantly lower in the land condition than in both the control and water conditions, with the highest level observed in the water condition. This finding, which supports the prediction that session conditions would produce significant differences in the positive mood item, is consistent with previous studies highlighting the effects of natural environments and especially of “blue spaces” on psychological well-being, vitality, and positive affect (White et al., 2010; Gascon et al., 2017; White et al., 2013b). The literature reports that blue spaces provide relaxation through visual and auditory stimuli and create a balanced affective state between arousal and relaxation (White et al., 2013a; Cooney et al., 2013). Recent research (Britton et al., 2020) suggests that exposure to blue spaces may produce a stronger mood-regulatory effect compared with green spaces. In this context, the higher energetic scores observed in the water environment can be explained by the contribution of environmental stimuli to emotional regulation processes.

Conversely, the negative mood items (Confused, Anxious, and Worried) were highest in the control (no-exercise) condition. The most parsimonious explanation is the acute mood-enhancing effect of physical activity: a single exercise bout typically reduces tension and confusion and improves affect relative to a resting condition (Crush et al., 2018; Cooney et al., 2013). In the present study, both apnea sessions involved structured physical activity, whereas the control session did not, which may account for the more negative mood profile observed at rest. Restorative-environment frameworks such as Attention Restoration Theory and Stress Reduction Theory additionally propose that contact with natural and especially water settings supports cognitive recovery and reduces stress-related responses (Steg et al., 2012; Ohly et al., 2016; Ulrich et al., 1991; Stenfors et al., 2019); these frameworks are relevant to the aquatic (water) condition but should not be extended to the dry-land or control conditions, which were not natural environments.

Beyond this general exercise effect, the water condition showed a distinct advantage, combining the highest energetic scores with the lowest worry scores. Research on water-based exercise and contact with water has linked the aquatic medium to reduced anxiety, lower physiological stress, and a calmer, more positive affective state (Hunter et al., 2019; Bratman et al., 2019; Shuda et al., 2020; Frazão et al., 2016). Because the present water condition was an indoor pool rather than a natural blue space, and because physiological markers (e.g., cortisol) were not collected, these parallels should be regarded as suggestive rather than confirmatory, and the mechanisms (e.g., immersion, thermal, or sensory effects) underlying the water-specific advantage remain to be established. This pathway is conceptually distinct from the "blue space" literature, which typically concerns open, natural water landscapes and attributes their restorative effects largely to visual and auditory scenic exposure. An indoor pool offers no such scenery; instead, its influence on mood is more plausibly driven by direct physical properties of water immersion — buoyancy-related reductions in musculoskeletal load, thermal contact with water at a stable temperature, hydrostatic pressure on the torso, and activation of the mammalian diving reflex — none of which have an equivalent in a natural landscape setting. The present findings should therefore be interpreted as evidence for an immersion-based, rather than a scenery-based, pathway to mood improvement.

The dry-land condition revealed a more heterogeneous mood profile: although its confusion and anxiety scores were the lowest of the three conditions, its energetic scores were also significantly lower than those of the water condition. The lower energetic scores in the dry-land condition may reflect the physical fatigue of the apnea protocol without the arousal- and affect-related benefits associated with the aquatic medium. The observation that emotional benefits can differ markedly across exercise settings is in line with Berman et al. (2008), who noted that the affective benefits of an environment depend on its specific characteristics, and is consistent with evidence that aquatic exercise can favourably influence mood and anxiety (Tang et al., 2022).

With respect to sex, the analyses revealed two significant differences, both confined to the control (resting) condition: male athletes reported higher energetic scores, whereas female athletes reported higher worry scores. No significant sex differences emerged in the water or land conditions or for the confused and anxious items. The absence of sex differences during the active water and land sessions suggests that the environmental and exercise context, rather than sex, was the dominant driver of acute mood responses, with the resting-state differences possibly reflecting baseline dispositional or arousal-related variation. Given the modest and unbalanced sample ($n = 9$ females vs. $n = 16$ males), however, these comparisons are statistically underpowered and should be interpreted with caution; the literature suggesting that emotional regulation and stress-coping strategies may differ between female and male athletes (Terry et al., 2021) cannot be adequately tested with the present sample, and larger, sex-balanced studies are needed.

