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Research Article

Investigating the Relationship between Depression and Physical Activity Index Following Short-Term Stress Induction: An Animal Study

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Abstract

Background: Examining the impact of short-term stress on depressive-like behavior and motor activity in rats is a crucial aspect of behavioral and neuroscience research. Short-term stress can influence rats' depressive-like behavior and decrease their motor activity. The purpose of this study was to investigate the effect of short-term stress on depressive-like behavior and the running index of male Wistar rats, as well as the relationship between the two variables.

Materials and Methods: Examining the impact of short-term stress on depressive-like behavior and motor activity in rats is a crucial aspect of behavioral and neuroscience research. Short-term stress can influence rats' depressive-like behavior and decrease their motor activity. The purpose of this study was to investigate the effect of short-term stress on depressive-like behavior and the running index of male Wistar rats, as well as the relationship between the two variables.

Results: Short-term stress significantly increased the 24-hour running index (P=0.01). The depression-like behavior of rats after stress induction did not show any significant difference. There was no significant relationship between the amount of running and depressive-like behavior (P=0.13).

Conclusion: Based on the present findings, short-term stress caused an increase in the activity of male Wistar rats, which was not related to depressive-like behavior.

Keywords:
Stress, depression, activity index, behavioral test, forced swimming test.

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1. Introduction

Short-term stress has wide range of effects on human health and psychology [1, 2]. Some of the consequences of this type of stress include an elevated heart rate, difficulty breathing, an increase in stress hormones like cortisol, a higher risk of cardiovascular diseases, an increased susceptibility to mental disorders such as depression and anxiety, a heightened risk of chronic conditions like diabetes and high blood pressure, weakened immune system function, disrupted sleep patterns, heightened fatigue, decreased concentration and attention, increased feelings of nervousness and impatience, heightened aggression, and an increased likelihood of substance abuse [3, 4].

Inducing acute/short-term stress in mice occurs as a result of sudden and intense stimuli, leading to a rise in cortisol levels in the body [1, 5]. This acute/short-term stress response in mice can trigger both biological and behavioral changes, playing a significant role in behavioral and neuroscience studies. The investigation of short-term in rodents can help elucidate the physiological and behavioral outcomes of this state and its impact on their nervous system and actions [6, 7].

Examining the impact of short-term stress on depressive-like behavior and motor activity in rats is a crucial aspect of behavioral and neuroscience research. Short-term stress can influence rats' depressive-like behavior and decrease their motor activity [6, 8]. Various methods, such as behavioral assessments like the Forced Swim Test and the Open Field Test, can be employed to study these effects. Additionally, neurochemical approaches can be utilized to measure serotonin and dopamine levels in the brain to understand how stress affects central nervous system activity [9, 10].

Ultimately, this research can enhance our comprehension of depressive-like behavior, aid in the development of treatment strategies, and improve therapeutic approaches for depression and related conditions [6].

This study aims to explore the effects of short-term unpredictable stress on depressive-like behavior and running performance in male Wistar rats, as well as examine the correlation between these two variables.

2. Materials and Methods

The current study is an experimental study that utilized 16 male Wistar rats with an average weight ranging from 200 to 250 grams. The rats were housed in special polycarbonate cages under standard conditions, including an average temperature of 22±4°C, humidity of 55±4%, and a 12:12 light-dark cycle. They were provided with free access to laboratory mice food and water from Pars Animal Feed Company.

The rats were randomly divided into two groups: experimental and control, with 8 rats in each group. The experimental group was subjected to short-term stress for four weeks, while the control group remained under normal conditions. Following a 48-hour post-intervention period, all rats underwent a forced swimming test, and their 24-hour running values were recorded on a rotary wheel [11].

The short-term stress intervention included one period of various stressors such as food deprivation, water deprivation, being in a wet cage, cage tilting, exposure to white noise and flasher, light-dark cycle mixing, and stress-free conditions [12].

The forced swimming test was conducted to assess levels of hopelessness and despair, as well as the effectiveness of antidepressant interventions. Each rat was placed in a cylindrical chamber filled with water, and immobility time was recorded as an indicator of depressive behavior [13, 14].

Data analysis was performed using mean and standard deviation, and the normal distribution of data was confirmed using the Shapiro-Wilk test. Parametric statistical methods including one-way analysis of variance and repeated-measures analysis of variance were employed with a significance level of $P<0.05$. The Pearson correlation coefficient was used to determine the relationship between dependent variables. Data analysis was conducted using SPSS version 24.

3. Results

Short-term stress significantly increased the 24-hour running distance ($P=0.01$, $F=8.77$) (Figure 1), while pseudo-depressive behavior exhibited no significant difference ($P=0.18$, $F=2.06$) (Figure 2). There was also no significant correlation between running distance and pseudo-depressive behavior ($P=0.13$, $r=0.45$).

Figure 1. Recorded 24-hour running wheel distance of rats in different research groups.

Significant difference between short-term stress group and control.