The training protocol applied in the present study is consistent with established methodological standards in the international freediving literature. The number of sets (6 sets), the upper intensity limit (80% MBHT), and the 1:1.5 recovery ratio align with the parameters proposed by Bain et al. (2018) for elite breath-hold divers and confirmed by Patrician et al. (2021). The progressive-intensity structure ("O_2 table" approach) follows the apnea training principles systematically defined by Schagatay (2009). Costalat et al. (2015) reported that similar progressive protocols may trigger physiological adaptations such as peripheral vasoconstriction, increased splenic contraction, and improved oxygen storage. Although physiological adaptation was not measured in the present study, the protocol used provides a scientifically defensible basis for the evaluation of psychological effects.

One of the unique methodological contributions of this study is the application of the same static apnea protocol under both water (pool) and land (dry environment) conditions. Joulia et al. (2003) demonstrated that dry-environment apnea training can provide adequate psychophysiological stimuli and contribute to the reduction of oxidative stress and blood acidosis. In contrast, Tetzlaff et al. (2021) emphasized that the water environment elicits a different adaptive response through additional environmental stimuli (hydrostatic pressure, decrease in body temperature, diving reflex). The present study combines these two methodological approaches in a single experimental design, thus representing one of the few studies in the literature that allow the isolation of environmental context. In this respect, the study features both methodological alignment with international standards at the protocol level and an original comparative approach at the design level.

The Brunel Mood Scale (BRUMS) used in this study has once again been shown to be a sensitive measurement tool for short-term environmental changes. The validity and reliability of BRUMS in different athlete populations and contexts is supported by previous studies (Lan et al., 2012; Vlachopoulos et al., 2023; Terry et al., 1999; Lane & Terry, 2000). The medium effect sizes obtained in the study (Kendall's W) indicate that the effect of environmental conditions on mood is meaningful not only statistically but also practically.

The findings of the study indicate that water environments offer a more emotionally compatible profile for freediving athletes. This points to the use of environmental arrangements as a tool to support psychological well-being in domains such as sport, exercise, recreation, and rehabilitation. In particular, in recovery processes, training phases requiring mental preparation, or in high-stress sports disciplines, the preference for water-based environments may support athletes' mood-regulation capacities.

Limitations

Some limitations should be considered in the interpretation of this study. First, the findings refer only to acute effects, and the chronic effects of long-term environmental exposure on mood were not evaluated. Second, physiological indicators (e.g., heart rate variability, cortisol, or alpha-amylase levels) were not included in the study, which limited the verification of possible physiological mechanisms underlying the observed psychological changes. Third, the sample size ($n = 25$) and the unbalanced sex distribution (16 males, 9 females) limit the statistical power of sex-based comparisons. Fourth, since BRUMS is a selfreport instrument, the data are limited by social desirability effects and by participants' introspective accuracy. Finally, individual environmental preferences (e.g., fear/aversion to the sea, phobias, environmental comfort level) were not controlled in the study, which may have contributed to the heterogeneity of the findings.

Future Research Directions

Future research should investigate the chronic effects of environmental context on mood through longitudinal designs. The concurrent use of psychophysiological indicators (HRV, cortisol, EEG) alongside BRUMS measurements would contribute to elucidating the neurophysiological mechanisms underlying the observed psychological changes. In addition, studies conducted with larger and sex-balanced samples would allow more robust testing of the session-condition × sex interaction. Examining different depth levels (shallow/medium/deep) and open/closed water environments separately would also provide unique contributions to the literature. Finally, future studies investigating the effects of virtual-reality (VR)-based water environments on mood would represent an innovative research area regarding the applicability of digital interventions in sport psychology (Yeo et al., 2020).