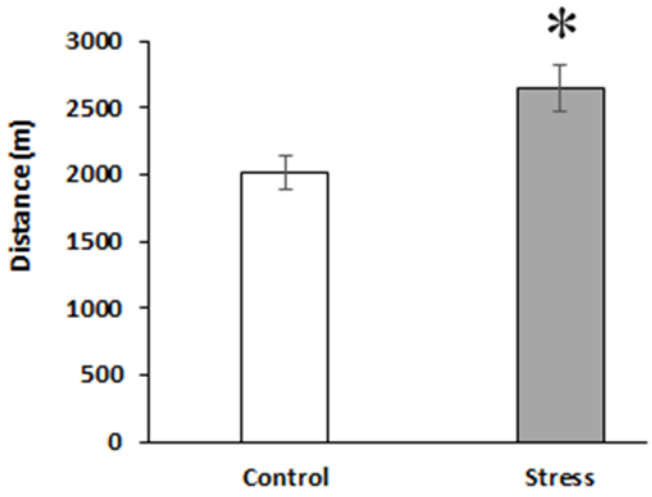
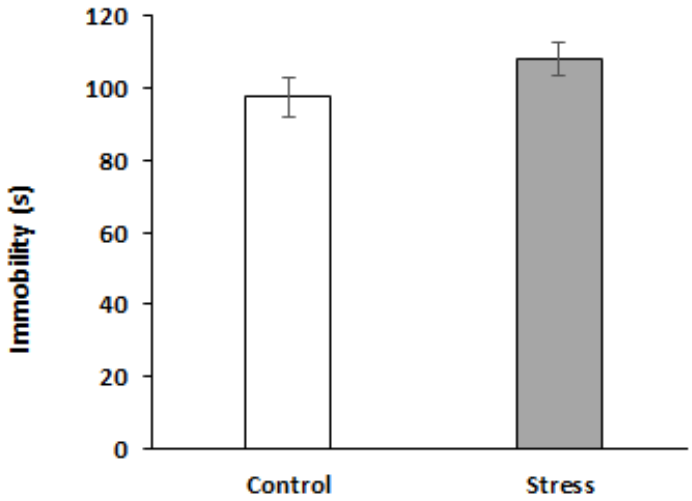


Figure 2. Immobility behavior of rats in different research groups.

Significant difference between short-term stress group and control.



4. Discussion

Short-term stress significantly increased the 24-hour running distance in the study. The pseudo-depressive behavior exhibited by rats after stress induction did not show any significant difference. There was no significant relationship found between the amount of running and depressive-like behavior. Therefore, short-term stress induced an increase in activity in male Wistar rats that was not associated with depressive-like behavior.

Stress is a psychological phenomenon that impacts the daily lives of both humans and animals [15]. It can occur in the short or long term and may be caused by various factors such as social, physical, or psychological pressures, and environmental changes. Numerous studies have been conducted on the effects of stress on animals in scientific research [16]. One area of interest is the impact of short-term stress on animal movements and behaviors [17].

The results of the study showed that short-term stress significantly increases the 24-hour running distance in rats. Rats exposed to short-term stress traveled a greater distance in 24 hours compared to control rats that did not experience stress. Furthermore, the study revealed that there is no significant relationship between the amount of running and depressive-like behavior in rats. This suggests that the increase in running distance due to stress is more likely caused by physiological changes rather than psychological behaviors such as pseudo-depression.

Short-term stress can lead to increased running distance and motor activity through various mechanisms, including changes in stress hormone levels, nervous system activity, immune system response, and the production of neurodevelopmental factors [18-20].

Exercise and physical activity can also help reduce stress and relax the mind by releasing endorphins that improve mood and relieve pain and stress [21].

Overall, the current research indicates that short-term stress may influence animal physiological issues, such as locomotor activity. The effects of stress may vary depending on factors such as the type and duration of exposure to stress, as well as the physiological and psychological conditions of the animals [16]. Suggestions for future research include measuring indicators related to cognitive processes and conducting additional studies with variables such as oxidative stress levels, brain neurotrophins, and stress hormones.

Conclusion

This research aimed to investigate the effects of stress induction on rats and its impact on their running distance index. The results revealed that stress induction in rats led to an increase in their running distance within 24 hours. However, no significant correlation was found between the amount of running and pseudo-depression. It appears that the rise in motor activity due to stress is more closely linked to the physiological aspects of isolated animals rather than psychological factors such as pseudo-depression.

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Compliance with ethical standards

All ethical principles regarding working with laboratory animals were strictly adhered to in this study. The research also received approval from the ethics committee with the code number IR.IAU.CTB.REC.1401.093 from Islamic Azad University, Central Tehran Branch.

Author contributions

Conceptualization: M.P, S.R, Z.E, M.B ; Methodology: M.P, S.R, Z.E, M.B ; Software: M.P, S.R, Z.E, M.B ; Validation M.P, S.R, Z.E, M.B ; Formal analysis: M.P, S.R, Z.E, M.B ; Investigation: M.P, S.R, Z.E, M.B ; Resources: M.P, S.R, Z.E, M.B ; Data curation: M.P, S.R, Z.E, M.B ; Writing - original draft: M.P, S.R, Z.E, M.B ; Writing - review & editing: M.P, S.R, Z.E, M.B ; Visualization: M.P, S.R, Z.E, M.B ; Supervision: M.P, S.R, Z.E, M.B ; Project administration: M.P, S.R, Z.E, M.B ; Funding acquisition: M.P, S.R, Z.E, M.B .

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