Conclusions

This study examined the acute effects of different environmental session conditions on the mood profiles of freediving athletes and demonstrated that environmental context plays a significant and distinguishing role in short-term emotional responses. The findings showed that the control (no-exercise) condition was associated with the most negative mood profile (the highest confusion, anxiety, and worry scores). The water condition produced the highest energetic scores and the lowest worry scores, whereas the land (dry) condition produced the lowest energetic scores while also showing low confusion and anxiety scores. Thus, both exercise conditions reduced negative mood relative to control, but only the water condition combined low negative mood with high energy, indicating that the aquatic and dry-land conditions did not produce equivalent psychological profiles. Beyond the contrast with the control condition, arguably the most informative finding is the divergence between the two exercise conditions themselves: despite following an identical apnea protocol, the land session produced the lowest energetic scores of the three conditions, consistent with physical fatigue unaccompanied by a compensating positive effect, whereas the water session produced the highest energetic scores together with the lowest worry scores. This pattern indicates that the aquatic environment itself, rather than exercise alone, was the primary driver of the more favourable mood profile observed. The medium effect sizes obtained indicate that the impact of environmental conditions on mood is meaningful not only statistically but also practically. On balance, a single-session freediving training performed at minimal depth—particularly in a water-based environment—may support athletes' emotional regulation processes, and considering environmental context in training planning may be beneficial in terms of athlete well-being and performance preparation. From a practical standpoint, these findings suggest that shallow-water apnea sessions, rather than land-based sessions alone, may be worth prioritising in the recovery routines of elite freediving athletes experiencing heightened pre-competition anxiety, given their association with lower worry and higher energy in the present sample.

Ethics Statement: *In the present article, the ethical rules of the journal were followed in the research process in the current article. The responsibility for any violations that may arise regarding the article belongs to the author. The approval of Trakya University Ethics Committee dated 06.04.2026 and numbered 07/27 was obtained.*

Conflict of Interest: *There is no personal or financial conflict of interest between the authors in the present study.*

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GENİŞLETİLMİŞ ÖZET

Çalışmanın Amacı: Serbest dalış, yoğun fizyolojik ve psikolojik talepler içeren ekstrem bir spor dalıdır. Sporcular, nefes tutma süresince hipoksik ve hiperbarik koşullara maruz kalır; bu durum hem fizyolojik tepkileri hem de akut duygu durumu değişimlerini tetikler. Doğal ortamların —özellikle su temelli "mavi alanların" (blue spaces)—psikolojik iyi oluş üzerindeki etkilerini vurgulayan literatür hızla genişlese de, farklı antrenman ortamlarının serbest dalış sporcularının akut duygu durumu profillerini nasıl şekillendirdiği sistematik biçimde yeterince incelenmemiştir. Bu çalışmanın amacı, üç farklı çevresel oturum koşulunun (kontrol, su ve kara) serbest dalış sporcularının duygu durumu profilleri üzerindeki akut etkilerini Brunel Ruh Hali Ölçeği (BRUMS) aracılığıyla incelemektir.

Araştırma Problemleri: Çalışmada şu sorulara yanıt aranmıştır: (1) Farklı oturum koşulları (kontrol, su ve kara) serbest dalış sporcularının olumlu duygu durumu maddesinde (Enerjik) anlamlı farklılıklar oluşturmakta mıdır? (2) Farklı oturum koşulları olumsuz duygu durumu maddelerinde (Aklı karışık, Kaygılı, Tedirgin) anlamlı farklılıklar oluşturmakta mıdır? (3) Koşula bağlı en belirgin etkiler hangi maddelerde ortaya çıkmaktadır? Bu soruların yanıtları, ekstrem sporcularda çevresel bağlamın kısa süreli duygusal tepkileri nasıl biçimlendirdiğine ilişkin anlayışa katkı sağlamakta; antrenman planlaması ve toparlanma açısından uygulamaya dönük çıkarımlar sunmaktadır.

Literatür Araştırması : Mevcut literatür, fiziksel egzersizin genel olarak duygu durumunu ve bilişsel işlevleri iyileştirdiğini; doğal ortamların —mavi (su) ve yeşil (orman) alanlar dâhil— ek onarıcı etkiler sağladığını vurgulamaktadır. Dikkat Onarımı Kuramı (ART) ve Stres Azaltma Kuramı (SRT), doğal ortamların bilişsel toparlanmayı desteklediğini ve strese bağlı duygusal tepkileri hafiflettiğini öne sürmektedir. Güncel meta-analizler, mavi alanlara maruz kalmanın kaygıyı azalttığını, kortizol düzeylerini düşürdüğünü ve olumlu duygulanımı artırdığını bildirmektedir. Nefes tutmalı dalış bağlamında hipoksi ve hiperkapni, bir yandan öfori benzeri duyumlara yol açarken diğer yandan uyarılmışlığı artırabilmektedir. BRUMS, akut duygu durumu değişimlerini saptamada duyarlı, kültürler arası ve farklı sporcu popülasyonlarında geçerliği kanıtlanmış bir ölçme aracıdır. Bununla birlikte, minimal derinlikte (≈2 m) gerçekleştirilen serbest dalış antrenmanı sırasında farklı çevresel bağlamlardaki duygu durumu tepkilerini inceleyen çalışmalar son derece sınırlıdır; bu durum spor psikolojisi alanında önemli bir boşluğu temsil etmektedir.

Yöntem : Araştırmaya 25 sağlıklı serbest dalış sporcusu (16 erkek, 9 kadın; yaş ortalaması 20,04 ± 2,47 yıl) tekrarlı ölçümlü deneysel desende gönüllü olarak katılmıştır. Veriler, en az 48 saat arayla gerçekleştirilen üç ayrı oturumda toplanmıştır: kontrol oturumu; su oturumu (ısınma, maksimal nefes tutma süresinin %80'ine kadar ilerleyen statik apne setleri ve soğuma aşamalarından oluşan, 2 m derinlikte havuz antrenmanı) ve kara oturumu (aynı protokolün kuru ortamda uygulanması). BRUMS, her oturumdan hemen önce ve sonra uygulanmıştır. Araştırma protokolü, Trakya Üniversitesi Tıp Fakültesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu tarafından onaylanmıştır (Karar No: TUTF-GOBAEK 2026/182). Veriler IBM SPSS Statistics v25.0 ile çözümlenmiştir. Shapiro–Wilk testi puanların normal dağılmadığını gösterdiğinden tüm analizlerde parametrik olmayan yöntemlere başvurulmuş; oturumlar arası farklar Friedman testiyle, anlamlı durumlarda Conover yöntemiyle (Bonferroni düzeltmeli) ikili olarak karşılaştırılmış, etki büyüklüğü Kendall W ile kestirilmiştir. Anlamlılık eşiği $p < 0,05$ alınmıştır.

Sonuç ve Değerlendirme: Bulgular, çevresel oturum koşullarının dört duygu durumu maddesinin tamamını anlamlı biçimde etkilediğini göstermiştir. Enerjik puanları en yüksek su koşulunda (M = 2,84 ± 1,18), en düşük ise kara koşulunda (M = 1,52 ± 1,42) elde edilmiş; kara koşulu hem kontrol (p = 0,032) hem de su (p = 0,004) koşulundan anlamlı düzeyde düşük çıkmıştır [$\chi^2(2) = 10,69$; p = 0,005; Kendall W = 0,214]. Aklı karışıklık puanları kara koşulunda kontrol (p = 0,002) ve su (p = 0,011) koşullarına göre anlamlı düzeyde düşüktür [$\chi^2(2) = 12,20$; p = 0,002]. Kaygı puanları kontrol koşulunda kara koşuluna kıyasla anlamlı düzeyde yüksektir (p = 0,019) [$\chi^2(2) = 7,73$; p = 0,021]. Tedirginlik puanları kontrol koşulunda hem su (p = 0,008) hem de kara (p = 0,034) koşullarına göre daha yüksek olup en düşük değer su koşulunda gözlenmiştir (M = 0,04 ± 0,20) [$\chi^2(2) = 9,74$; p = 0,008]. Elde edilen küçük–orta düzey etki büyüklükleri (Kendall W = 0,16–0,24), çevresel koşulların duygu durumu üzerindeki etkisinin yalnızca istatistiksel değil pratik açıdan da anlamlı olduğunu göstermektedir. Cinsiyet açısından, yalnızca kontrol oturumunda iki anlamlı fark gözlenmiştir (Mann–Whitney U): erkek sporcularda enerjik, kadın sporcularda tedirginlik puanları daha yüksek bulunmuş; su ve kara oturumlarında ise anlamlı fark saptanmamıştır. Sonuç olarak, minimal derinlikte gerçekleştirilen tek oturumluk serbest dalış antrenmanı —özellikle su temelli ortamda— sporcuların duygu düzenleme süreçlerini destekleyebilir; antrenman planlamasında çevresel bağlamın dikkate alınması sporcu iyi oluşu ve performansa hazırlık açısından yararlı olabilir. Gelecek çalışmaların daha büyük örneklemlerle, cinsiyet kodlamasıyla, boylamsal desenlerle ve psikofizyolojik göstergelerle (KHD, kortizol, EEG) yürütülmesi önerilmektedir.